



UNIVERSITY OF LEEDS

This is a repository copy of *GIS Application to Support Land Administration Services in Ghana: Institutional Factors and Software Developments*.

White Rose Research Online URL for this paper:
<http://eprints.whiterose.ac.uk/5008/>

Monograph:

Karikari, I.B., Stillwell, J. and Carver, S. (2002) *GIS Application to Support Land Administration Services in Ghana: Institutional Factors and Software Developments*. Working Paper. School of Geography , University of Leeds.

School of Geography Working Paper 02/02

Reuse

Unless indicated otherwise, fulltext items are protected by copyright with all rights reserved. The copyright exception in section 29 of the Copyright, Designs and Patents Act 1988 allows the making of a single copy solely for the purpose of non-commercial research or private study within the limits of fair dealing. The publisher or other rights-holder may allow further reproduction and re-use of this version - refer to the White Rose Research Online record for this item. Where records identify the publisher as the copyright holder, users can verify any specific terms of use on the publisher's website.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.



eprints@whiterose.ac.uk
<https://eprints.whiterose.ac.uk/>

WORKING PAPER 02/02

**GIS Application to Support Land
Administration Services in Ghana:
Institutional Factors and
Software Developments**

Isaac Bonsu Karikari,

John Stillwell

and Steve Carver

School of Geography

University Of Leeds

LS2 9JT

April 2002

ABSTRACT

In June 1999, the Ghanaian Government launched a new land policy document that sought to address some fundamental problems associated with land administration and management in the country. The document identified the weak land administration system as a particular problem and recommended the introduction of computer-aided information systems in the 'lands sector'. In 2001, the Government made further proposals to prepare and implement a Land Administration Programme (LAP) to provide a better platform for evolving an efficient land administration that would translate the 'National Land Policy' into action. Thus, an up-to-date land information system (LIS), supporting efficient management of land records, is to be constructed, which provides a context for the research reported in this paper.

We document two aspects of our research on the adoption of GIS by the Lands Commission Secretariat (LCS) which form part of a pilot project in GIS diffusion. Part one of the paper mainly outlines the empirical results arising from fieldwork undertaken during 2001 to determine the information and GIS requirements of the LCS in relation to their routine administrative processes and to identify the critical factors that are required to ensure that any new GIS applications are successfully embraced. Part two explains the prototype software system developed using ArcView 3.2 and Access that provides the LCS with a means to automate some of the routine administrative tasks that they are required to fulfil. The software has been modified and upgraded following an initial evaluation by LCS employees also conducted as part of the fieldwork in Accra.

Keywords

Land administration; diffusion of geographic information systems; Ghana; Accra

Lands Commission Secretariat

TABLE OF CONTENTS

		Page
CONTENTS		
	ABSTRACT	ii
	LIST OF TABLES	iv
	LIST OF FIGURES	iv
	LIST OF BOXES	v
	LIST OF PLATES	v
1	Introduction	1
2	GIS Diffusion	2
3	Land Administration in Ghana	4
	3.1 Land Ownership	4
	3.2 The Lands Commission Secretariat	6
	3.3 Progress Towards GIS Adoption and Land Policy	7
4	GIS Implementation in the Accra LCS	10
	4.1 Strategies and Methodologies for Data Collection	11
	4.2 Questionnaire Surveys	12
	4.3 Questionnaire Responses: Institutional Issues	14
	4.4 Questionnaire Responses: Application Issues	17
5	Results from the Critical Success Factor (CSF) Methodology	20
	5.1 Applying the Methodology	20
	5.2 Critical Success Factors Identified	35
	5.3 General Observations and Problems Encountered	37
	5.4 Major Findings and Discussion	39
	5.5 Implications for GIS Implementation in the Accra LCS	46
6	The LANDAMIN Prototype Software	49
	6.1 Study of Search Process using the Data Flow Analysis Methodology	50
	6.2 Design Issues	67

6.3	The Architecture of the LANDAMIN Prototype Software	71
6.4	ArcView 3.2 User Interfaces	72
6.5	The Linked ArcView and Microsoft Access Interfaces	74
6.6	The Microsoft Access Interfaces	78
7	Respondents Reaction to Initial Prototype Software	80
8	Conclusions	83
	References	86
	Appendix 1: Scoring ‘Factors’	89
	Appendix 2: Questionnaires for Key Decision Makers /Technical Staff (Part 1)	90
	Appendix 3: Questionnaires for Key Decision Makers /Technical Staff (Part 2)	96
	Appendix 4: The Prototype Users Evaluation Form	103
	Appendix 5: Initial Features of the Prototype Software for Testing in the Accra LCS (September 2001) – ArcView 3.2 Interface	110
	Appendix 6: Summary of Individual Respondent’s Views on Software Applications (September 2001) – ArcView 3.2 Interface	111

LIST OF TABLES

1.	Use of selected software packages by respondents (September 2001)	17
2.	‘Factors’ emerging out of brainstorming sessions and their initial scores	25
3.	Reviewed ‘Factors’ and their prioritisation by respondents	31
4.	Sample data set in ArcView 3.2	71
5.	Sample data set in Microsoft Access	72
6.	Overview schema of the menu structure in ArcView 3.2 (Project window)	73

LIST OF FIGURES

1.	The Critical Success Factor (CSF) pilot study	22
2.	Juxtaposing ‘Activities’ and ‘Factors’ (The CSF matrix before validation)	27
3.	The data flow analysis (DFA) and prototype design pilot study	51
4.	The data flow diagram - ‘Context’	53
5.	The data flow diagram – ‘Top Level (The Searches process)	55
6.	The data flow diagram – ‘Level One (Current Searches process)	57

7. The data flow diagram – Level One (Future Situation)	64
8. Detailed architecture of the LCS prototype software (LANDADMIN)	69
9. Site plans selection via themes	74
10. Site plans selection via input of plot number	74
11. Linking ArcView to Microsoft Access	75
12. Microsoft Access – meta data structure	77
13. Lessees general information on Achimota Residential Area	78
14. Attribute information as part of search report	79
15. Link to the Internet from Access to the Ghana home page	80

LIST OF BOXES

1. Storage is a problem in the Accra LCS	
2. Why the CSF was chosen	23
3. Data dictionary for ‘Processes’ (Searches)	58
4. Data dictionary for ‘Flows’ (Searches)	59
5. Data dictionary for ‘Stores’ (Searches)	60

LIST OF PLATES

1. Registers (showing how information is presently stored)	7
2. Participants to the fieldwork exercise (August – September 2001)	10
3. Plotting at the Greater Accra Region Records Office (GARRO)	13
4. Brainstorming session during fieldwork (September 2001)	19
5. Validation session (September 2001)	21
6. Review with top management	32
7. Legacy left by GERMP	33
8. Sorting at the Search Office (September 2001)	54
9. Legacy left by GERMP (equipment heavily underutilised)	67
10. Testing LANDADMIN (ArcView 3.2 Interfaces)	81

GIS Application to Support Land Administration Services in Ghana: Institutional Factors and Software Developments

PART ONE

1 Introduction

In Ghana, as elsewhere in the world, land is a unique resource of fixed location, incapable of expansion in supply (except in cases where, marginal increases have been made through reclamation). The necessity for efficient and effective management of this limited resource is of paramount importance. Both land administration and management involve land registration and it has been recognised that improvements to land registration systems and the establishment of land information systems (LIS) or geographic information systems (GIS) are important catalysts for development in less developed countries. This position is recognised by the Global Strategy for Shelter for the Year 2000 (UNCHS, 1990) that recommends the establishment of efficient land registration and GIS as a priority area of national policy action for all countries.

In this paper, we are concerned with the diffusion of GIS into organisations in a less developed country. Our attention is focused on both institutional factors and technical developments, recognising that the transfer of innovations (diffusion) is a difficult and complex process, only likely to succeed if it becomes a part of the daily lives of the organisation(s) involved. Carter (1989) defines GIS as an “*institutional entity reflecting an organisational structure that integrates technology with a database, expertise and continuing financial support over time*”. This view is shared by Chan and Williamson (1999) who suggest the elements of this perception should include data, information technology, standards, people with GIS expertise and the organisational setting. The research in this paper adopts Carter’s definition as being relevant to the land sector in general and to the Accra Lands Commission Secretariat (LCS) in particular. The paper assumes ‘land administration’ to be the process whereby land, and information about land, may be effectively managed. Land administration therefore includes identifying those people who have interest in real estate and information about those interests such as the nature and duration of rights to land. It also includes information about each land parcel such as its location, size,

improvements, ownership and value. The term land administration is restricted here to ownership means and land taxation and does not include the wider issues involved in optimising the use of land as a resource (UNCHS, 1990). This distinguishes ‘land administration’ from ‘land management’ which is the process of managing the use and development of land resources in a sustainable way.

The paper highlights some of the characteristics of Ghana’s lands sector from the perspective of the Accra Lands Commission Secretariat (LCS), the agency responsible for the administration of public lands in Accra (Section 3). Thereafter, we report the results of using a suite of methodologies to identify the information requirements of the Lands Commission Secretariat (LCS) for GIS use (Section 4) and the factors that are deemed to be critical in successful implementation (Section 5). Section 6 outlines the technical development of a customised administrative support system called ‘*LandAdmin*’ that has been designed to automate several of the routine land administrative tasks that the LCS is required to undertake on a routine basis. The prototype software, which has a number of selected features, has been demonstrated in the LCS as part of the strategy of gaining acceptability prior to adoption. We report on the initial evaluation of the prototype by LCS employees (Section 7) and show how modifications and extensions have been incorporated. However, before the results of the fieldwork relating to the institutional context and the prototype software are discussed in detail, we provide a broader perspective by reviewing the extant literature on GIS diffusion.

2 GIS Diffusion

Like the definition of the term GIS itself, the word *diffusion* has various meanings. Zeltman *et al.* (1973) define it as the process of communicating a novelty to and among the population of potential users who might choose to adopt or reject it. Campbell and Masser (1995) suggest that it refers to “*the fundamental process that is responsible for the transfer of innovations from the workshops of their inventors to becoming a daily part of the lives of a large section of society*” (Campbell and Masser, 1995: 4). Alternatively, Rogers defines diffusion as “*the process by which an innovation is communicated through certain channels over time among members of a social system. It is a special type of communication, in that the messages are concerned with new ideas*” (Rogers, 1983: 5). The review of Rogers’ work by

Onsrud and Pinto (1991) helps to provide an understanding of the factors and processes underpinning adoption, implementation and utilisation of geographic information technologies. These indicate that innovation, communication, adoption over time and the social system are the four main elements in the diffusion process; and that innovation is an idea, practice or object perceived as new by an individual, group or organisation. For technological innovation to diffuse faster, it must have a low degree of complexity, a high degree of 'trialability' before commitment, a high degree of visibility to other potential adopters, a high degree of compatibility with existing values, past experiences and needs of potential adopters, and finally have relative advantage over the methods it supplants (Rogers, 1983)

Eason (1988) has indicated that the sequence of stages – what he terms the traditional data process approach – in implementing GIS in organisations represents a 'linear view of diffusion'. These stages include project selection, a feasibility study through trials (prototyping) and implementation. Campbell and Masser (1995) acknowledge that this may define implementation narrowly as users have not been fully involved. Eason (1988) had accepted this, criticising the attempt to merely involve users as they have not really been practically involved, *"especially as there is limited time that is often available for users to assimilate and contribute to the complex and highly technical documentation with which they are confronted"* (Campbell and Masser, 1995). There is, therefore, a need to gain organisational and user acceptance of the technology, placing emphasis on participative approaches to implementation characterised by user-centred design values. According to Eason, such a philosophy starts with the supposition that it is the organisational rather than technological issues that are most likely to endanger the effective implementation of computer-based systems. He accepts that such a philosophy does not deny the technological component of such systems, even though, placing too much emphasis on this element may be counter-productive. Campbell and Masser (1995) insist that user involvement must not be restricted to symbolic consultations. Users ought to be given enough time and skill *"that they have real ownership of the project"*.

Zwart (1990) notes that whilst computerisation may be necessary, most countries are well advised to carry out a review of their current information practices. They need to examine existing practices on such issues as their data recording, data maintenance

and data quality procedures. These activities do not rely on investments in high cost technology, but mainly require an investment in people as individuals and in organisations. *“The time to decide as to whether to use computer-based schemes is when these organisations and management reforms are in place. They need not, and in most cases should not, go hand in hand as the common wisdom seems to suggest. In the meanwhile, by reforming your existing Land Information Management system before introducing the computer, you will have taken the major step to secure their success. You will also have minimised the risks and gained most of the benefits”* (Zwart, 1990). Keen (1981) has noted some interesting reactions by users to the implementation of computer-based systems. He notes that these include exploiting the system designers’ lack of knowledge about the organisational environment and therefore ensuring that the project ultimately does not succeed; undermining key individuals in the project so that their trustworthiness is lost; and lying low so as to avoid direct confrontation and thereby not fully playing a part in the project!

Finally, it is apparent that much of the reported research on GIS diffusion in the developing world has either been ‘anecdotally based’ (research not conducted under controlled conditions) or focused on retrospective single case studies of successful implementations. There is little evidence to show the use of empirical methods in a more organised study of GIS/LIS diffusion in developing countries. Much could be learned from prospective studies as new classes of users learn about the possible application of the new geotechnology tools to their fields. Thus, we conclude that in evaluating the transfer of geographic information innovations, it is essential to take into consideration the full process of adoption (Onsrud and Pinto, 1991).

3 Land Administration in Ghana

3.1 Land Ownership

Land administration in Ghana is complicated because of the existing land ownership arrangements. In broad terms, the country has a land ownership system in which *customary tenures* are distinguished from *state land*. Customary tenures comprise ‘absolute interests’ held by two main types of the land-owning community and may occur through discovery of land or through conquest/war. The lands that are held by these land-owning communities are termed ‘stool/skin’ and ‘family’ lands. The head of a stool or skin (the latter term used in the northern part of the country) holds these

lands in trust for the subjects of the stool in accordance with customary law and usage. The stool or skin symbolises the authority of heads of these traditional states who are vested with managerial functions of the lands under their control. Members of these two land owning groups who are subjects of stool/skin or family lands also have '*usufructuary rights*' - rights to use or dispose of use-rights over land, including the right to occupy, till or otherwise enjoy any 'unappropriated' portion of the stool or skin land. There are also '*private lands*' that emerge out of such transactions.

The second main type of land in Ghana is state or public land. Under Act 123, the Administration of Lands Act, 1962, the Government was able to vest stool/skin lands in the President by 'executive instrument' in what comes about as 'split ownership'. In this case, the Ghanaian Government manages the land and collects rent on behalf of the customary landowner who retains the beneficiary or equitable rights in the land rents emanating therefrom. On the other hand, through the exercise of the powers of eminent domain (compulsory acquisition of land), the Government could also acquire land, subject to the payment of compensation. This is provided under the 1992 Constitution through its enabling Act, Act 125 – the State Lands Act, 1962.

It has been the case in Ghana that obstacles arising out of inappropriate land tenure in some areas, and poor land utilisation procedures in the country as a whole have prevented investment in both agriculture and industry. This is one of the reasons why there is a growing need for a better land administration and management throughout the country. Other problems include that of land encroachments and multiple sales of land that have led to environmental problems, disputes, conflicts and endless litigation. Encroachments on public lands appear to engage the serious attention of government. These encroachments sometimes involve building on lands without regard to planning schemes prepared by government for such areas. In the Greater Accra Region alone, almost all sites earmarked for various activities have been taken over by the "encroachers". The site for the Council for Scientific and Industrial Research (CSIR) to serve as a scientific instrumentation centre at Otinshie-Accra has been affected by encroachment, forcing government to release a vast portion of the land back to the owners. The status of these owners, like many others, cannot be readily ascertained due to conflicting claims that have to be eventually settled in the courts. Other sites extensively encroached upon include the site for the National

Sports Complex at Achimota, the site for Police Depot and College at Ofankor. The residential and industrial sites at Ofankor and the site for Ambassadorial Enclave at East Legon have all also been heavily affected.

‘There are indeterminate boundaries resulting directly from lack of reliable maps/plans and the use of unapproved, old or inaccurate maps’. This has led to land conflicts and litigation between stools, skins and other land owning groups. The government has not utilised large tracts of land acquired compulsorily neither has compensation been paid for most of the acquired lands. Landowners have been left ‘landless’ having been denied their source of livelihood.

The lack of adequate functional and co-ordinated geographic information systems and networks as well as of transparent guidelines have been identified as one of the problems to be tackled. This requires that the land agencies ‘maintain up to date scientific data, maps and plans; geographic database and information systems’.

3.2 The Lands Commission Secretariat

The Lands Commission is a public institution set up under the Lands Commission Act of 1994 (Act 483) in accordance with Article 258 of the 1992 Constitution of Ghana. It is mainly charged with the responsibility of managing *public lands* and any *lands vested* in the President of the Republic. It has a Secretariat, the Lands Commission Secretariat (LCS) that carries out its functions. It is both a provider and user of geographic information. The current information system for the LCS comprises a complex set of requirements with the primary purpose of using geographic information related to creating and maintaining an inventory of land data. The LCS is expected to respond to a government mandate to manage public land in the most effective and efficient manner possible and to advise the Government on land use change and capability. This involves identifying land problems, determining strategies for land reform, monitoring land use change on public land, developing alternative plans and finding solutions to a myriad of land problems, including encroachments on public land.

The LCS uses various themes that may include land use on land parcels as geographic units. The output of the current system of administration is primarily maps at various

scales (mostly 1:2,500 for urban areas) and other tabular listings mostly in hardcopy. The large volume of land data requires an equally large amount of space for data storage (Plate 1). Generally, the manual system can be said to be a ‘clerical support system’. Computers are mainly used for word processing. Even though the Accra LCS has begun to build its databases using Microsoft Access, the automation process occurs at the very end. For instance, the rent collection branch still uses the manual approach in the collection of rents and only sends information to the ‘computer room’ for input into Access. The input of rent data in the computer that occurs at the end of the manual rent collection process is not bringing optimal results. The application to be developed in this research will be a fully automated administrative support system. This characteristic adds to uncertainty in specifying information requirements.

Plate 1: Storage is a problem in the Accra LCS (September 2001)



3.3 Progress Towards GIS Adoption and Land Policy

Literature is available on various themes relating to land in Ghana, ranging from discussions on institutional and legal issues associated with land delivery to surveys on corruption and other constraints on the land market and land administration

(Ollennu, 1962; Acquaye and Associates, 1989; Brobby, 1991; 1992; Kasanga, 1990; Kasanga *et al.*, 1996; Larbi, 1995; 1996; CDD, 2000; Somevi, 2001). Almost all of these studies with the exception of CDD (2000) and Somevi (2001) have failed to recommend the need to use computers or capture, analyse and disseminate land-related information using GIS capabilities. However, there are some discussions (Mills *et al.*, 1997; <http://glacier.gg.rhbnc.ac.uk/kumasi/Inception/inception.html>; GERMP, 1999) of projects with GIS components such as KUMINFO and GERMP that were initiated by the international donor community and that related to the wider issues involved in optimising the use of land as a resource in Ghana.

‘KUMINFO’, for instance, is the GIS component of the Ghana’s Natural Resource Management Project aimed at addressing critical issues on environmental conditions confronting inhabitants of peri-urban Kumasi in Ghana. It is based on a pre-project prototype, ‘PUDSI’ an acronym for Peri-Urban Demonstrator for Spatial Integration with programmed interfaces that is based on ArcView 3.2 and allows the display, querying and analysing of spatial and non-spatial data for Kumasi. It also allows easy access to research topics. The system runs in Kumasi within the Institute of Renewable Natural Resources (IRNR), a constituent unit within the University of Science and Technology (UST), Kumasi with parallel systems at the Natural Resources Institute, University of Greenwich and the Royal Holloway College, University of London. Reports indicate that the ‘lack of clearly pre-defined user-needs and requirements, and the lack of available data for Kumasi limited the development of PUDSI’.

In 1991, the Government approved the Ghana Environmental Resource Management Project (GERMP) that aimed to implement the National Environmental Action Plan (NEAP) under the co-ordinating role of the Environmental Protection Agency (EPA). The Lands Commission, together with the Land Administration Research Centre (LARC) of the University of Science and Technology (UST) Kumasi, were responsible for the land ownership aspects under the Land and Water Management Component of the project, under which the LCS inherited some GIS equipment that is still available for use. Thus, although the KUMINFO and GERMP projects have not focused on the lands sector directly, agencies such as the LCS have been involved because of the land ownership and mapping issues that have arisen in these projects. Despite the existence of the GERMP project, progress towards automation has

remained very slow in Ghana's lands sector agencies. This can be attributed to inherent difficulties with the technology itself and with problems of data conversion that confront organisations in this sector. Even though the Survey Department under GERMP used computers to perform land survey computations, the implementation of GIS has proved difficult. The awareness of the potential of this technology appears to be growing yet the technical, economic and institutional problems are yet to be addressed in practice.

In 1999, the Government of Ghana initiated a 'Land Policy Document' aimed, among other things, at establishing and developing a land information system (LIS) and networks between related agencies. It was noted that the basis for better management of information, and for considerable improvement of information within the lands sector might be brought about by evaluating and appraising existing tasks, discarding unnecessary procedures and developing a better use of resources (UNCHS, 1990). One of the main objectives has been to lessen duplication in the storage of information and to restore registers physically damaged through handling (Plate 2) with electronic versions. In 2001, the Government made proposals to prepare and implement a Land Administration Programme (LAP) to provide a better stage for evolving an effective and efficient land administration that would translate, within a holistic environment, the National Land Policy into action. The proposed project is consistent with the World Bank's Country Assistance Strategy of March 2000 for Ghana.

Thus, whilst there have been attempts to apply GIS in Ghana, several of which have had implications for the lands sector, there has been no attempt to address the specific issue of using GIS to support the administration of land in the country. One of the dangers in this context is that GIS technologies may be adopted without critical analysis and without consideration of the socio-economic and institutional background of the land agencies concerned and without the need to involve the indigenous experts from the very outset. It is our view that whilst some financial and technical support for successful GIS diffusion in the lands sector is required, governments in countries such as Ghana must now claim and expect to receive more control over project design and execution. In most cases (as seen with the GERMP project), while the role of expatriates was significant in the beginning insofar as

technology transfer is concerned, the end of most projects has brought to the fore such stark realities. It appears noticeable that, after the expatriate experts involved in technological transfers have left, no-one remains with the commitment to continue where the experts left off and equipment is left without the required maintenance. It would therefore be more sensible to establish a national prerequisite to develop indigenous expertise. We concur with the view that if GIS is to be introduced, it must be *“developed, modified and controlled by indigenous people who understand the social, economic and political context of the situation as well as the technical capabilities of GIS”* (Taylor, 1991).

Plate 2: Registers (showing how information is presently stored in the Accra LCS)



4 GIS Implementation in the Accra LCS

The situation in Ghana outlined in the previous section provides the context for undertaking a pilot study of the institutional environment within which GIS is to be implemented in the lands sector. In this section of the paper, we report on the fieldwork carried out at the LCS during the summer of 2001 with the objective of determining the factors deemed most critical for achieving successful adoption of GIS. Our research is founded on the argument that serious attention must be given to

institutional processes of GIS adoption and use even though *technical issues* relating to the development of the software system are also essential. One of the primary objectives has been to identify the range of factors relevant to GIS diffusion in the Accra LCS through empirical study. The ethnic background of Isaac Bonsu Karikari as a Ghanaian who has been involved in land administration for well over twelve years, at which period he headed three of Ghana's ten regions as Regional Lands Officer, the last being the Greater Accra Regional office of the LCS, was particularly necessary in gaining the support of the organisation and the willingness of the workforce to collaborate in the pilot project.

4.1 Strategies and Methodologies for Data Collection

It was necessary to develop a strategy for data collection and analysis in order to achieve the objectives of:

- understanding the organisational issues confronting the LCS that might impact on GIS adoption ;
- determining the factors that are critical for the successful implementation of GIS; and
- identifying the functional needs of the LCS in relation to GIS

In order to achieve the first of these objectives and establish the organisational context, we adopted the approach of *asking* (through questionnaires) a selection of senior managers and technical staff to give independent opinions about the various characteristics of the LCS, the results of which are presented in Section 4.3. Similarly, questionnaires were used to obtain information from respondents to fulfil the third objective and to establish the (functional) needs of the LCS with respect to GIS (Section 4.4). *Brainstorming* sessions were carried out and the critical success factor (CSF) methodology was used to achieve the second objective of prioritising those factors deemed by respondents to be the key factors for successful GIS implementation. We report on the results of the application in section 5. In section 6, we present a prototype application of GIS to support various administrative services. A methodology known as data flow analysis (DFA) was used to identify the software requirements and the results of the DFA are also reported in this section. Respondents' reactions to the prototype software were obtained by using an evaluation questionnaire, the results of which are shown in section 7.

4.2 Questionnaire Surveys

The questionnaire for eliciting *organisational* requirements was designed to determine the characteristics of the Accra LCS and covered issues such as wage levels, inter-personal and individual behaviour, conflicts, management style, authority definition and hierarchy *et cetera*. Overall eighteen questions were posed. Appendix 2 details the structure and results obtained from the questionnaire. With the *application* level questionnaires, the aim was to determine the application requirements such as users competence with selected and widely used software such as Word and GIS tools such as ArcView, training needs, storage space, data needs *etceteras*. Twenty-three such questions were asked. Appendix 3 details the structure and results obtained at this level.

These questionnaires were administered to two types of respondents, namely 15 respondents at the middle or line management level and five respondents at the top management or policy level. The evaluation of responses to questionnaires by top management was delayed until initial requirements from the middle level had been obtained¹. It is these initial requirements that are evaluated to determine the characteristics of the LCS. Both open and closed questions were used in combination for eliciting staff responses. The use of open questions safeguards against interview prejudices that would have been achieved if only closed questions were used. To minimise errors of interpretation, the responses to open questions were condensed in the questionnaire (Flynn and Warhurst, 1994).

Nine males and six females (of the middle level) fully participated in the fieldwork exercise. The mean number of years' experience for the middle level management is 9 per person, with values ranging from 2 to 29 years' experience on the job. The job titles of the respondents included: Senior Lands Officer (1); Lands Officer (2); Assistant Lands Officer (7); Principal Inspector of Lands (3); Assistant Chief Technical Officer (1); and Senior Technical Officer (1). The respondents are an appropriate representation of the LCS workforce and include all types of staff who will be involved in GIS implementation (Plate 3).

¹ Reasons for this are given at 5.7 (implications for GIS)

Plate 3: Participants to the fieldwork exercise (August/September 2001)



The questionnaires were administered after respondents had gone through a brainstorming session on the CSF methodology lasting three hours. The brainstorming sessions introduced the respondents to the research and the interview process and to prepare them for what lay ahead. The purpose of asking individual respondents to complete these questionnaires was to identify the elements that the respondents think will ensure success in GIS implementation, based on their personal judgements. The approach of administering open and closed questions outside the brainstorming sessions therefore helped among others, in the detection of problems experienced by the individual staff member.

With regard to top management, the same questionnaires were administered albeit in interview sessions lasting up to an hour or more per interviewee. Their responses are compared with those of middle level management in order to determine problem areas that may arise in terms of GIS project implementation. It must be noted that the context for the questionnaires is that of an early requirement determination stage in the development and innovation process and they are therefore exploratory in nature. The approach is staff or user-oriented rather than computer-oriented.

4.3 Questionnaire Responses: Institutional Issues

Creating Awareness (Questions 1 – 3) The initial part of the questionnaire on organisational issues was so designed as to create awareness among staff members in positions to influence the attainment of the project's objectives. Before the general characteristics of the Accra LCS was determined, and as part of an attempt to *create awareness* on GIS implementation, therefore, the fifteen respondents were asked three questions that required their acceptance of the goal set by the Commission in GIS use. They were also made aware of the crucial role GIS could play in the LCS whilst an attempt was made to let them come to terms to the fact that the introduction of a full-fledged GIS project may warrant a different way of doing things. It was necessary for this to be done by staff members since there was the need for ensuring continuing active support and interest. There was also the need to ensure internal consensus as early as possible so that the machinery to maintain the GIS project could be established. All respondents agreed with goal of *“introducing a GIS that will support land management applications leading within five years to increased revenue base, efficiency and timely processes and high customer confidence in the Accra LCS work processes”*².

Nature of the LCS (Questions 8 – 14, 17 and 18): Other questions were designed to determine the organisational set up of the LCS and other institutional problems or bottlenecks such as personal behaviour and their impact on the image of the Lands Commission. Of the 15 respondents, 10 (67%) thought the LCS was overstaffed; three (20%) disagreed. The ten who agreed were of the opinion that excess workers in the LCS have led to underemployment and minimal workloads. However, almost all respondents (14 respondents representing 93%) agreed that wage levels were low and that levels must relate to productivity. Twelve (80%) of the respondents saw conflicts existing between the Estates Section of the Commission and the Legal Section with 10 (67%) citing a conflict situation existing between the Estates section and the Accounts section. When asked further to determine where the conflict emanated from, five respondents (33%) attributed it to leadership style and roles only, whilst three (20%) related it to work processes (only) and three respondents to policy issues (only). It would appear that improved pay and incentives and greater opportunities for

² This was adapted from the Lands Commission Mission Statement of 2001

promotion have a strong part to play in the bid to introduce a full-fledged GIS into the Accra LCS. The study also points to the fact that the LCS is badly in need of some streamlining of its structures and processes or even some overhaul. The GIS project has to take into account the potential impact of these factors, anticipate these problems and modify the implementation path accordingly.

Management style (Questions 15): Management style appears to have been detrimental over the years, as there have been few consultations between the implementation of different programmes. Changes in user personnel (as happened in 2000³) may create unstable user patterns (Davies, 1983). On management style, nine respondents (60%) thought that leadership style for the last 10 years had been autocratic whilst two respondents (13%) thought it had been paternalistic. Only one thought it had been consultative; three did not respond. Whilst respondents attributed this to lack of managerial talent, most felt that political interference was also to blame. Discontinuity of management as a result of frequent changes for political reasons is deemed highly disruptive. The GIS project characterised by a positive commitment on the part of management and politicians will be crucial for its success in the Accra LCS.

Authority definition/hierarchy and degree of decentralisation of operations (Questions 15 and 16): Eleven respondents (73%) saw authority definition and hierarchy as unclear. Only three (20%) insisted that it was clear; and one did not respond. Our investigations reveal that a Deputy Executive Secretary has never been appointed even though this was a Constitutional requirement. If the Executive Secretary was indisposed, who acts? We concluded that the LCS would have to be strengthened at different hierarchical levels and in various aspects relating to management, planning and policy formulation. A GIS project with a clear and well-defined institutional environment coupled with the right managerial arrangements and attitudes will greatly enhanced prospects for success. This point brought to the fore an

³In the year 2000, the new Executive Secretary supervised the ‘exchange’ of over 20 clerical staff members who had worked with the LCS for 10 years or more to other government institutions for what as unofficially attributed to corrupt practices on the part of such staff. One year ahead, the present crop of clerical staff is being accused of the same thing!

investigation into the degree of decentralisation now existing. Fourteen respondents (93%) believe that the Accra LCS must have a role distinct from the Head Office as envisaged by the Lands Commission Act, Act 483. The lack of this clear role re-enforced the respondents' earlier view that the definitions of authority and hierarchy in the LCS were unclear.

Political interference in the work of the LCS (Questions 4 - 7): Our investigations also revealed that there is the lack of stability in the structure of the organisation due to Government's interventions, particularly in the appointment and removal of 'top brass' in the LCS. The perceived political pressure on the LCS from the Ministry of Lands and Forestry was therefore investigated. Three (20%) respondents deemed such interference as positive, four (27%) saw it as negative with six (40%) being uncertain. However, 11 respondents (73%) were emphatic in agreeing to the proposition that the LCS must receive autonomy and be insulated from government control, whose role must be catalytic only. Nine respondents (60%) agreed that all directions from Government must be rooted through the National Lands Commission with three (20%) disagreeing; two were unsure. A general conclusion may be drawn, as has already been indicated, that the GIS project in the LCS will require strong and sustained Government support if the project's objectives are to be achieved. This is a complex matter that ought to be handled and monitored carefully by the GIS project manager. Government support in the allocation of human and financial resources or through the workings of the administrative and political apparatus will be critical to the Accra LCS GIS project's success.

As the empirical study shows, with management control changing, uncertainty is high and therefore this factor 'adds' to the level of uncertainty when introducing GIS. Because uncertainties are generally high, this suggests the need for the LCS to begin with a small pilot project preceded by a selected features prototype software that is deliberately experimental in nature and that needs to be monitored closely for eventual adoption. The next part of this paper will examine questionnaires administered at the application level before discussions on the use of the CSF methodology which seeks to establish which prioritised factors and their associated activities are critical for GIS diffusion and implementation in the Accra LCS are made.

4.4 Questionnaire Responses: Application Issues

In terms of the technical process of land administration, there is an initial need to study critically the needs of the agencies involved in land administration, management and planning. This will help to bridge the gaps in conceptual understanding between the potential GIS users (staff in the LCS and other land agencies) and the GIS developer. The design of information systems in this research depends not only on the development of concepts of performance (organisational issues) and but also the functional needs (application issues) for these land agencies. This part of the paper reports the results obtained from the questionnaire on application issues.

Training needs (Questions 1 - 7): Seven questions were asked of the 15 respondents in order to determine the level of user experience with computers generally and with the application proposed. Only four (27%) respondents used computers often, with eight (53%) admitting using computers 'sometimes' (Table 1). Two have never used computers before; one did not respond. No one had consistently used spreadsheets before with five (53%) having sometimes used this software. Seven (47%) had never used any spreadsheet before. It must be noted that 13 of the 15 respondents were university graduates.

Table 1: Use of selected software packages in the Accra LCS by selected respondents (September 2001)

Software	Often %	Sometimes %	Never %
Spreadsheets	0	33	47
Data Base Management Systems	13	20	40
Word Processing	33	53	7
GIS (Vector) e.g. ArcView	7	27	47
GIS (Raster) e.g. Illwis	0	13	60

Only seven percent of all respondents had heard about Knowledge Base Systems (KBS) or Decision Support Systems (DSS) even though 93% had heard about GIS. Of

these, only 4 (27%) had received some training in GIS⁴. To solicit commitment, all the respondents admitted that upon the introduction of a full fledged GIS, training was critical and that they were prepared to undergo training. Thirteen (87%) agreed to the proposition that training must be tailored to suit the LCS needs and that all employees must be computer literate. Two disagreed, citing reasons that not all staff members are trainable. These characteristics suggest the need to build the LCS institutional capacity. It is to be noted that none of the six women respondents had any training in GIS and therefore development of organisational capacity must be designed to involve women from the very beginning. This point is significant since it is proven (even though not documented) that women are more likely to remain at work after training. Other serious limitations solicited include no clear-cut training for staff and some difficulty in information retrieval.

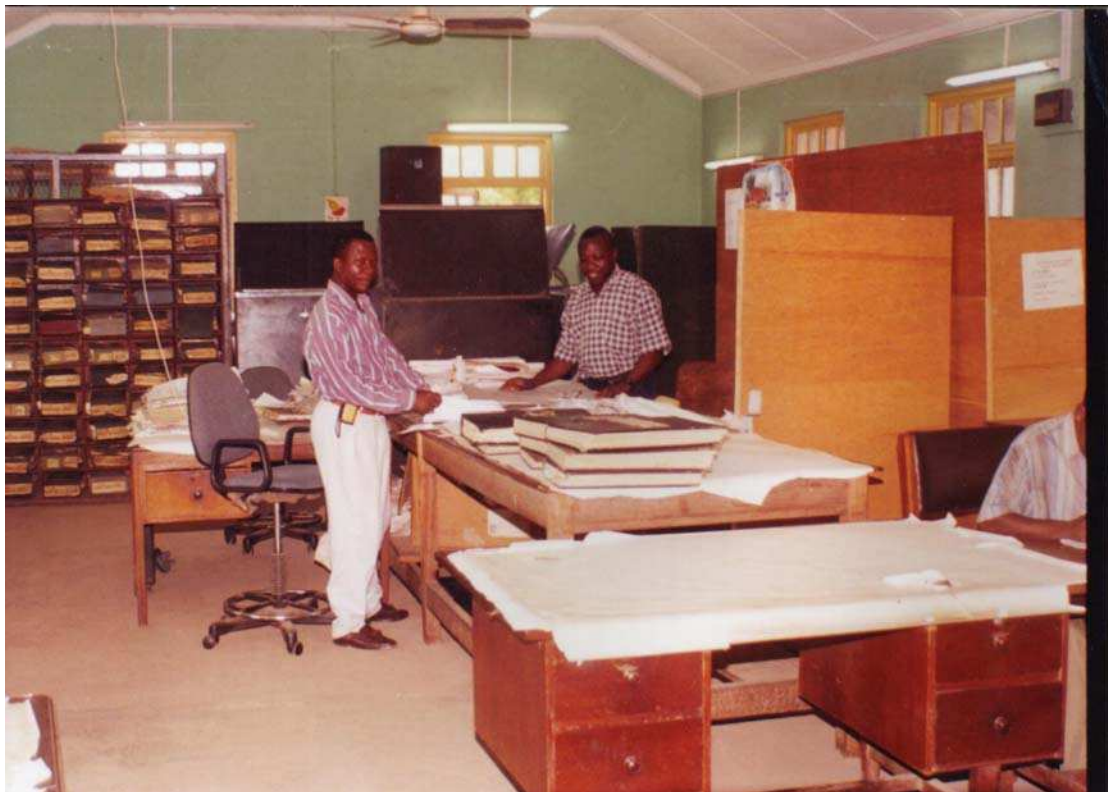
Work processes (Questions 8 - 15): When asked which work processes they wanted computerised most, the 'searches' procedure was awarded the highest total aggregated score of 120 followed by rent assessment and collection (104) and plotting(s) – the penultimate stage in the registration of deeds or leases (88)⁵ (Plate 4). The study concluded that most activities are not programmed and procedures will have to be streamlined and improved. For GIS implementation, it may require some re-engineering in all aspects of the Commission's work processes. This will require a careful diagnosis in order to establish an overall strategy for change. Implementing this agreed upon strategy will require a selective approach. Initially, a few more critical problem areas would have to be tackled, as a comprehensive reform may be seen as too ambitious and unworkable. It will therefore mean that issues that seriously constrain the performance of the LCS and that are within the capacity to change would have to be given priority. Public support for such a reform ought to be solicited.

⁴ During the validation session, it came out clearly that only one had been actually trained in GIS and therefore fully understood the principles underlying GIS. The other three had received instructions on how to use ArcView 3.2

⁵ Respondents were asked to give scales ranging from 1 to 9 to the type of work, scale 9 being the most important. These were then totalled to arrive at the level of importance attached for automation of such work processes.

Information needs (Questions 18 -17): All respondents agreed to the proposition that information/data the LCS provides or uses must be seen as a corporate resource; 27% suggested that this information should be subsidised with 20% advocating for its free use; and 53% felt that it should be at market value. This has some implications for GIS as corporate usage and pricing of information at market value would ensure that duplication is removed and adequate financial resources are obtained to ensure sustainability. It must be noted that for the LCS, the issue is not principally the accuracy of information but that of automation to help speed up processing capacity. This will place an enormous challenge to management as it seeks to redefine the information system.

Plate 4: Plotting at the Greater Accra Regional Records Office (September 2001)



Data needs (Questions 20 - 23): On *quality of maps*, 20% were of the opinion that this was poor; 60% thought it was fair, with only 7% insisting it was good. None thought the *quality of data* was poor. Thirty three percent thought the LCS data was of fair quality with 60% saying it was of good quality. When the question was put to determine the *reliability of maps*, 27% said the range of reliability was as high as 80-

100%, 33% said it was 60-79% reliable, 27% (49-59% reliable) with only 7% thinking it lay within the 20-39% range. On *data reliability*, none saw it as poor, with 20% considering it as of fair quality. Seventy three percent thought one could rely on the data since reliability was good. In any case to be able to accurately determine the reliability and quality of data, an inventory ought to have been conducted. The research that was exploratory did not have the objective of doing this. What is certain is that the LCS has devoted less attention to the problems of gathering and storing basic data and of monitoring progress toward good record management objectives. The use of GIS has the potential of providing land administrators with current analysis of relevant data and moving forward to achieving optimum results.

Organisational needs (Questions 18 - 19): Eighty seven percent of the 15 respondents were of the opinion that GIS must be a unit/department within the LCS ‘so that there can be some permanent staff in the unit to see to the day to day updating of spatial and attribute data’.

Based on these initial assessments, the study came to a conclusion that there is very high uncertainty as to necessary and desirable requirements at the application level. There was also a high uncertainty as to users’ ability to specify the correct requirements and a fairly high uncertainty as to the ability of any analyst to convince users to accept a new information system that may drastically change the usual way of doing things. This suggests a discovery methodology in which requirements are identified ‘iteratively’ as the application system evolves. The prototyping method is therefore recommended as the primary methodology at the application level. We will now discuss issues related to the factors necessary for GIS successful implementation in the Accra secretariat.

5 Results from the Critical Success Factor (CSF) Methodology

5.1 Applying the Methodology

It has been noted elsewhere that the *brainstorming method* that is actually an *asking strategy* was used with the *CSF method* in obtaining ‘factors’ and associated ‘activities’ necessary for successful GIS implementation. Brainstorming sessions comprising the fifteen respondents selected by the LCS management involved intense discussions that were recorded on tape to facilitate analysis of the issues raised. The

brainstorming method was used in eliciting a variety of suggestions through an open flow of ideas within the selected group of ‘experts’ (the respondents) and gave good results (Wasmund, 1993). The discussions covered a wide range of factors and issues necessary to meet the LCS goals such as maintenance, education and training and leadership style. The research reported here therefore, develops a list of ‘factors’ with their associated support ‘activities’ in order to provide a more broad understanding of the drivers of GIS implementation success in the Accra LCS. The aim was not only to gain a deeper understanding at the organisational level as to what factors are important, but which ones will be given priority by the users themselves. Brainstorming sessions (Plate 5) enabled the extension of the boundaries of the problem space of participants and elicited non-conventional solutions (Davies, 1982). Two such sessions were organised, the last being purposely for review and validation. The sessions lasted approximately three hours per session.

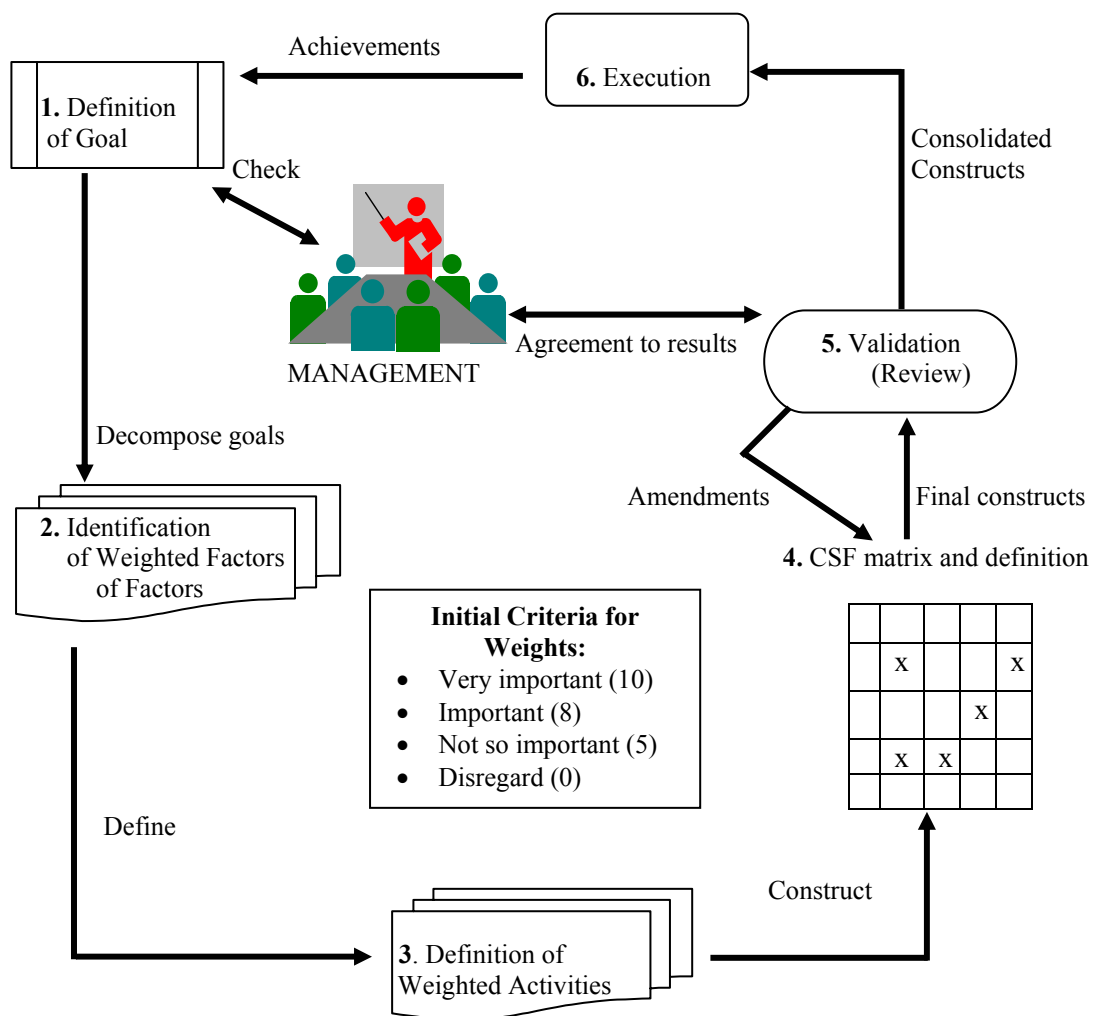
Plate 5: Brainstorming sessions during fieldwork (August/September 2001)



In Figure 1, the main components of the Critical Success Factor (CSF) method are shown. Double-ended arrows indicate processes that may be reviewed in transit,

whilst single-ended ones indicate processes that are consulted by other processes. The processes are followed rigidly (from definition of goals to execution) and show the various criteria to be used. The CSF analysis is a method for eliciting significant decisions on issues or on factors that are used in deriving requirements. The CSF method basically allowed the creation of a *project* out of a problem definition. We decomposed the goal the LCS has set for GIS development into a comprehensive list of sub-goals called ‘factors’. From this a list of ‘activities’ whose purpose is to obtain these ‘factors’ and eventually accomplish the specified goal is ascertained. The ‘activities’ are executed in a project context leading eventually to the solution of the original problem (Wasmund, 1993). This process will become clearer as we proceed. Box 1 explains why this methodology was chosen.

Figure 1: The Critical Success Factor (CSF) pilot study: study of performance needs (modified from Wasmund, 1993)



In the next part of this paper, the six steps in the CSF methodology will be explained and this is followed by an overview of the prioritised critical factors deemed necessary by respondents for successful GIS implementation. This is then followed by general observations made and the problems encountered in the entire exercise. Major findings and discussions are presented and respondent characteristics are analysed to determine the overall implication for GIS use.

Box 1: Why the CSF was used

The CSF methodology was chosen over the other methods such as the Business System Planning (BSP) developed by IBM Corporation because:

- it required relatively little effort to arrive at critical factors for ensuring the LCS systems' success;
- it was a means to recognise and eliminate redundant activities in order to focus resources on crucial areas of concern to the Accra LCS; and
- the selected respondents were involved as it is a method of eliciting requirements by *asking* them to define the factors that are crucial to success in performing their functions or in making decisions (Davies, 1982).

5.1.1 Step One: Definition of the LCS Goal

As previously noted, the goal of the LCS (as adapted from the mission statement of the Lands Commission) to establish a full-fledged GIS implementation was included as part of the discussions in the brainstorming sessions to help create awareness. The rationale of the goal for GIS development is to build a system that delivers quickly and is error-free as much as possible and that generates the expected revenue with respect to land administration and management. It is worth mentioning here that we tried to make the goal as exact as possible since succeeding steps depend heavily on it. The purpose, scope and time frame have been included and are made as specific as possible (Wasmund, 1993).

5.1.2 Step Two: Identification of Weighted Factors

The respondents are asked to identify ‘factors’ that will ensure the success of GIS implementation through intense discussions and consensus building. The analyst(s) had some factors that had been predefined for adoption⁶ even though respondents were told to freely modify, discard or add to such factors as they pleased. They were not only to identify but also prioritise such factors by initially awarding scores into four main criteria, namely a score of 10 (Very Important); a score of 8 (Important); 5 (Not So Important); and 0 (Disregard). The requirement was to identify those factors that are significant by system of ordering and deriving a set of ‘activities’ that might support these ‘ordered factors’. The initial ordered or weighted factors identified by respondents are shown in Table 2. The reference number has no significance except to uniquely reference a factor whilst the order of factors is in alphabetical order within each group. The meaning of every factor was given to enable the respondents to fully understand each factor (Appendix 1). This initial selection and scoring process allowed the relationship between the ‘factors’ and the respondents’ perception of GIS success in the LCS to be analysed.

Respondents initially disregarded ‘transportation and mobility’ citing the fact that (for administrative reasons) it was a general requirement and had nothing to do with the use of GIS per se. These initial designations will change, as would be seen shortly, after validation. It is important to state that we are, particularly, interested in the critical ‘factors’ for GIS implementation. We will therefore intentionally delay discussions on ‘factors’ until ‘activities’ to support them are first defined to help us understand fully the methodology. Once the factors are chosen, their associated activities can easily be identified and linked to them.

5.1.3 Step Three: Definition of Required Weighted Activities for the Accra LCS

In contrast to the first step of defining ‘factors’, the next step of defining activities expresses the work to be performed that would satisfy one or several factors. Again, most of these activities had been pre-defined by the researcher(s). However, there was

⁶ Some factors were predefined to enable easy discussions. It was necessary that this be done, looking at the level of experience of respondents in GIS. The factors were selected based on other countries’ experiences that the analyst(s) found germane to the LCS situation.

an additional activity that was added by the group since it appeared that the ‘Accounting and auditing’ factor had no related activity. The agreed upon ‘activity’ – *‘Have a proper accounting and cash control system’* is added in Italics (Figure 2).

The ‘activities’ as defined and discussed by the group is now presented as follows:

- *Have supporting equipment.* Equipment support, it was noted, is essential if one is to proceed in an efficient way. Of particular mention is efficient uninterrupted power supplies (UPS) or generators to forestall stoppage of work due to frequent power cuts that normally occur in the Accra LCS.
- *Have maintenance of equipment schedule.* Maintaining equipment was considered a strong prerequisite. It must be noted that the need to ensure adequate funds extends to the operational phase of a GIS project as well. There should never be an under-estimation of recurrent cost obligations, so that facilities would not undergo rapid deterioration for want of adequate operating and maintenance funds.

Table 2: Factors emerging out of brainstorming sessions and their initial attendant scores

Reference	Factor	Initial Score	Meaning
1.	Communication (Networks)	10	Very Important
2.	Education and Training	10	Very Important
3.	Hardware and Software	10	Very Important
4.	Leadership style and support for GIS	10	Very Important
5.	Maintenance	10	Very Important
6.	Remuneration	10	Very Important
7.	Current Budget	8	Important
8.	Discipline	8	Important
9.	Motivation	8	Important
10.	Progress Control	8	Important
11.	Staff Number Reduction	8	Important
12.	Accounting and Auditing	5	Not so important
13.	Autonomy	5	Not so important
14.	External Funding	5	Not so important
15.	Political Leadership	5	Not so important
16.	Transport and Mobility	0	Disregard

- *Establish a curriculum for training.* Training was to be planned from the very outset and must be properly executed. The group acknowledged that it was wrong for training programmes to be added at the very last moment. This requires that the LCS must make provision for adequate resources for training and for skilled trainees to be recruited. Female staff members have to be encouraged, as they are more likely to stay after training. The closer the training is to the workplace the better and therefore on-the-job training must be embraced where feasible
- *Ensure motivation and commitment.* It was agreed that realisation of the overall goal is a long-term process. Continued interest in and active support by individual staff members who are in a position to ensure the attainment of the project's objectives must always be solicited. This, the group agreed, can be done through provision of incentives and award schemes as 'accelerators'. Incentives would be needed to change human behaviour. Incentives should be linked to measurable results attained by staff within set time frames.
- *Relate remuneration to production targets.* Related to the 'motivation and commitment' activity is that of linking remuneration to the level of production. This would depend, to a large extent, on the autonomy status that the LCS is now seeking. The group suggested that increases in pay must relate to performance and not merely 'to fight inflation'.
- *Define and apply standards.* Standards are required for land administration purposes in order to track and record land ownership details and for verification of land data. Standardisation of input documentation is necessary to speed up processing times and improve efficiency. It is also to ensure a smooth running of the computer operations.
- *Establish an upgrading programme on software.* Existing systems would have to be upgraded continuously. This suggests that a timetable for changing usable parts and systems must be drawn and followed.
- *Make a reserve fund to recoup capital.* There was a general consensus that it would be wise to set aside funds from the annual budget as a reserve fund to purchase needed items and for general maintenance of equipment.

Figure 2: Juxtaposing activities and ‘factors’: the CSF matrix before validation

		Leadership style	Staff number reduction	Political Leadership	Communication (networks)	Transport (mobility)	Autonomy	Discipline	External funding	Current Budget	Progress control/Updating	Accounting and auditing	Remuneration	Motivation	Education and training	Maintenance	Hardware and software
X	X				X					X	X						<u>Have supporting tools</u> (e. g. air conditioners/uninterrupted power supply (UPS))
X					X					X	X						<u>Have maintenance</u> (of equipment) schedule
				X					X						X		<u>Establish curriculum</u> for training of staff
							X		X			X					<u>Ensure motivation and commitment</u> (by provision of incentives) of Staff
							X		X					X			<u>Relate remuneration to level of production</u>
X									X	X	X				X		<u>Define & apply data standards</u> (ensure data quality, reliability and integrity)
X	X				X					X							<u>Establish an upgrading programme</u> on software *
										X							<u>Make reserve fund</u> to recoup capital invested into GIS
									X								<u>Seek external assistance</u> (donors such as the World Bank) *
	X								X								Have more vehicles to <u>ensure mobility</u>
X	X	X							X								<u>Establish communication networks</u> with other land related agencies)
		X				X								X			<u>Government to play catalytic roles</u>
		X					X		X					X			<u>Remove underemployment</u> (the right number of trained & staff)
		X	X	X			X		X	X				X			<u>Have consultative leadership style</u>
X	X									X		X					<u>Have a proper Accounting and cash control system</u>

- *Seek external assistance.* Initially, this activity was identified as comprising two components namely: seeking external funds for initial GIS take off and the use of foreign consultants. The group dropped the former since equipment through the GERMP was already in place. The issue of foreign consultants was also dropped since respondents were of the view that there was in-house capacity to meet the demands of the project even though refresher courses were a necessity for such experts. The use of local consultants was an accepted alternative to the group, one of which had already been contracted.
- *Have more vehicles to ensure mobility.* The Estates section of the Commission is to be strengthened with the allocation of vehicles specifically for checking unofficial changes of use and for upgrading addresses of lessees to facilitate rent collection.
- *Establish communication networks.* It is important that the Local Area Network (LAN) already installed is made optimally operational to enable corporate-wide storage and retrieval of information for internal use by all sections. The LCS was (in consultation with other agencies) to have on the drawing board the possibility of linking to agencies such as the Survey Department, the Administrator of Stool Lands and the Land Valuation Board that are in close proximity to it and that need to be networked as well.
- *Remove underemployment.* The LCS is expected to undertake a programme of removing excess staff by a phased-out policy of voluntary retirement of non-essential staff. Staff members who cannot be trained, it was agreed, must be retired with due compensation.
- *Government to play catalytic roles.* This activity relates to perceived Government interference in the work of the LCS by the Ministry of Lands and Forestry. The issue of the mode of appointment of the Executive Secretary particularly came under intense discussions. The group deems the rapid rotation of personnel in top posts to be highly detrimental and noted that the practice if not stopped, could affect the project's goals in the long run.
- *Have consultative leadership style.* It was agreed that, managerial problems are often the root cause of GIS implementation delays and cost overruns. Good managers are a major determinant to project success and consultation at every level always pay good dividends.

- *Have a proper accounting and cash control system.* As noted, this activity was added after discussions. This was to ensure transparency in the accounts of the GIS project during and after computerisation. There is the need to have a general outline or financial plan to ensure availability of funds and for checking possible dissipation of funds.

5.1.4 Step Four: The CSF Matrix and Definition of Factors

Apart from the fact that the CSF methodology allows the recognition of unsupported factors for which no activities have so far been defined or vice versa, it allows the juxtaposition of weighted factors and activities and the subsequent removal of all redundant activities. (These redundant activities have asterisks associated with them in Figure 2).

The relation of ‘activities’ to ‘factors’ is that of one-to-many relationship. One ‘activity’ can support one or more ‘factors’. When the weighted ‘factors’ and ‘activities’ were juxtaposed and the respondents were asked in the brainstorming session to mark the ties between them there was confusion! For while initially ‘*Current budget*’ was seen as ‘important’ it came to supersede all factors as it had fourteen activities (93% of all activities) supporting it and therefore was actually the most important factor. This was followed by ‘*Education and Training*’ with eight activities (53%) supporting it. This called for a more careful analysis. The group acknowledged that they had been rash with the scoring process from the very beginning. The goal of the LCS had to be re-examined. Analysing the goal, we found that the LCS is concerned with land information administration and management and with revenue generation for Government. It was therefore necessary, among other things, to establish a land information infrastructure devoid of errors, that delivers quickly and that will also link with other land agencies with the view of ensuring increased revenue base for the LCS.

Table 3 shows the new criteria indicating the frequencies and associated percentages that implicitly also show the respondents’ preferences and perception of GIS success in the LCS. Comparison of Tables 2 and 3 shows an interesting phenomenon. The ‘Communication (Networks)’ factor has moved from ‘very important’ to ‘important’

and 'Current Budget' from 'important' to 'very important'. 'Progress Control' moves from 'important' to the 'very important' category whilst 'Autonomy', 'Political Leadership' and 'Accounting and Auditing' move from 'not so important' to 'important'. The 'Transport and mobility' factor is promoted from the 'disregard' criterion to 'important'. The only 'not so important' factor had come to be the 'External Funding' Factor.

Based on this review exercise, the 'disregard' criterion was changed into 'not necessary' criterion and given a score of zero by the group. No factor was given this criterion unlike the initial assignment of the 'disregard' criterion to the 'Transportation (mobility)' factor. New scores were therefore set resulting in criteria or meaning that were to be associated with any one factor (Table 3). Factors with a score of greater than or equal to 4 activities supporting it were deemed 'very important'. Those between 2 – 3 inclusive were 'important', 1 was 'not so important' and 0 was 'not necessary'. The allocation of scores was simple. The ties relating to a specific factor were counted. If the count fell within a particular range then it qualified for that criterion. For example, 'Hardware and Software' had 6 ties. It fell within a range greater than 4 and therefore qualified as 'very important'. It is this review that is sent to top management for further review and validation and acceptance.

Table 3: Reviewed ‘factors’ and their prioritisation by respondents in a brainstorming session

Reference	Factor	New Score	New Meaning	Frequency (n = (15), 13)	Per Cent
7.	Current Budget	≥ 4	Very Important	(14) 12	(93) 92
2.	Education and Training	≥ 4	Very Important	8	62
3.	Hardware and Software	≥ 4	Very Important	(6) 5	(40) 38
4.	Leadership Style & GIS support	≥ 4	Very Important	4	31
5.	Maintenance	≥ 4	Very Important	4	31
6.	Remuneration	≥ 4	Very Important	4	31
9.	Motivation	2 – 3	Important	3	23
15.	Political Leadership	2 – 3	Important	3	23
10.	Progress Control	2 – 3	Important	3	23
11.	Staff Number Reduction	2 – 3	Important	3	23
16.	Transportation (Mobility)	2 – 3	Important	3	23
12.	Accounting and Auditing	2 – 3	Important	2	15
13.	Autonomy	2 – 3	Important	2	15
1.	Communication (Network)	2 – 3	Important	(3) 2	(20) 15
8.	Discipline	2 – 3	Important	2	15
14.	External Funding	1	Not so important	1	8
-	-	0	Not necessary	-	0

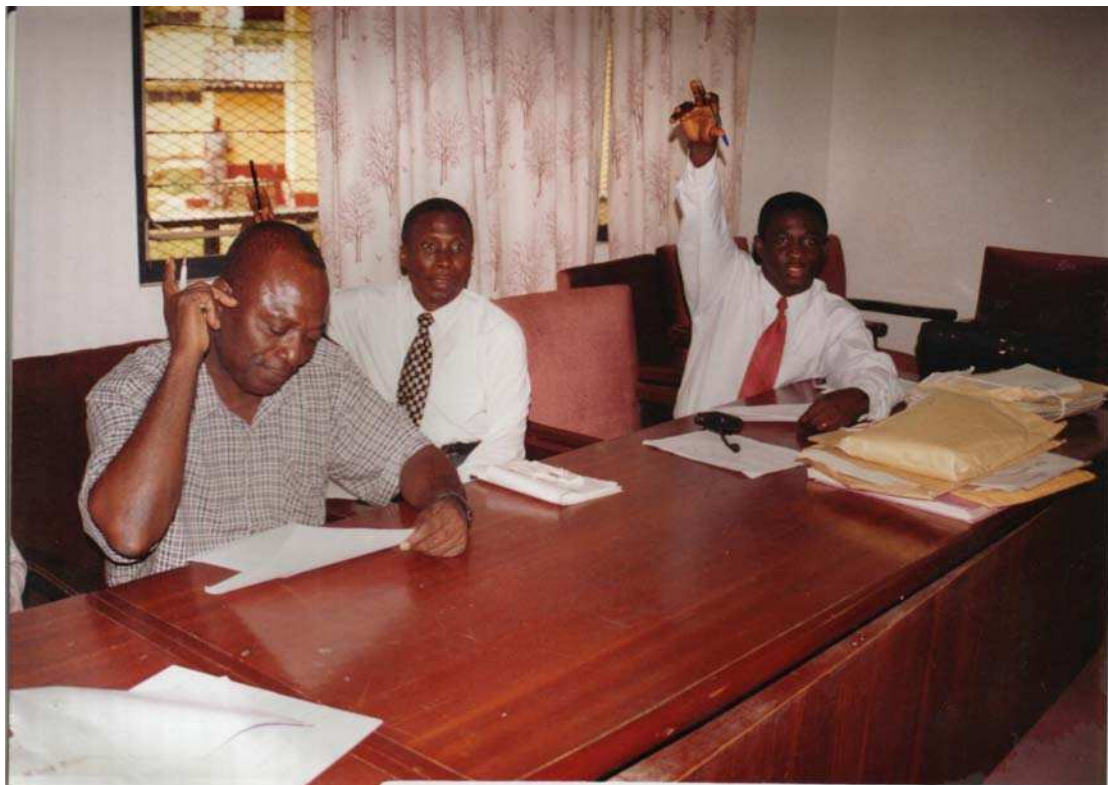
Note: (n is the total number of ‘activities’ that would support any ‘factor’ e.g. 12 activities support the ‘current budget’ factor – after removal of redundancies. Before redundancies were removed, 14 activities supported it). Figures in brackets indicate values before redundancies were removed.

5.1.5 Step five: Validation and Review

Validation with middle management on CSF methodology. Validation took the form of presenting back to the respondents their *responses during the brainstorming sessions* to determine whether their requirements were captured correctly (Plate 6). The various factors and activities for GIS use were verified as correct, and the CSF matrix was accepted as a true reflection of respondents’ initial position on issues raised. Before then, two things occurred to the matrix. Firstly, it was noticed that the ‘Establish a upgrading programme on software’ activity, could merge with the ‘Have supporting tools’ activity’ since the former was subsumed in the latter. The same marked ties are replicated. One activity – ‘Have supporting tools and upgrading programme’ was then proposed and accepted. Secondly, in the same vein, the ‘Seek external assistance’ activity was covered by the ‘Make reserve fund to recoup capital’

activity. The former activity was therefore rendered redundant. However, respondents particularly wanted a clarification on why the ‘Seek external assistance’ activity was considered by them to be redundant and asked that this should be explicitly captured. The meaning assigned to this activity – ‘not so necessary’ to them meant that no external donor assistance was needed for GIS take off in as far as the *Accra LCS* was concerned but some form of assistance may be required for *training abroad* for key staff only. On the issue of consultants, the grouped wanted stressed that, whilst consultants may be needed overall, the in-house capacity existed in the Accra LCS, and that when their involvement became imperative, they must be used to develop and improve local capacity as a matter of priority.

Plate 6: Validation session (September 2001)



Validation with middle management on questionnaires. The second major event during the validation session was presenting back to the respondents their *responses to the questionnaires* administered. The aim was to let them know what individuals thought above the peculiar issues raised with the view to engendering discussions. Intense discussions followed, culminating in the clarification of some points raised

therein such as what was meant by leadership being ‘autocratic’? It appeared that some respondents actually answered questions they were not sure of!

To enable a convergence of views as expressed by the middle level management and that of top management, appointments with top management were made. The Chief Records Officer (CRO) who is the most senior of all technical staff, the Chief Accountant, the Personnel Officer, a Principal Lands Officer at the Head Office and the Executive Secretary himself were presented with respondents’ findings (mostly in their area of competence) for their comments (Plate 7). It was not possible to get a representative of the legal section due to their tight schedules. In certain instances, some top management (the Chief accountant and Personnel Officer) submitted documents in response and in support of questions and observations posed or made. These interviews, as already noted, took up to one hour per interviewee and were conducted in different days agreed upon by the analyst(s) and the top-level personnel. This approach meant that both top and middle-level personnel have been involved from the very beginning. Their participation in the preparatory stage (that is expected to spill over into the implementation stage) would therefore ensure some commitment to the project goal and subsequently help achieve the GIS project’s objectives in the Accra LCS.

Plate 7: Review with top management



5.1.6 Step six: Execution of Activities in Support of Prioritised Factors

The LCS pilot project would be deemed to be successful if it achieves a moderate to high rate of return after investment, and if the Commission is strengthened in terms of its structure and hierarchy and policies, so that a solid foundation for sustainability is laid for the GIS project. But how do we ensure the successful execution of the agreed activities? The application of the CSF methodology has helped in determining, coordinating and tracking crucial factors and activities that are required for introducing a full-fledged GIS into the LCS in Accra. The method does not itself support implementation and execution of the identified activities. Implementation has to be carefully tailored to the Accra LCS local environment and culture in order to be effective (Wasmund, 1993).

It has been observed that the success of GIS implementation would depend, among others, on autonomy being given to the LCS to enable it carry out its activities in accordance with broad goals and specific performance targets agreed on with Government. The successful execution of activities to support the project goal would also depend on certain institutional changes that were imminent, and on how each member of staff would personally assess the implication of GIS introduction into the system. It will depend on sustained management support and commitment and on the availability of dedicated a GIS champion(s). It would also depend on appropriate design and adequate preparation. A strong financial base and a pilot project approach preceded by prototype software on identified application areas will provide the best-sustained results in practice. This is despite the fact that the pilot project will require a fair amount of patience from the LCS management or even Government who are expected to issue funds to support the project. It must be stressed that, continuity of staffing for the initial design through implementation is necessary so that those responsible for design and for implementation have access to each other for a lengthy time period.

We will now present results obtained by the brainstorming session giving an overview of the prioritised critical factors that we found are necessary to support the GIS project goal.

5.2 Critical Success Factors Identified

Respondents were of the opinion that to be able to have a successful GIS, the Accra LCS must first and foremost aim at having a *sound revenue base (Current budget)* (92%) on which to operate. This supports the view that future budgets must start with current budgets (Loy, 1997). Insistence on financial viability (based on the LCS own resources) is an important means by which discipline would be imposed on the Accra LCS whilst encouraging efficient management and use of available resources. Ironically, the group was of the opinion that it is only the introduction of a full-fledged GIS in the LCS that would ensure a sustainable financial base. There must be sufficient funds both to complete the GIS project and to operate and maintain it. The present system as it is now (in the Accra LCS) may not warrant any foreign assistance for take off. The group, as noted, attributed this to the legacy left by the GERMP and to the current policy of management on computerisation.

To be able to meet the overall goal set by the Accra LCS on GIS implementation, the LCS must have a well-trained staff needed to create the appropriate mind set and establish the necessary technical skills. This supports the view that appropriate staff with requisite training must be available and that staff who are lacking in the necessary technical and communicative skills are most likely to ensure failure (Fox, 1991; Edralin, 1991 and Huxhold, 1991). *Education and training* (62%) including in-house and workshops are therefore necessary ingredients to update knowledge. Training may be supplemented by *external funding* (8%) through sponsorship of courses abroad for a core group (only) who are expected to train others locally. The group thought that overall, the external funding factor was 'not so important', since such a core group have already been trained abroad but are scattered in the regional offices of the Commission with the Accra LCS alone benefiting substantially. Short refresher courses are needed for key staff with GIS knowledge to enable proper orientation and teaching of new ideas to take place.

The existing *hardware and software* (38%) need to be upgraded or replaced regularly. All offices must be linked to the Local Area Network with each office having computers for use so that work processes can be automated as far as possible. Closely linked to a good *networking system* (23%), the group observed was an effective *maintenance* (31%) programme to maintain existing hardware and to update software

and make necessary backups. This presents an enormous challenge to management as Ghanaians generally 'lack a maintenance culture'.

Leadership style and top management support (31%) for GIS was required for a lengthy time period. This supports the view that full management support and involvement in the execution of GIS projects with such projects directed at intended GIS beneficiaries is an important requirement. For this reason, inappropriate management styles will obscure direction and put investment in GIS at risk. It is important that good *political leadership* (23%), especially as it relates to the mode of appointment of the Executive Secretary of the Commission, was considered. All were in agreement that the post ought to be advertised and the selection procedure made transparent. Frequent changes in the media of the top post must stop to enable policies to be fully implemented. There is also the need for the LCS to be given greater operational freedom to carry out its assigned task. Why for instance would the Executive Secretary require ministerial approval for the appointment of a Systems Administrator to help in GIS implementation? The LCS ought only to be held more accountable for results and not be crippled by unnecessary bureaucracy.

On *progress control* (31%), the respondents are particularly interested in monitoring progress towards the set goal. Progress control comprises definition of progress, checkpoints and milestones. *Proper accounting and auditing* (15%) are required in order to record exchanges and associated costs in GIS implementation. The practice of involving internal auditors, as part of a complete team that looks at future computer developments is worth considering. This is expected to lead to controls and security surrounding any new development. The low percentage rate (13%) is attributable to respondents' view that such a factor is needed whether GIS is in place or not and therefore 'does not exert any positive peculiar pull' with GIS implementation.

When it came to discussions on *staff number reductions* (23%), some respondents were initially apprehensive. However, the majority were of the view that there was need to remove underemployment, which already existed in the LCS as part of the Civil Service legacy. Associated with this was the idea that the retained staff should be computer literate as far as possible. These must undergo some *motivation* (23%) to attain higher standards, especially in the area of professionals who have to change

their practice. This, of course, is related to *better remuneration* (31%). Ideally, better salaries commensurate with job descriptions and performance is a necessary prerequisite for continuity in the job. The idea is to stop ‘brain drain’ after training. *Discipline* (15%) is required in a system such as the LCS where indiscipline thrives. From the very top to the bottom hierarchy and authority must be respected.

Mobility (23%) is another issue that was extensively discussed. Whilst initially this ‘factor’ was disregarded the ensuing review raised the need to reconsider this factor. The group was of the view that transportation will be necessary for site inspections in an updating information programme. Changes of use on the estates managed by the Commission without consent and encroachments could be monitored this way. Addresses of lessees could be easily checked and updated enabling effective rent collection if mobility is assured. However, respondents insisted that since this responsibility would most probably be ceded to the private sector (if management is to lend its support), transportation as a ‘factor’ was extraneous to the LCS in GIS implementation. Ironically, in the filling of the questionnaire 13 out of the 15 respondents did not want to see the private sector get directly involved in the work of the Commission, especially in the area of rent collection, that respondents acknowledged had serious shortcomings! Evidently, the respondents were suspicious. The element of suspicion engenders in them a natural tendency to resist any interference in their domain of influence.

5.3 General Observations and Problems Encountered

An essential element of this empirical survey is the identification of problems found with the brainstorming and validation sessions and subsequently with the responses (users’ characteristics) to questionnaires administered.

5.3.1 Problems Associated with Brainstorming and Validation Sessions

- The analysts’ knowledge and experience are assessed. The problems associated with the two sessions brought to the fore the fact that the analysts ought to be knowledgeable in the proposed system and be experienced with the current information system to enable him to correctly structure the problem space. This

became evident during the sessions, as the analyst(s) had to constantly draw on his experience.

- Detection of contributions by a vocal few. A few of the respondents made contributions during the sessions. Five males and two females of the fifteen participants appeared to be dominating proceedings. This is a problem associated with brainstorming sessions. Reliance on such a vociferous few alone could not elicit complete and reliable requirements even though to the Ghanaian, ‘silence means consent’. On this note, review sessions with top management become crucial if results obtained from such a small subset of the sample are not to be treated with doubt and utmost caution. The questionnaires given for individual assessment also helped to reduce any such shortcoming.
- Difficulty in eliciting information due to changing requirements. The analysts had, in some instances, assumed that requirements (such as factors under the CSF method) were known and had fixed them prior to these sessions. However, the constant change of direction through debate meant a lot of fine-tuning and modifications. The recording of proceedings on tape helped to ensure that requirements were captured correctly and cross-checked. The validation session proved very significant as it accorded the group the chance to review and accept facts collected by the analyst(s) as a true reflection of their views.
- Rashness in the scoring process. As a corollary of the previous point, some indiscretion in the scoring process on the ‘factors’ and ‘activities’ was detected in the initial stages. The analyst(s) had to provide a good leverage so that the group could remain focussed on the stated GIS goals by re-stating goals and objectives of the proposed GIS project and by engendering intense discussions during brainstorming sessions.

5.3.2 Problems associated with responses to questionnaire: users’ characteristics

- Non-participation. Two of the initial 17 respondents (both women) originally picked by management did not attend the brainstorming session bringing the total number of respondents who actually participated to 15. Incidentally, one of the absentees attended the validation session. As expected, she sat through the session as an observer and therefore never made any contributions. We can only provide

some allusion for this problem such as respondents' unwillingness to participate or that they were kept away by pressing issues beyond their control, the latter being a more plausible reason.

- Detection of non-commitment in filling of questionnaires. There was evidence that at least one respondent was unwilling to participate or was totally uncommitted. The level of commitment in answering questions may be attributable to some ambiguity of some questions in the questionnaires⁷, the respondents themselves having some difficulty in understanding and expressing their requirements and/or the sheer unwillingness on the part of some respondents to participate.
- Users give reasons or comments. On *organisational issues* only two respondents (13%) gave reasons or comments for all the eight spaces provided for such comments. One respondent gave just one comment. Comments given on *application issues* were relatively low with only one providing comments to all twelve spaces provided. One person again gave only two comments, that being the lowest count. It can be concluded that respondents had difficulty expressing their requirements, which may be because they are unfamiliar with the specifications or did not devote sufficient time to communicate their requirements, even though the former factor appear more likely to be the case.
- Detection of ambiguity and incompleteness. Some questions (as indicated earlier) were either not too clear or presented some problems of interpretation. Some responses were ambiguous especially those related to the issue of autonomy and political interference. The validation session helped to iron out the differences.

5.4 Major Findings and Discussion

The brainstorming session can be viewed as a formal process as it involved following well-defined steps in the use of the CSF methodology. The administration and filling in of questionnaires were based on individual judgement and experience and therefore constituted an informal process. The two complimented each other. However, there is the possibility of a divergence between the two approaches and how they will relate to the actual situation on the ground. The validation and review processes associated

⁷ During the validation session some concerns expressed related to clarifications of some questions.

with the research helped to bridge this gap through an iterative process involving a major level of learning between the researcher, the respondents and top management. This gives weight to the now widely accepted view that to provide information systems that meet user requirements will entail an iterative validation process (Avison and Wood-Harper, 1990). We will now discuss the areas of agreements and disagreements between views expressed by the fifteen respondents and that of top management.

5.4.1 Areas of Agreement between Top Management and Respondents

- *Political pressure from the Ministry of Lands and Forestry:* The Executive Secretary (ES) agreed with the five respondents who specified that they were uncertain as to whether pressure from the Ministry was positive or negative. He was of the opinion that the intervention from Government had always related to pressure on the LCS to improve service delivery, reduce delays and introduce transparent practices and saw such interventions as necessary whether it is seen as positive or negative. The role of GIS in automating processes and thereby speeding up such processes is therefore deemed crucial to the work culture of the LCS.
- *Autonomy:* Whilst the ES saw that the Act that established the LCS seeks autonomy for it, he was quick to explain that the push for autonomy related to “financial and organisational autonomy”. This implies that the LCS must have the ‘power’ to employ and sack its own staff, determine its own level of remuneration, and have its own budget. He said the present state where these requirements are non-existent puts the LCS in a predicament. The LCS, for instance, cannot sack recalcitrant members of staff that are seconded from the Attorney General and Accountant General’s offices. If GIS is to be a unit or department in the LCS as envisaged, then the unit ought to be given autonomy to carry out its functions in accordance with agreed goals and specific performance targets. This must be set within broad goals set by the government on autonomy for the LCS as a whole. The set goals by government will hold the LCS accountable for results, while improving the flow of information to Government about the Commission’s performance. Eleven of the respondents are in agreement with this view insisting that government’s role must be catalytic (speeding up the

work processes only).

- *Government's directives through the National Lands Commission (NLC):* The ES was in agreement with the majority of respondents who were of the opinion that all directives from Government must be rooted through the NLC and in fact saw this as a *fait accompli*. At the moment, however, the NLC is not sitting. For over a year now the Chairperson and the ES take all decisions on behalf of the NLC. The ES, however, saw the composition of the NLC (as stipulated by the Act) as too large making it difficult for it to reach decisions at board level. Upon the introduction of GIS, continued political support from government and the establishment and optimal operation of all requisite institutions within the appropriate policy frameworks will among others, engender growth and improve access to information.
- *Corruption:* The factors that respondents think underpin the reason for corruption in the LCS are, in order of priority, low wage levels, indiscipline, pressure from the public, sheer greed and the culture of the LCS. On wage levels, for instance, the Chief Accountant cited an example of a Senior Lands Officer (capable of heading a regional office) with more than ten years of experience, and with a second degree in GIS, taking a monthly net salary of ₦617,389 (approximately £62) in July 2001! He has no allowance except that he may use a government vehicle that is regulated and fuelled every week. He admits that enormous pressure is put on staff because of very low remuneration. The ES, however, thinks the issue of corruption has more to do with the shortage of staff and its concomitant delays in the system. He is of the opinion that a system with limited or no delays will remove 'rent seeking' in the normal work processes since the public is compelled to pay bribes to 'jump queues'. Recalcitrant staff would always create institutional bottlenecks as 'hiding of files' in such an environment, in order to foster illegal financial exchanges. For a successful implementation of a GIS project, salaries and benefits for staff must be adequate to attract, retain and motivate competent professional staff. It may mean raising pay levels of staff to bring it closely in line with that of competing positions in the private sector. GIS placed in a proper institutional setting will help change procedures that will enable services to be delivered expeditiously.
- *Position of Executive Secretary (ES):* The ES gave approval in principle to

respondents desire to see changes in wage levels, and work processes and the mode of appointments to the ES position (in that order) but chose to comment rather extensively on the latter. He was of the view that the position ought to be advertised to defeat the notion that the appointment is political and not based on merit. He admitted that there is so much insecurity attached to the ES position that one is 'always looking over one's shoulders and thinking when he would be removed'. As noted elsewhere, discontinuity of management as a result of frequent changes for political reasons can spell doom for any GIS project. It is important to state also that good managers are often a major determinant of GIS project success and it is imperative that leadership is appointed based on qualification and competence in a transparent process as much as possible. It has been noted that managerial problems are often the fundamental cause of GIS implementation delays and cost overruns.

- *Training:* The ES admitted that training at the LCS had been at a 'very low level' but stressed that the current manual system is so very problematic that it has to be improved substantially before a full-fledged computerisation programme is embarked on. This accords with Zwart's (1990) position that reforming existing (manual) systems before introducing the computer is a major step to securing their success. He admitted that even though nine persons have been trained in various fields in GIS nation-wide, they had gone rusty as they had gone back to the manual way of doing things. A change in organisational focus will help, he said. For GIS, management and staff need training and skill development since the need for skilled people remains urgent. The search for training strategies relevant to the LCS institutional needs must continue. It may be necessary to train more staff than are immediately required to forestall frequent loss of people once trained.
- *Work processes most needed to be computerised:* The ES like, the majority of the respondents, would want to see that the searches process, leases and associated consents, rent collection and management in relation to *all aspects of state lands* are automated as a matter of priority. These are areas that are most likely to meet the revenue objectives of the LCS aimed at covering operating costs and contributing to investment from internally generated funds.
- *Information as a corporate resource:* Whilst top management agreed with the respondents that information must be treated as a corporate resource, it was of the

view that such information should not be free or subsidised either. It must be ‘at cost and not sold for profit’. In the public service where the LCS fits, cost recovery can be a difficult issue. Practical administrative and political considerations are determining factors. It is therefore clear that the introduction of new fees or charges or a possible substantial increase in existing fees is more likely to be accepted by the Ghanaian public after project implementation is well advanced and some benefits have been derived from GIS use.

- *Private participation:* In the area of rent collection and management, the ES agreed with the respondents that with the necessary financial support, better training and stronger incentives, the staff of the LCS was capable of delivering and ruled out any private participation in the LCS work processes. As already noted, the limited management capacity of the LCS may require a re-think on this issue. In this case, it is expected that a strong bond would be fostered between management, staff and the private/local consultant if indeed private sector participation was warranted.
- *GIS as a Department:* Top management shared the view of all respondents that GIS must be a department on its own in the Accra LCS environment ‘but certainly not a unit hiding somewhere’. It must be a full-fledged department well integrated into the LCS system. It is therefore essential that the proposed GIS unit first identifies and concentrates on activities central to the project’s objectives whilst ensuring that co-ordination of the projects requirements are scrutinised. This will require that authority for getting practical tasks done be clearly demarcated as well as clear lines of responsibility mapped out in order to avoid unnecessary conflicts.

5.4.2 Areas of Disagreement between Management and Respondent

- *The LCS is unnecessarily large?* The ES disagreed with ten of the respondents that the size of the LCS was unnecessarily large and therefore ought to be trimmed, insisting that this assertion must be put in perspective. He stated that the LCS is ‘bottom heavy’ and ‘top light’, apparently referring to the small number of qualified professionals, as compared to the large number of available unprofessional staff; the LCS was understaffed from the angle of needed qualified professionals. He suggested that, there was the need for some ‘needs assessment’ on the present stock as to whether to retrain or retrench any staff. This would

depend on the financial autonomy that the LCS so requires. He intimated that since the ‘bottom heavy staff’ is actually staff of the Civil Service, they cannot just be laid off without adequate compensation and can at best be off loaded back to the service. It is important to note that, at the heart of the performance of the LCS, lay issues relating to morale, efficiency and competence of the civil servant. There is evidence that such personnel at lower levels are overstaffed. Ironically, salaries and benefits at the professional levels are inadequate and may not attract, retain or motivate qualified professional staff. For GIS, there is the need to identify redundant workers and help retrain and relocate them while efforts are made to attract more professional staff through better salaries and incentives.

- *Conflicts?* The Chief Records Officer (CRO) and the ES dissociated themselves with the respondents who saw conflicts existing between the Estates Section and the Legal Section on one hand and that between the Estates section and both the Accounts section and the Technical section on the other. Whilst agreeing that such conflicts are normal with every organisation, they were of the view that, this was an issue of the past and not related to the present administration which now has a management team in place that meets fortnightly to iron out differences. Hitherto, conflicts had related to approach to work and to how some technical issues had been handled. It is to be observed that this observation is in agreement with the reasons assigned for such conflicts by the respondents (leadership styles and roles and work processes) but not in agreement with the groups’ tacit acceptance of such conflicts even under this administration. It is possible that the introduction of GIS may bring some conflicts of its own. To avoid conflicts and possible delays in the start-up phase and during the project implementation, all and sundry must participate adequately in the GIS project preparation and design. Perhaps, a full time project implementation team must be put in place as early as practicable whose duty will include setting clear objectives and ensuring an efficient decision-making authority.
- *Management style autocratic?* Again the ES and the CRO did not agree with the nine respondents who said that management style for the past ten years had been autocratic. They said it was normal for any leader to set up a team of loyalists with whom to work with and that the close working relationships that normally existed between such trustworthy and hardworking staff and management should not be

interpreted to mean that the rest are not consulted. The ES was of the opinion that, what had transpired during that period, was a ‘monolithic style of administration’ where respective Executive Secretaries had ‘gone it alone’ whenever they felt their vision was being impeded. He insisted that this was ‘not necessarily dictatorial but may not be consultative either’ and wondered whether the word ‘autocratic’ was appropriate in such a case since they did not wield absolute power in the actual sense of the word. However, the Personnel Officer cited a case where in 1999, the then ES exchanged nineteen clerical staff for other staff of various civil service sectors, without adequate consultation, on what was unofficially attributed to corruption charges. As noted, good managers are a major determinant of GIS project success. GIS projects, like any other projects, can get into a vicious or virtuous cycle. There is the need, therefore, for a consultative management style within the LCS administrative structure and with clearly defined responsibilities that would involve a redefinition of tasks. The clarification of who should do what must be spelt out early and they must be held responsible for work outcomes whilst following the vision set up by management.

- *Authority definition unclear?* The ES again distinguished what must have happened before he took over management and the situation as it pertains now. He thinks authority definition and hierarchy in the LCS is now clear as opposed to the eleven respondents who think otherwise. When pressed further, he admitted that the respondents must have been looking at the junior staff and the way they operate, citing the search office as an example. At this office, he said, it is difficult to determine who is in control since the clerk responsible appears to report to no one directly. But he insisted that this problem is now a thing of the past. With the introduction of GIS, as with all systems, there must be direct action to improve management and this may involve some carefully tailored reform of the LCS and its policy frameworks. There must be agreement on objectives and the establishment of performance criteria with clear lines of responsibility for all sections. This may warrant a careful diagnosis of all problems and delineation of possible solutions as a prerequisite for concrete action.
- *The role of Accra LCS vis-à-vis the Head Office undefined?* All 15 respondents were of the view that the Accra Regional lands Commission must have a distinct role from the Head Office as envisaged in the Lands Commission Act 483. They

stated that ‘the Head Office is virtually performing the duties of the Accra Office’ especially in the area of government lands. The ES insisted that the Head Office would continue to deal with such lands, since such lands have assumed a ‘national character’. His problem was that the entire process of dealing with state lands had to start from the Accra Office and end at the Head Office and wondered why this could not be handled entirely by the Head Office. The key question is, would changing the LCS and its procedures as found in the Act help bring efficiency, generate more accurate information and timely processes and make the organisation more responsive to the public or would it stifle improvement? A prudent course is warranted as the role of the ES in co-ordinating all the activities of all Regional Lands Commissions should not be sacrificed at the altar of political expediency.

- *Transportation only important?* In the use of the CSF methodology, the respondents gave certain ‘activities’ and their associated ‘prioritised factors’ as necessary requirements for GIS implementation in the LCS. Top management generally agreed to these but insisted that transportation had not been given the needed weight and should have been a ‘very important factor’. The ES, particularly, was of the opinion that transportation was a major problem since an exercise to review the status of all government-acquired lands through GIS use would require vehicles. He said the LCS, by virtue of a legislative instrument, can levy fees and charges to raise revenue to support its activities including purchase of vehicles, but the government has frozen any purchases in that regard.

5.5 Implications for GIS Implementation in the Accra LCS

The issues raised may be used as bases for debate amongst the middle level management (respondents) and top management concerning ways of addressing divergence whilst some of the specific findings may be used as a focus for further debate. Top management, it was realised, preferred to talk generally, placing particular importance on policy issues. That there should be disagreements on major policy issues among top management and middle-level management was expected. The middle level personnel appear to have their own concerns, preferring to address issues that directly affected them. They do have strong feelings about the qualities of the LCS as a body, insisting generally on the need to see the job being done and being

done well. These concerns cannot be ignored and would have to be addressed in GIS implementation.

It is to be realised that responses from the 15 respondents formed the basis for the choice of the methodologies. Whilst this was a tactical approach, involving management in the very beginning of requirement analysis would appear to be the better approach. However, deciding to delay their involvement a little was to stress the point that management and policies are bound to change with time. Conversely, those in line and operational management who are expected to operate the system may remain for a long period of time during the operational phase of the project and beyond. In any case, conflicts of opinion only accentuate the level of uncertainty that served as a barometer for the choice of the methodologies. Their early involvement, in this particular case, would have had little effect.

A recurring theme of this research is that a pilot project(s) preceded by a selected features prototype software of identified work processes is required and must be expanded according to a set timetable if success of GIS implementation in the Accra LCS is to be attained. This will involve initially identifying which activities are central to the projects primary purpose (which this research has already elicited through the CSF methodology). It would also involve, as indicated, subjecting these findings to more debate to enable concentration of scarce institutional resources on these prioritised factors or areas while deferring desirable but difficult or secondary objectives until activities that are central to the GIS project's primary purpose are well established. Three questions can therefore be posed in this regard: a) Is the problem a serious constraint on the functioning of the Accra LCS? b) Is the solution within the capability of the Accra LCS to carry out? c) Is the current climate constructive for sustained action? d) Can political and public support be mobilised and maintained for the GIS project? The implications of these questions and how they are treated are critical for full GIS implementation in the Accra LCS particularly and for its diffusion in the land sector generally.

Part two of this paper will first discuss some of the features of the prototype software called 'LANDADMIN' that is developed for the Accra LCS. This is not a full-scale model often referred to as a pilot. In other words this research is recommending a

selective and phased out approach that will eventually be part of a final system that is delivered to the Accra LCS as a pilot. In this part of the paper, the use of ‘Data Flow Analysis’ method in deriving information about *searches* is shown as a key example leading to prototyping for the Accra LCS. Discussions on the architecture of the *prototype software* that is aimed at automating a range of routine land administrative tasks will thereafter be tackled. The prototype will involve careful explanation, documentation and training if it is to be successfully implemented, if continuous funding (from within) is to be maintained and if the pilot project is to lead to a sustainable implementation.

PART TWO

6 The 'LANDADMIN' Prototype Software

The empirical survey indicated that on the spatial front, 'searches' to determine ownership status on state lands were to be automated as a matter of urgency. Rent assessment and management is another area that, according to respondents' requirements, required automation. The design of the prototype software is based on respondents' requirements. ArcView 3.2 is used for the spatial data and Microsoft Access for the non-spatial data, both of which have been installed in the LCS. As already indicated, the Data Flow Analysis (DFA) is used to systematically define the processes of the 'search' procedure. Rent collection and management, are already being undertaken using Microsoft Access. The research studied the present system (on the LCS using Access) and identified areas for improvement. An improved design is therefore made (on rent collection and management) incorporating other areas recommended for improvement by the users (six selected staff who are expected to operate the prototype software). The two methods (DFA and the Prototyping methods) will now be explained.

The DFA, when used at a high level of analysis is a graphic method of defining inputs, processes and outputs of systems. The process is top-down. It would help simplify the detection of errors or bottlenecks between *processes* and *data flows* of the 'search' process through its associated data dictionary (meta database). The DFA method was delayed until after the primary analysis method – CSF – had provided an initial set of requirements (Davies, 1982) so that the application element of the LCS information requirements would fit well into the organisational framework set by the CSF methodology. The DFA is used in conjunction with the discovery methodology - prototyping, which is the primary method applied at the application level.

Prototyping is in fact a 'verification technique' (Sakthivel, 1991). The methodology forces the analyst(s) or the systems developer to respond to users' identification of deficiencies in information requirements (Braunstein et. al, 1991). It is defined here to mean 'a selected features prototype' (Kendall and Kendall, 1996) that includes some but not all of the required features of the LCS information requirements and which the users will attest to as their own since they had been involved in its design from the very beginning. If the design (and implementation) is successful, it will be

part of a large final system that is to be delivered to the LCS under the Land Administration Programme (LAP). *“When completed, the prototype would be an exhibit of what the system is expected to do, how it is expected to do it and what the machine interface would look like. In essence it is the design of the system. If agreed to, the design is then documented using the capabilities of the system to print and document reports”* (Zeltan, 1989). The use of this methodology, without following the traditional Systems Development Life Cycle (SDLC) approach – ‘a logical systematic approach to follow in the development of information systems’ - is based on the effective shortening of the time required between information requirements and delivery of a workable system using the prototyping methodology. Extended time is required to go through the development life cycle. The advantage here is that the LCS environment is uncertain and decision-making is semi-structured, if not ill structured and therefore the use of prototyping is considered very appropriate under the circumstances. It is also not necessary or desirable to build an entire working system for prototyping purposes (Kendall and Kendall, 1996). The design of the SEARCH prototype to determine ownership status on state land is based on the framework as indicated in Figure 3. This will now be discussed.

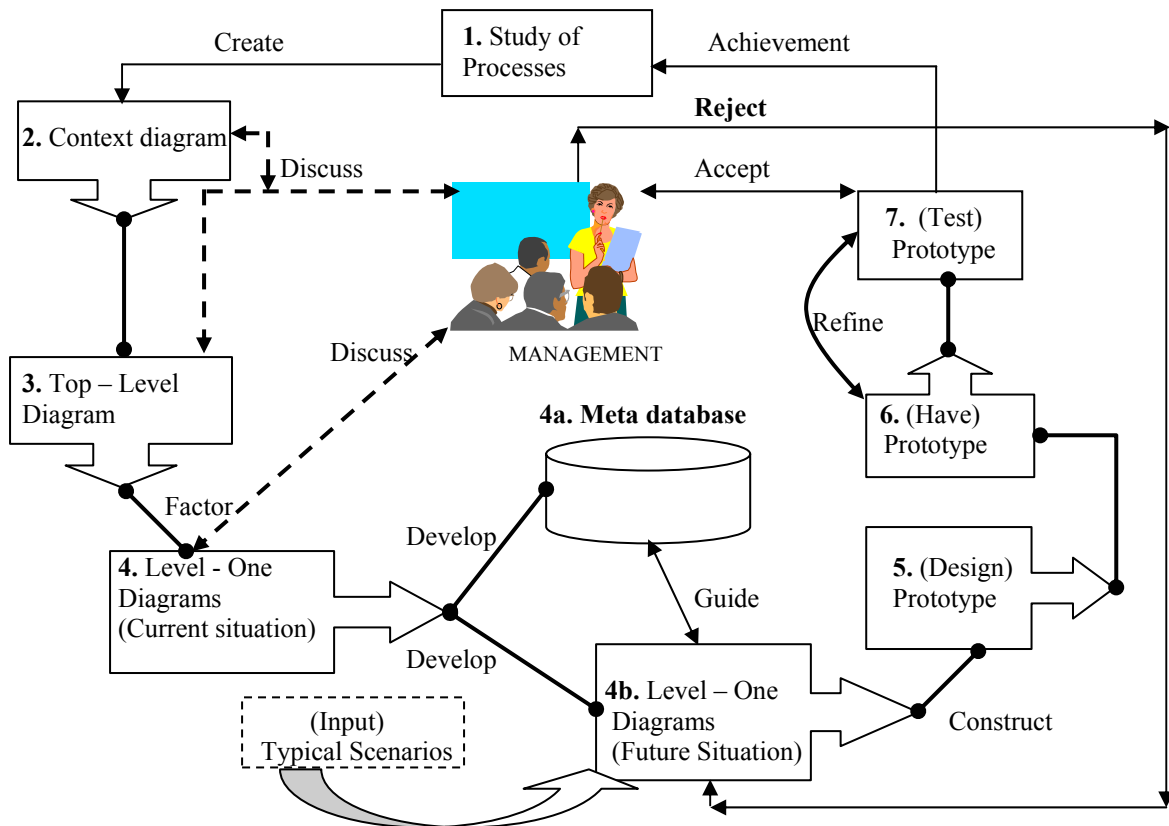
6.1 Study of the Search Process using the Data Flow Analysis Methodology

6.1.1 Step One: The Study of the Accra LCS Search Process on State Land

The study process involved interviews with technical staff in the four main offices that deal with the ‘official’ searches⁸ namely the Search Office itself, the Accounts Office, the Greater Accra Regional Records Office (GARRO) and the Central Records Office (CRO). The results obtained from these interviews become clearer as each step is explained in depth.

⁸ Generally, ‘Official’ searches are distinguished from ‘Administrative’ ones, which receive the signature of the Regional Lands Officer to authenticate them. The Registrar of Deeds signs the former. In this research no distinction is made between the two, as they are practically the same.

Figure 3: The data flow analysis (DFA) and prototype design pilot study of official searches on state land in the Accra LCS (Study of Functional Needs)



6.1.2 Step Two: The Accra LCS Context Diagram

To enable us structure the search process, the LCS boundaries and ‘terminators’ (users’ and providers of the LCS information) are first defined. The *context diagram* evolves from this (Figure 4). This shows the LCS in one process and indicates the LCS services as a whole⁹. The diagram depicts the ‘terminators’ such as the Ministry of Lands and Forestry, the Land Valuation Board etc that shows linkages and information exchanges between the LCS and outside agencies.

The Ministry of Lands and Forestry, for instance, provides policy guidelines to the LCS and the LCS advises government on land matters through the Ministry. The police would request search reports to determine ownership status over a piece of land

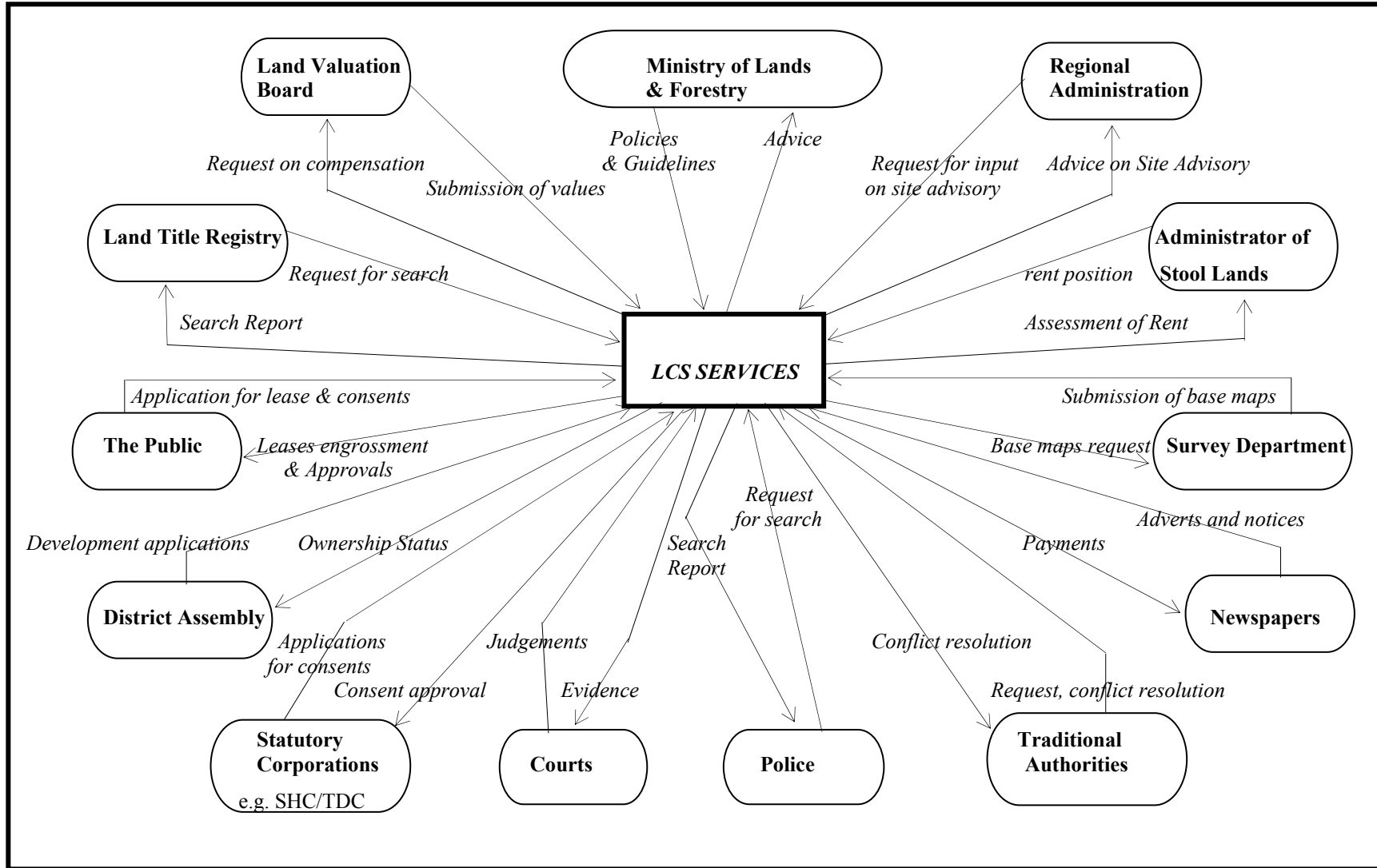
⁹ The ‘context’ diagram can be used as a starting point in determining *all* application requirements within the LCS as it represents all processes within and without the LCS administrative system.

under police investigation and the LCS provides this report upon request. The District Assemblies through their decentralised departments (the Town and Country Planning) would request search reports from the LCS on applications received for planning permission/building permit to determine the status of ownership. The traditional authorities would normally request conflict resolution through the Regional Lands Commission over disputed lands whilst a statutory corporation such as the State Housing Company (SHC) would request approval for consent to either lease, sublease or mortgage on behalf of their clients. The LCS is obliged to give its approval. The context diagram, being the first step in the DFA methodology, therefore depicts the LCS system as a whole with the search process being only a small part.

6.1.3 Step Three: Top-level Diagram - The ‘Searches’ on State Land – Current Situation.

A top-level diagram is then prepared zooming into the search process itself. This enables the analyst to arrive at the level of details necessary for describing single processes (Figure 5). There are six main ‘terminators’ that are identified in the search processing service. The Searches procedure comprises three main processes: (1) the Search Office processing unit (deals with the receipt and processing of the search application and liaises with the Accounts section for payment of fees) (Plate 8); (2) the GARRO retrieval process; and the CRO retrieval process.

Figure 4: Data flow diagram: context on the Lands Commission Secretariat, Accra

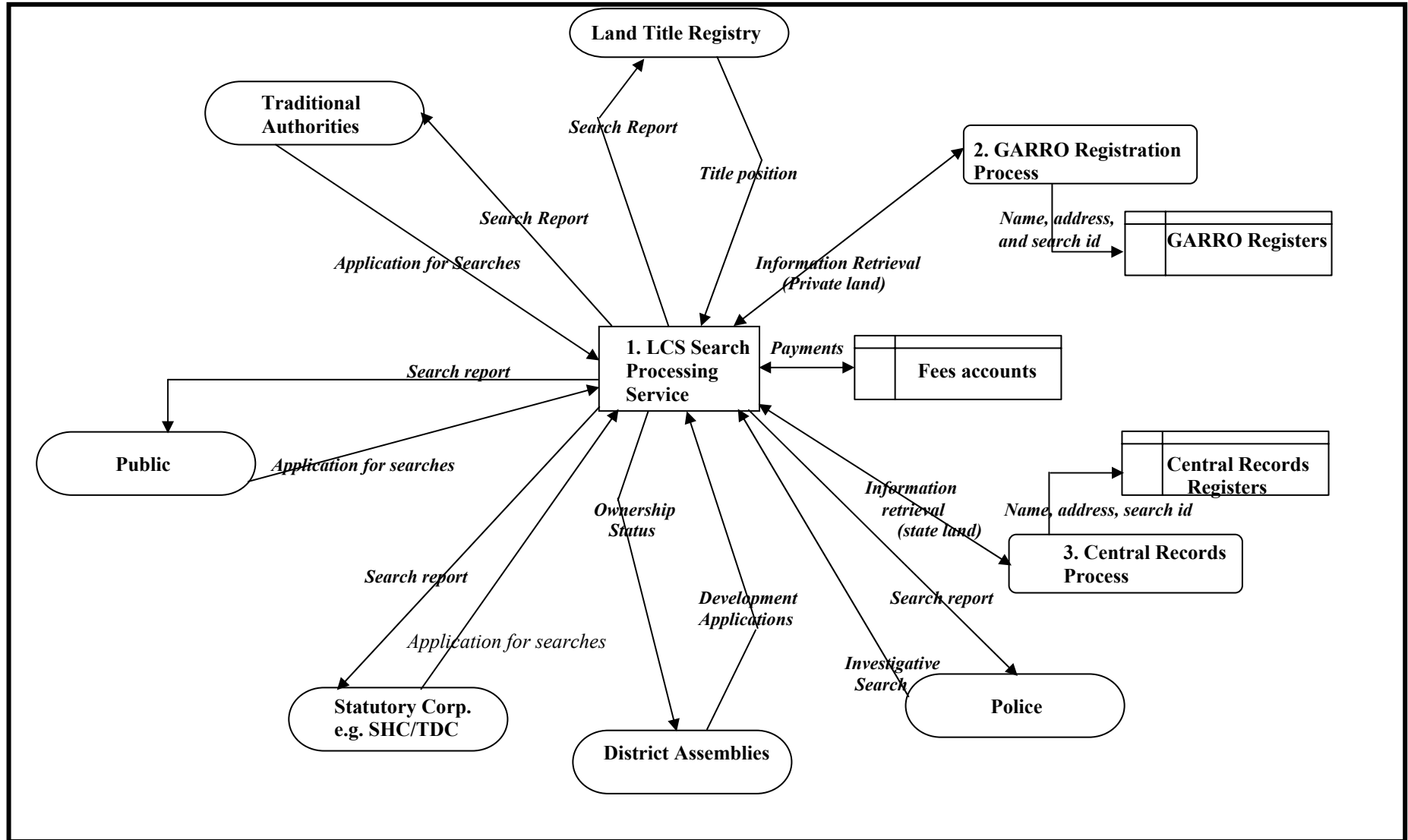


The LCS search processing service *inflows* include applications for searches by the public, traditional authorities, the Land Title Registry, statutory corporations, district assemblies via the Town and Country Planning Department, and the police. The associated *outflows* are all search reports that the LCS issues upon request by these bodies. In the retrieval of information, the GARRO as well as the CRO processes generate independent *stores* (or registers) to be consulted or updated by other processes within the process itself. Note that in Figure 5 there is still a relation with other LCS units or sections such as the Legal section that are not included for clarity and readability purposes.

Plate 8: Sorting searches in the Search Office (September 2001)



Figure 5: Data flow diagram: top-level (current situation) on official searches on state land in the Lands Commission Secretariat, Accra



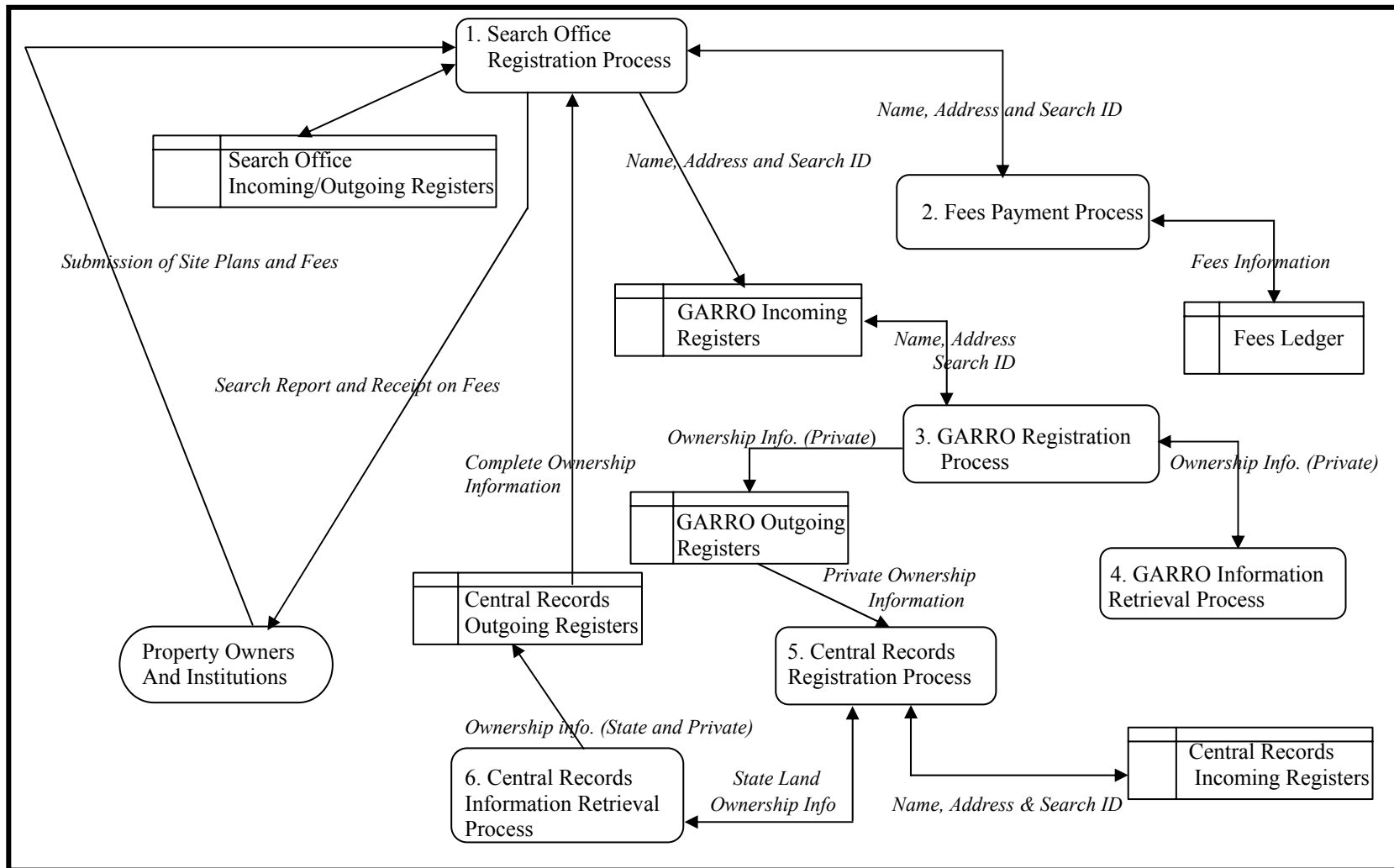
6.1.4 Step Four: The ‘Searches’ Level-One Diagram on State Land.

The top-level diagram is further zoomed in to the necessary level of detail while still focusing on the area of interest to this research – the LCS search processing service. This is referred to as a *Level-one diagram* (Figure 6). In this study, six processes are identified: the search office registration process, the fees payment process, the GARRO search process, the GARRO information retrieval process, the CRO search process and the CRO information retrieval process.

It is to be noted that the Search Office registration process is now split into two, distinguishing its primary function of seeing to the processing of these searches from that of the (Accounts) fees payment process that generates a fee ledger (store). The GARRO search process is restricted to the retrieval of information on *private land* and generates incoming and outgoing registers. The CRO deals mainly with information retrieval on *state land*, generates its own incoming and outgoing registers. Reports from this section combine with reports from GARRO to provide complete ownership information for the benefit of institutions and property owners. An important element in the whole application process is the submission of the subject site plans, the names and addresses of applicants and the payments of requisite fees. The Search Office allocates search numbers (ids) for easy retrieval purposes. The name, address and search *id* are used in the entire process. The output of the search process is 1) site plans with LD (Lands Department) numbers and 2) associated information retrieved from the LCS database.

To fully understand Figure 6, a meta database is needed. Boxes 2, 3 and 4 show data dictionaries for each process, data flow and store. Bottlenecks in the process are also determined. These processes, flows and stores that indicate the current search situation, evolved through the study of the search process by the analyst(s) and through subsequent discussions with the selected fifteen respondents involved in the initial brainstorming session. The discussion took place during the validation session. It meant reviewing most of the earlier work done by the analyst(s) in the validation session. The analyst(s) for instance, forgot to include the courts in the whole process and this could only be rectified through such a review.

Figure 6: Data flow diagram: level one (current situation), searches on state land – Accra Lands Commission Secretariat



Box 2: Data dictionary for processes (level one diagram): current situation on searches – Accra Lands Commission Secretariat

Process Name	Process Number	Process Description	Input Flow	Output Flow	Process Frequency	Bottlenecks
Search Office Registration Process	1.	A process responsible for input of name, address of applicants, issuance of search Ids and the release of completed search reports.	Names and addresses of applicants, site plans (subject of search report) in duplicate.	Generates personal information in registers and search number (id).	Constant (Frequent).	- Very slow manual process - Loss of reports in the system - Extortion to enable quick process and delivery.
Payment of Fees Process	2.	A process responsible for receipt of fees on search applications.	Name and address of applicant accompanied by search id.	Payment registers (accounts).	Constant (Frequent).	- Slow process
Greater Accra Region Records (GARRO) registration process	3.	A process responsible for input of name, address and output of completed information retrieved from GARRO.	Name and address of applicant accompanied by search sheets with id and site plans in duplicate.	Generates GARRO incoming and outgoing registers.	Constant (Frequent).	- Very slow process - Possible extortion.
GARRO information retrieval process	4.	A process responsible for the retrieval of ownership information on mainly <i>private lands</i> in the Accra Region.	- Ditto -	Generates search report on mainly private lands (ownership information).	Constant (Frequent).	- Slow process - Errors in retrieval - Misreporting - Manipulation (Extortion).
Central Records registration process (CRO)	5.	A process responsible for input name, address and output of completed information retrieved from CRO.	- Ditto -	Generates CRO incoming and outgoing registers.	Constant (Frequent).	- Very slow process - Possible extortion.
CRO Retrieval process	6.	A process responsible for the retrieval of ownership information on mainly <i>state lands</i> in the Accra Region.	- Ditto -	Generates search report on mainly state lands - now complete ownership information	Constant (Frequent).	- Slow process - Errors in retrieval - Misreporting - Manipulation (Extortion).

Box 3: Data dictionary for data flows – level one diagram: current situation on searches – Accra Lands Commission Secretariat

Data Name	Data Description	Data Type	Used By Processes	Bottlenecks	Data Source
Name, Addresses and Search numbers (ids) and associated site plans	Personal data that enables the identification of enquirer and search # associated with search report.	Alphanumeric.	1, 2,3,4,5 and 6.	Slow inflow due to non-adherence of 'first come first served basis' principle.	Search registration office.
Fees information and receipt on fees	Information on Fees as identified by receipts issued upon payment	Alphanumeric.	2.	- Ditto -	Accounts office
Ownership Information (private and state land)	Data relating to site plans as retrieved from GARRO and CRO respectively and separately.	Alphanumeric.	1, 3, 4, 5, 6	- Very slow retrieval process and error prone - Manipulation through extortion - May be unreliable - Untimely.	Records sheets, name and property registers at GARRO and CRO
Complete Ownership information (Search Report)	Data retrieved from both GARRO and CRO and combined for release as search reports	Alphanumeric.	1.	- Quite slow - Report can be contentious on grounds of ambiguity and errors	Records sheets, name and property registers at GARRO and CRO

Box 4: Data dictionary for data stores – level one diagram: current situation on searches – Accra Lands Commission Secretariat

Store Name	Store Description	Updated/ Consulted by Process	Store Organisation and Security	Bottlenecks
Search Incoming and Outgoing Registers	Contains names, addresses, search ids and date of submission (incoming) and booking of the same for release of search report (outgoing).	1.	Manual files kept in ledgers and barely secure, as tracing reports may prove difficult	May contain correct information but may not serve the vital purpose of tracing the whereabouts of the search report.
Fees Ledger	Contains names and addresses of applicants and more importantly search ids and fees paid with receipt issued (Accounts number).	1, 2.	Accounts Ledgers Stored manually	-
GARRO Incoming Registers	Date of receipt of search documents, search number and name and addresses of applicants	1, 3.	Manual files kept in ledgers and barely secure, as tracing reports may prove difficult	Unreliable at times since tracing may be laborious and may not elicit any positive results
GARRO Outgoing Registers	Date of despatch of search documents, name and addresses of applicants and search number (id)	1, 5.	- Ditto -	- Ditto -
CRO Incoming Registers	Date of receipt of search documents, search number and name and addresses of applicants	1, 3, 5.	- Ditto -	- Ditto -
CRO Outgoing Registers	Date of despatch of search documents, name and addresses of applicants and search number (id)	1, 5.	- Ditto -	- Ditto -

We have to examine the level-one diagram (Figure 6) to determine whether a new design cannot be made to improve the current search process. There are a number of issues raised by the current process:

- The manual system of registration and the forwarding system can, through human error, lead to the loss or misplacement of search reports.
- Retrieval of information could take a very long time as this is done manually and is not based on a 'first come, first serve basis'. Most applicants have quick search reports after payments of unofficial fees to staff¹⁰ whilst those who 'trust the system' may have to wait for well over four to six weeks sometimes even months to receive their reports.
- Wrong dissemination of information cannot be ruled out. It is possible for investors to base decisions on the LCS search report only to realise that the reports were either incomplete or wrong. Some of these investors had had problems with the banks that had conducted independent searches on the same piece of land but had been given conflicting reports.
- Duplication occurs. For instance there is no reason for a search being conducted should go to two places (GARRO and CRO). The fact that any search must of necessity be channelled through the GARRO office as well involves duplication of efforts at certain times.

These are general problems that are encountered but technically we need to detect and correct errors successfully. Identifying the requirement errors avoids re-working and improves the quality and productivity of systems development. Several requirement verification techniques exist aimed at detecting errors in systems specifications. These include simulation, reviews, data flow diagram algebra, walkthroughs, inspections and prototyping. Instead of explaining all these techniques and showing what they could do, focus will be placed on the choice of this research, prototyping.

It is important to state, however that, no technique can provide a comprehensive verification, and therefore an approach may, within certain constraints, integrate more techniques to provide adequate verification (Sakthivel, 1991). In this research, in

¹⁰ Such private arrangements between the public and staff are common and it is a cause for concern.

order to afford adequate verification, validation and review sessions with middle line management, are held in addition to the prototyping technique.

Prototyping will help in the identification of certain types of technical errors in the search process itself that include *incomplete requirement errors* and some errors associated with *inconsistencies*. Incomplete requirement errors identified with the current search process include *process insufficiency* and *data insufficiency*. The former is defined as a process defined insufficiently such that its specified input does not match specified output (Sakthivel, 1991). For example, the site plan submitted (input) should elicit correct information from the search database. However, more often than not, the retrieval process produces reports (output) that may be wrong due to a number of reasons that include wrong site plans emanating out of wrong survey work, wrong placement of grid values (or co-ordinates) and human error. Data insufficiency refers to the non-availability of all the data required for performing a process (Sakthivel, 1991). For example, technical officers are often confronted with data on different sheets that they are required to collate. These sheets sometimes cannot be traced, yet reports are sometimes released all the same! *External inconsistencies* refer to the conflict of specification with the systems goals and objectives. For example, the objective of the LCS search office is to give accurate and up to date information on its database. This requirement is normally not met as some manipulations of this database leading to wrong dissemination of information has sometimes been detected defeating the very goal the LCS has set itself. The database itself is not sufficiently updated.

The implications of the above for GIS system design are that information requirement errors are likely to be a major source of the system's deficiencies. For prototyping, this potential error becomes less pronounced. The methodology forces the system developer to respond to the users' identification of deficiencies in information requirements (Braunstein et al. 1991). What is to be done to have such an improved system? The next section examines the future proposed situation.

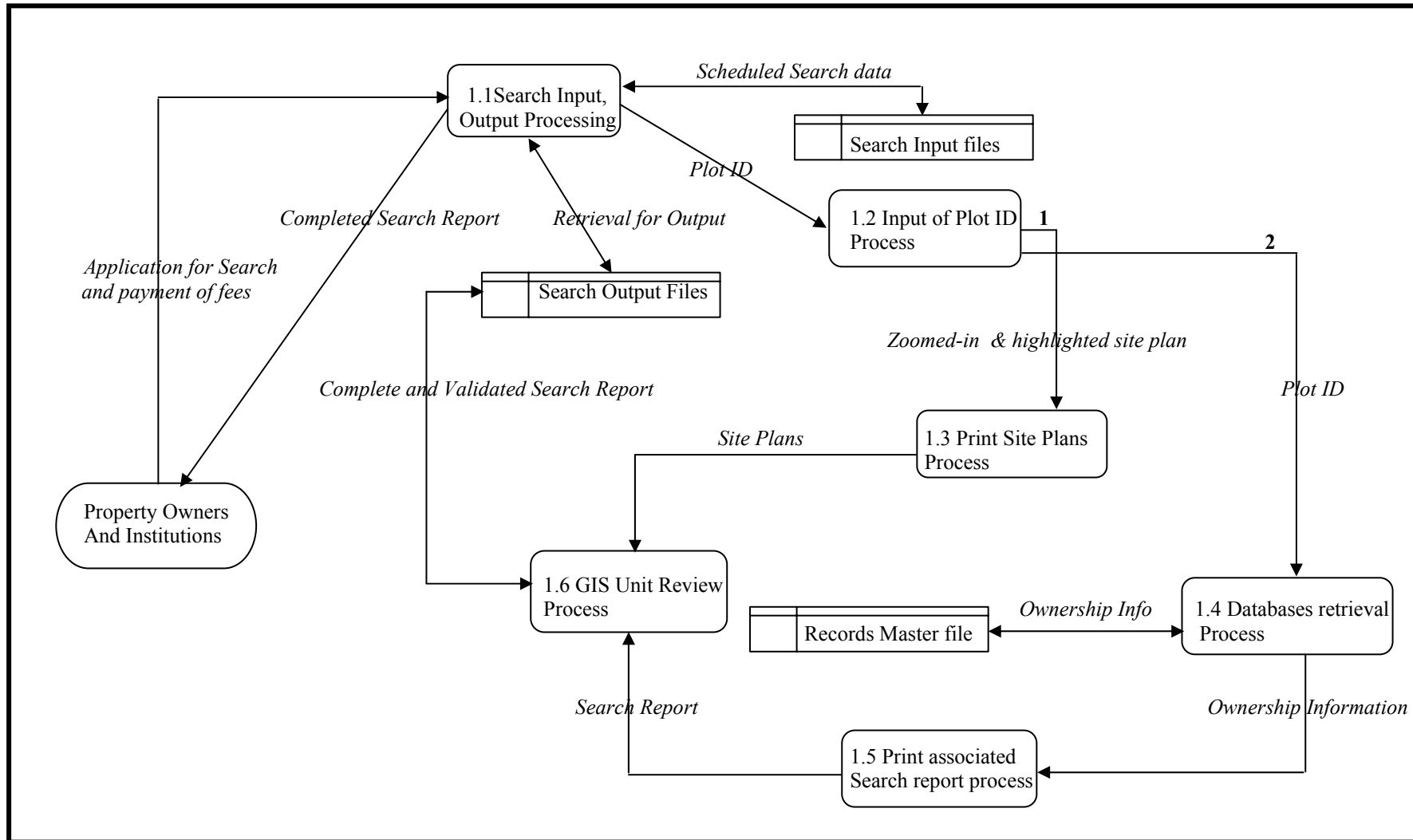
6.1.5 The Proposed Future Situation ('Searches' Level - One Diagram on State Lands)

The prototype search (core) design on state lands we are proposing is more systematic and may ensure that the system is as error-free as possible. Six processes are proposed through the demonstration of a typical scenario for this future situation that is principally digital (Figure 7). Each process is expected to be covered by written standards that may cover issues such as operational procedures, documentation, general security, storing and labelling of files, a maintenance programme and the like. These standards are to be tailored to meet the needs of the Accra LCS users' and fundamental procedures in order to safeguard both local processing and information requirements of the LCS (Dooley, 1996).

Typical future scenario: Following the application and payment of fees for a search, the name, address and search number (identifier) of the applicant are noted and allocated. This generates a 'search' input file (store) that is expected to contain scheduled search data on a *priority basis*. Scheduling is an important exercise. The first step is to help track and verify the new search application. Once this is done and the necessary fees are paid, the search forms are dispatched to the GIS search unit for retrieval of information.

In the GIS search unit, in order to ensure security in retrieval of information, a username and password must be given to enable the display of the LCS logo. However, the main function is that it basically allows the selection of *themes* and reselection of the associated plot number or input of the *plot number* or identifier that uniquely identifies each plot of land and ensures easy retrieval of information. This identifier is different from the *search number* that is given for administrative purposes only.

Figure 7: Data flow diagram for official searches on state land: level one (future situation) – Accra Lands Commission Secretariat



Retrieval occurs at two fronts (stages 1 and 2 in Figure 7). The first step will involve the printing of zoomed-in and highlighted and labelled site plans in ArcView 3.2 that is provided for the attention of the GIS Review Unit. The second step will involve the retrieval of information from the master file (LandsCommissionDatabases) in Access that also ends up at the GIS Review Unit. The role of this unit is, among other things, to collaborate with the Inspectorate Division of the LCS in order to re-check information on properties on the ground. This is for updating purposes only. Is there a change of user or address? Have any covenants been breached? This is a necessary step towards validation. In this case, the Inspectorate Division of the LCS should be fully 'resourced' and made vibrant in their operations. The complete and validated search report (site plans and attribute information on ownership) is then recorded in the search output files for onward transmission to the applicant. It is to be noted that retrieval occurs from one main database or different databases in one unit and at the same location and not two different units/locations as previously. The advantage of this future situation is that searches are done very quickly and since validation is a necessary ingredient, are also as error-free as possible. The suggested design is incorporated in the final user interface design.

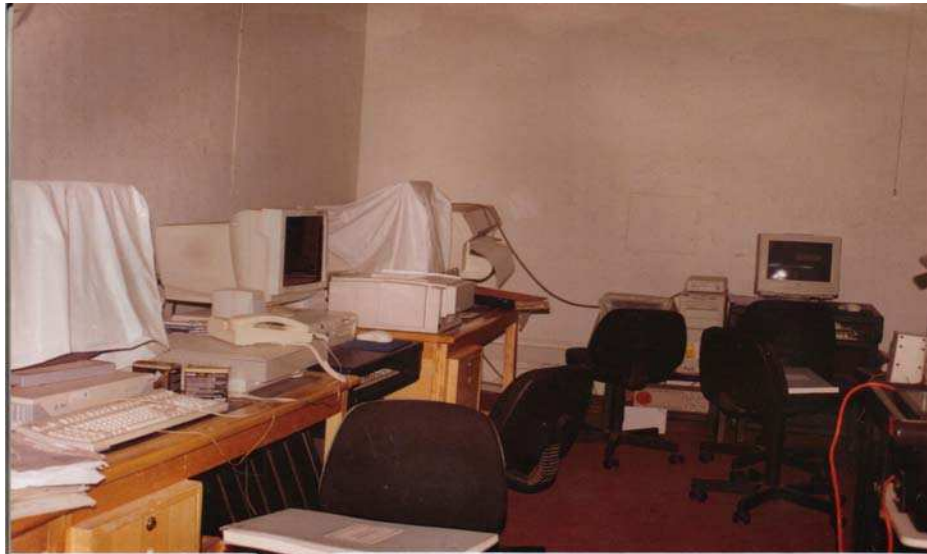
It is useful to recapitulate on what this research has so far achieved before the design of the Accra LCS GIS prototype and its associated user interface is described in the next section of part two. The study of key users' needs, the structure and processes of the Accra LCS have helped to reduce any differences that may exist between actual and perceived requirements in that organisation (Yadav, 1983). Two approaches have evolved as a result – the CSF as a primary information requirement methodology in determining the Accra LCS *performance needs* and the DFA as a secondary methodology in determining the Accra LCS *functional needs*. Both are used (as already indicated) as methods of information requirement analysis at the *organisational* and *application* levels. Neither method is used as a verification technique in itself. To eliminate inconsistencies, incorrectness and possible ambiguities, the prototyping methodology is used on the LCS actual system at the application level. The use of the method is based on the following:

1. as a specification verification technique; and
2. as the design of the system itself (this will involve formal specifications of requirements).

This section of the paper describes the prototype software system (*'LandAdmin'*) that has been developed using ArcView 3.2, the Avenue scripting language, and Microsoft's Access database, to handle routine land administration tasks. The design of quick maps for field inspections, of site plans to be incorporated in leases, map compositions, of lessees general and billing information, rent demand notices and searches, personnel and secretariat information, clients address lists, rent position and rent demand notices on state land *et cetera* are covered. We accept the fact that the selection of a proper project design is central to the Accra LCS successful GIS project implementation. The design of this software is both technically sound and appropriate, given the socio-economic environment of the intended beneficiaries. Careful attention had to be given to tasks normally performed by the LCS, with the view of having a user-friendly interface that is menu driven and that truly represents the LCS work processes, while placing this within the requisite institutional arrangements of the secretariat. This research therefore, had as a primary objective of designing a system that was to be optimally operational and that will be delivered to the LCS as part of its pilot project with the full participation of the users themselves from the very beginning. In this design, therefore, the bottom line is *practicality*.

The first fieldwork (July to September 2001) apart from releasing the prototype software using Arc View to six selected respondents for general testing, also afforded the chance to study the use of Access by the Accra LCS as a database management tool. Suggestions that were made with inputs from the present *actual* users (two in number as at end of September 2001) enabled the development of the Access interface. Testing of this design on a wider scale involving the six respondents is expected to undergo further testing. It is to be noted that GERMP had helped in the choice of software that includes Arc/Info that runs on PC and Unix systems, ArcView and Microsoft Access databases (Plate 9). The Accra LCS is at the moment using Access in its normal work processes albeit on a very minor scale (for only rent management).

Plate 9: Legacy left by GERMP (equipment heavily under-utilised)



Note: Picture was taken during normal working hours

6.2 Design Issues

Several authors and experts have suggested conceptual and practical design approaches arising out of the pursuit to integrate spatial and non-spatial in a reliable, easy-to-use, and cost-effective way (Black, 1996). Black notes that none of the applications that claim to bring about such integration has been without shortcomings. *“A few have been so problematic that GIS users find them to be more trouble than they’re worth”* (Black, 1996). Lai and Wong (1996) have suggested (in relation to developing countries) that applications must conform to existing practices and their procedures simplified using expert systems (ES) and numerical models where appropriate.

The conceptual framework developed by Pradhan and Tripathy (1994) offers promise for designing the prototype software for Ghana’s land sector agencies. These authors offer alternative prototype architectures using a specialised Data Base Management System (DBMS) for implementing GIS. One suggested feature is what the authors’ call the ‘multi-media database approach on an expert system’ that has the following features:

- *“extraction of geographic objects for map data and classification into points, lines or polygons;*

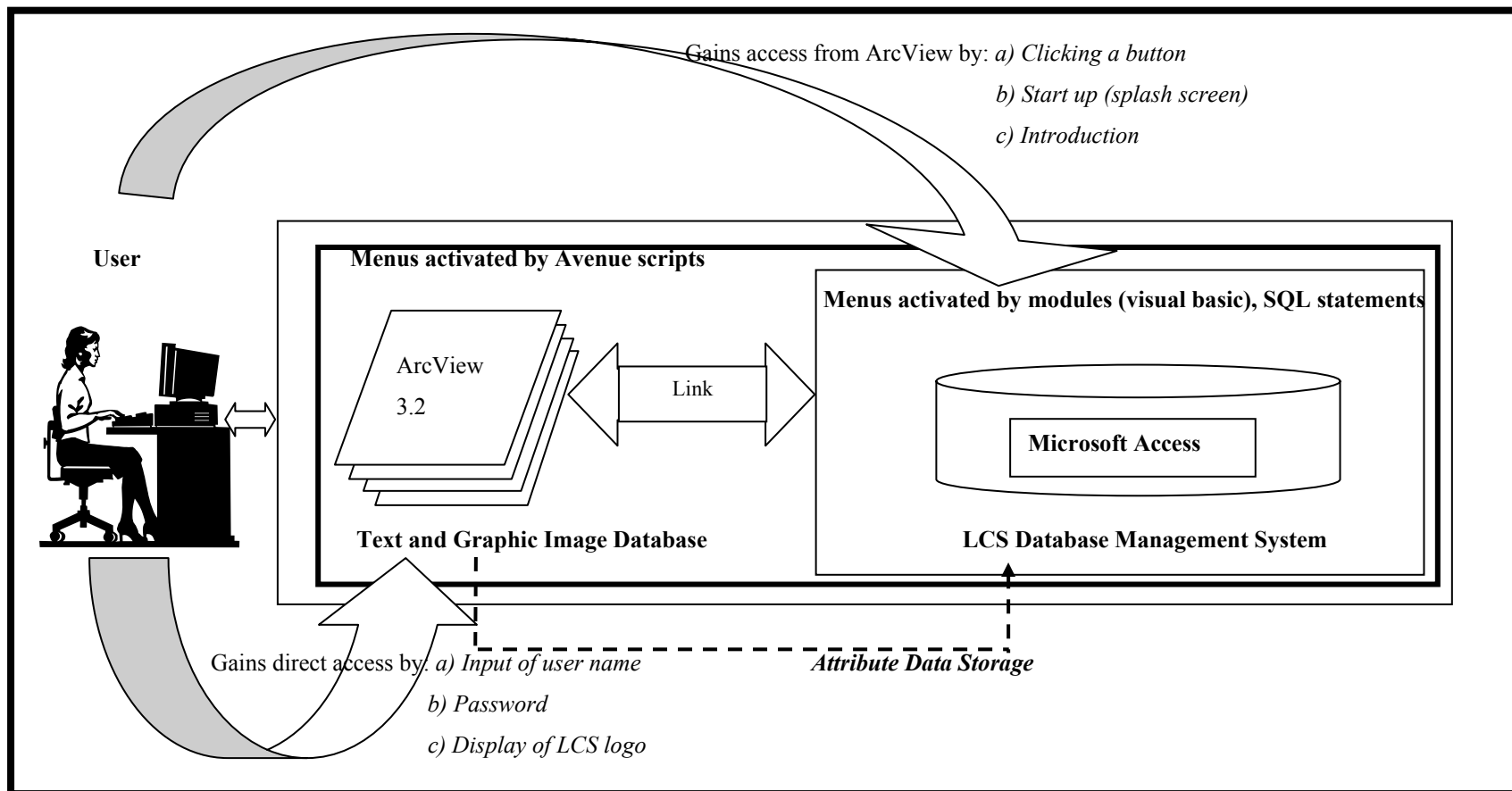
- *storage of the above in a relational database*¹¹;
- *unstructured background graphics and image are retained in their individual databases; and where KBS is used*¹²
- *the KBS becomes the top layer of the system that serves as an intelligent interface between the user and the data” (Pradhan and Tripathy, 1994).*

Such a system maintains complete database integrity through the simple concept that the spatial location of a particular feature can be considered as simply another attribute of that feature. Derived from this concept, both graphic and descriptive attributes are associated as a single record of a particular feature.

¹¹ Or object-oriented database as the case may be

¹² Knowledge Base Systems (KBS) are not explored in this work as no attempt is made to solve ill-structured problems associated with this system.

Figure 8 Detailed architecture of the LCS prototype software 'LANDADMIN': ArcView 3.2 interfaced with Microsoft Access



The use of this concept is influenced by the actual situation in the Accra LCS. The LCS has gone ahead to use Access (DBMS) *separately* with the aim of capturing attribute data and ensuring efficient management of its database with little or no parallel development of ArcView (GIS). The proper use of GIS will offer a better organisation of the parcel data the LCS uses and add the dimension of geo-referencing to the available data. The two systems are not linked and therefore are not being used together.

The observation by Huxhold (1991) is a very apt description of the Accra LCS situation. He has noted that one of the most accepted blunders about GIS is that non-graphics data from the organisation's administrative data bases must exist on the GIS with the base map information. *"The problem with this concept is that many local governments have already implemented information systems on existing computers to support their nongraphics data needs...Some of these systems may have been operating successfully for many years, and to abandon them in order to implement them on a new GIS would not only disrupt daily operations, but also create additional cost that may not be necessary"*.

Figure 8 shows the architecture of the prototype software based on the above principles. Conceptually¹³, it takes the complete text database in ArcView and stores them as attribute data in the Access database using the 'plot number' as the unique identifier. ArcView extracts geographic objects from the parcel data and classifies them into points, lines or polygons and displays them as maps etc as specified by the user. The geometric relationship between points, lines and areas in the structured layer are combined with other data such as names, addresses etc., in the Access Database to ensure efficient management of the database.

The communication medium between ArcView and the Access database is by executing system request commands through Avenue scripts in ArcView. This allows ArcView to exit temporarily to perform functions and operations of Access. Since this is a link, minimising the Access interface enables the user to interactively use both

¹³ In practice, however, the area and perimeter generated by ArcView is discarded in the Access database as they are of no practical use.

applications without realising that they are not embedded. ArcView allows the input of login name, password and displays the LCS logo. Access, when activated displays a splash screen and shows an introduction telling the user what to expect. This way, the right balance has been achieved between simplicity and complexity of project design. All menus are activated by scripts written using the avenue programming language in ArcView 3.2 and a series of SQL statements and visual basic programming language as macros and modules in Microsoft Access.

6.3 Architecture of the Prototype Software

In this core design, as already indicated, the bottom-line design issue is *practicality*, as demonstrated below by some examples of tasks handled by the prototype software. The interfaces are improved versions following feedback we had from respondents that are discussed after this section of the paper. We will first discuss how the design in both Arc View and Access was achieved.

6.3.1 Sample data set in Arc View 3.2

Figure 8 indicates that ArcView 3.2 is the text and graphic database. ArcView 3.2 automatically manages the relationship between themes and attribute tables. Table 4 shows a sample data set in ArcView 3.2.

Table 4: Sample data set of Achimota Forest Residential in ArcView 3.2

Shape	Area	Perimeter	New #	New1_id	Pin	Plotnr	Descrip.
Polygon	15552.588	513.054	2	32		2	residential
Polygon	3252.434	725.191	3	33		3	residential
Polygon	15293.551	517.048	4	35		4	residential
Polygon	31513.688	711.508	5	38		5	residential
Polygon	31296.070	765.184	6	40		6	residential

Source: Accra Lands Commission Secretariat (2001)

6.3.2 Sample Data Set in Microsoft Access

The above structure of ArcView 3.2 is compatible with Microsoft Access. This enables easy and efficient integration of the attribute databases with the spatial databases as depicted in Figure 1. Ideally, the entire data set above would be imported into Access and linked by a specific 'avenue' script from ArcView. Practically,

however, only the unique identifier – ‘plotnr’ need to be imported and the other descriptive data added to facilitate easy retrieval and query of information. Table 5 shows the ideal example. Note that the Accra LCSs Access database is actually used in this work. There is therefore no marked difference of the suggested data structure in Access to that actually found in the LCS database, even though there is no linkage to the ArcView graphic database.

Table 5: Sample of data set of Achimota Forest Residential in Microsoft Access

...		Plotnr	Descrip.	Other Attributes					Lessees Surname	..
...	...	Plotnr	Descrip.	Client ID	Area code	LS #	Lessees First name	Lessees Surname	..	
		2	residential	Larte	ACF	-	Thomas Aryee	Lartey		
		3	residential	Marbe	ACF	702/73	Dr. E. C.	Marbel		
		4	residential	Atsidd	ACF	704/73	Stephen Yaw	Atsu		
		5	residential	Addofour	ACF	125/76	Marian	Addo-kuffour		
		6	residential	Larb	ACF	56/81	Victor C.	Larbi		

6.4 ArcView 3.2 User Interfaces

Table 6 depicts the ArcView Project window menu structure. Pull down menus need not be command driven but have been added to give some added boost for user interaction. Search reports are vital elements to land administration and therefore we devoted time to studying this process. We will use this process as our example, using Table 6. Two things are required for determining ownership status (search report) namely *site plans* and *attribute information* on the plots. One would therefore require A (Production of site plans through theme selection) or alternatively B (production of site plans by input of the plot number itself) plus the attribute information C. It is worthy to state here that of the six respondents two preferred both A and B; three preferred A to B and two preferred B to A. Most were however critical on the form the attribute information (C) came out and suggested it looked precisely as the manual

system produced it. The accepted form as suggested by respondents that could only be achieved in Access is shown at Figure 14.

Figure 9 is a screen shot illustrating the selection of a land plot through theme selection (A) in ArcView. It opens two message boxes for selecting themes and reselecting associated plot numbers and pans the view to display the selected extent. The plot is highlighted and the end product is used as a site plan for a SEARCH report. An alternative process is by clicking an event script for a menu control that quickly zooms into to a select plot entered by the user by presenting a series of message boxes that gives feedback on the selection made (Figure 10). These processes prepare site plans for printing. Since the attribute information generated in ArcView was received with mixed feelings, we will not show it here.

Table 6: Overview Schema of the menu structure in ArcView (Project Window)

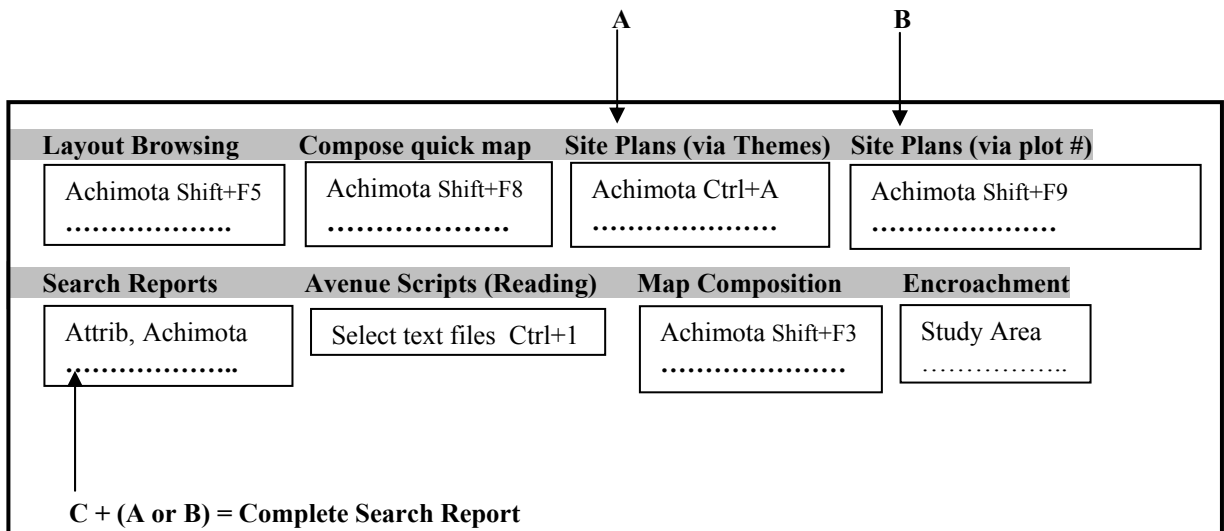


Figure 9: Site plans selection via Themes (on Roman Ridge Residential Area)

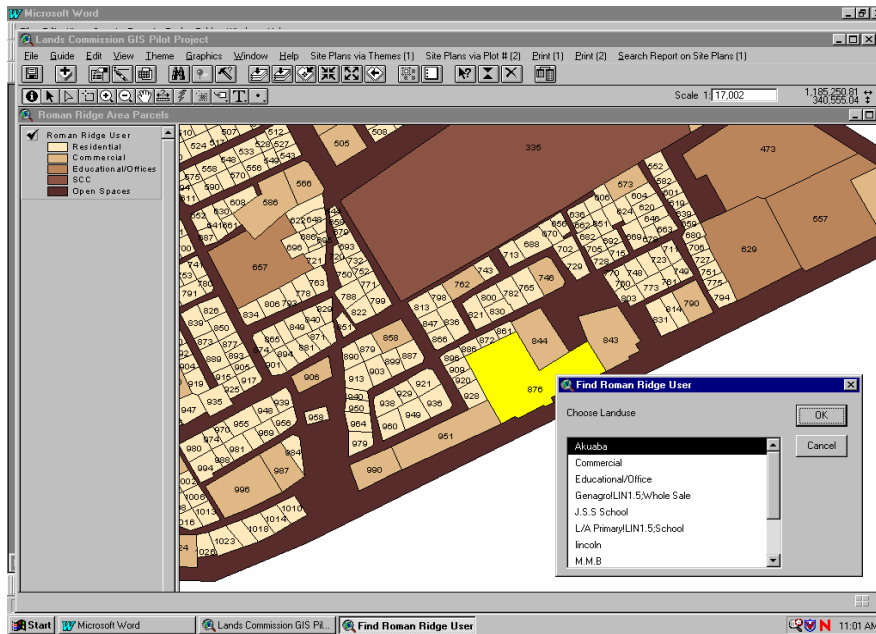
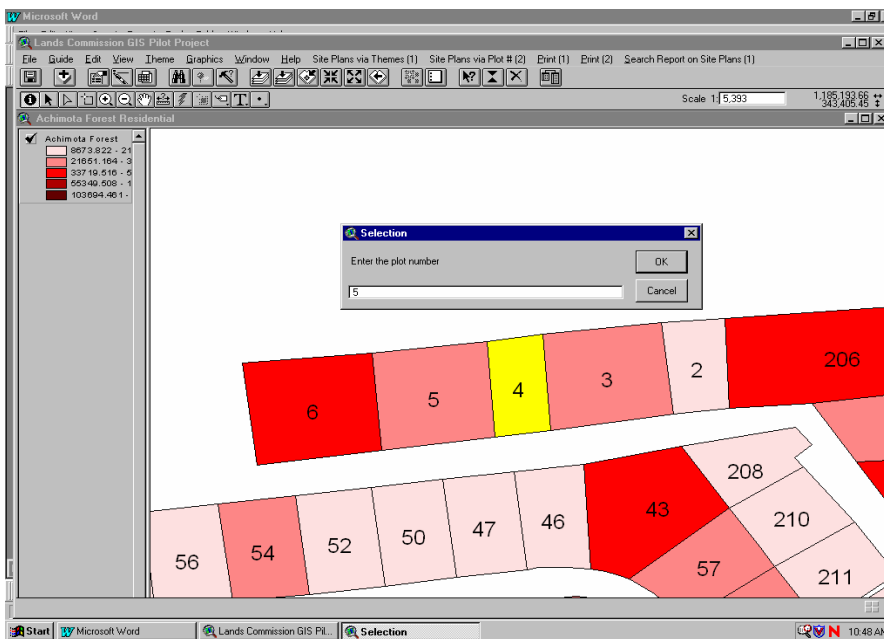


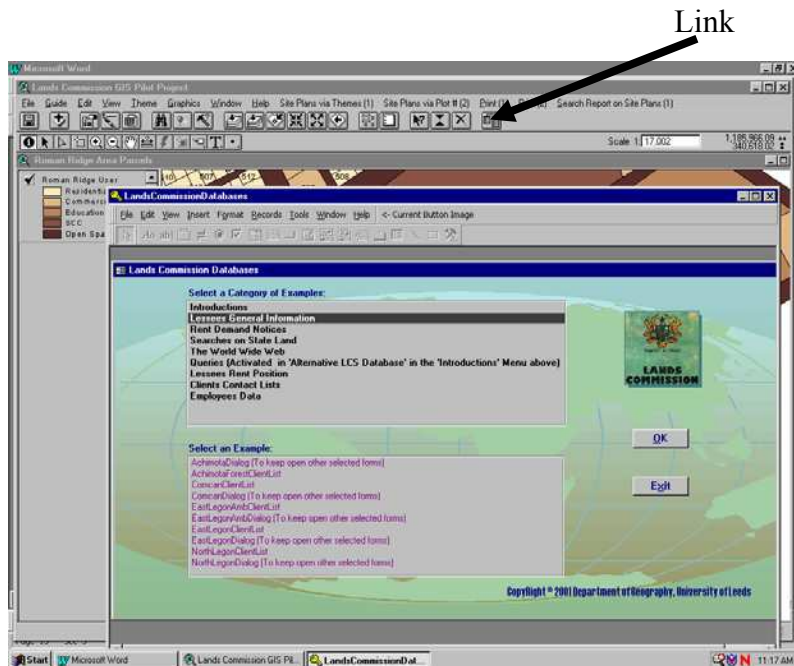
Figure 10: Site plans via input of plot number (on Achimota Forest Residential Area)



6.5 The Linked ArcView and Microsoft Access Interface

Figure 11 shows how ArcView is interfaced with Access. Launching into Access is by a simple avenue script that uses the 'System.Execute' command. The user activates it by clicking a button on the ArcView Interface (see arrow labelled 'link')

Figure 11: Linking ArcView to Microsoft Access (indicating the menu structure in Access)

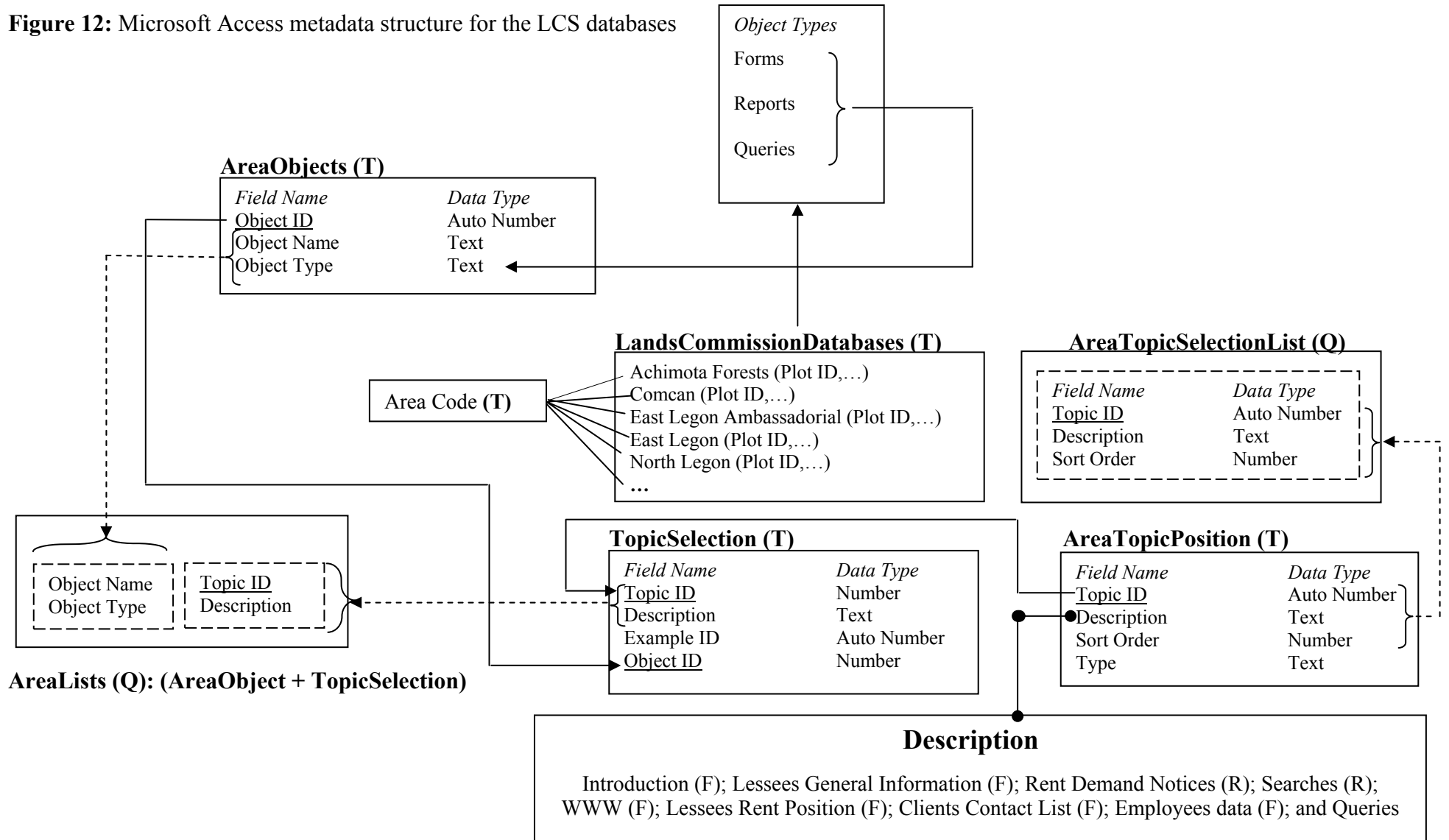


Microsoft Access metadata structure (Figure 12): There are three vital tables (T): the 'AreaObjects' table; the 'AreaPosition' table; and the 'TopicSelection' table that link the LCS main database and constitute the metadata structure. These tables are 'queried' (Q) (as 'AreaLists' and 'AreaTopicSelectionList') to produce the menu structure as shown in Figure 9. Various modules, as noted, (using the visual basic programming language) and SQL statements are used to generate forms, reports *etceteras*.

As indicated in Figure 12 the LCS databases are coded (e.g. Achimota (ACF)) and queries (Q), forms (F) and reports (R) are generated based on individual data sets. These forms and reports are then lodged in the 'AreaObjects' table (T) and given unique 'object' identifiers. Another table - 'AreaTopicPosition' - broadly groups reports, forms etc and give them unique 'topic' identifiers to help select topics that users would like to view. The two tables are linked by the common 'object id' field name. The querying of both tables' yields the 'AreaLists' select query (Q) that operates like an engine in the topic selection process from the 'LandCommissionDatabases.mdb', the main name given to the LCS Access database.

The 'AreaTopicPosition' is queried separately to generate the 'AreaTopic Selection' select query (Q). What happens then is that the user clicks a general topic on the 'LandsCommissionDatabases' *user interface* and gets a pull down menu with alternatives to select from (Figure 11). Let us now look at some examples of the Access user interface.

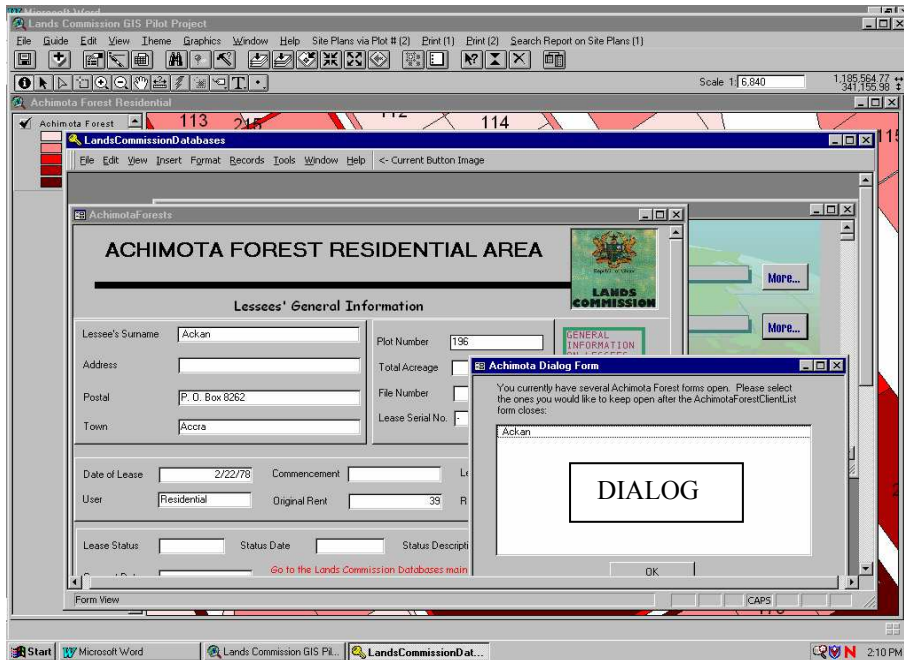
Figure 12: Microsoft Access metadata structure for the LCS databases



6.6 Microsoft Access Interfaces

Figure 13 shows *lessees general information* on Achimota Residential Area in Accra held within in the Access database. The user clicks a command button to view the detailed general or billing information of lessees. A dialog is presented allowing the user to keep open the selected information whilst new ones are examined.

Figure 13: Lessees' general information on Achimota Forest Residential Area



Note: Inset is dialog for keeping open selected billing information forms on individual lessees as new selections are made

Figure 14 depicts the attribute information part of a search report as generated in Access. The report is the exact replica of what the manual system generates and it is activated by input of the plot number by the user. This report together with the site plans will constitute a complete search report so very much needed by the land administration system.

Figure 14: Attribute information as part of search report

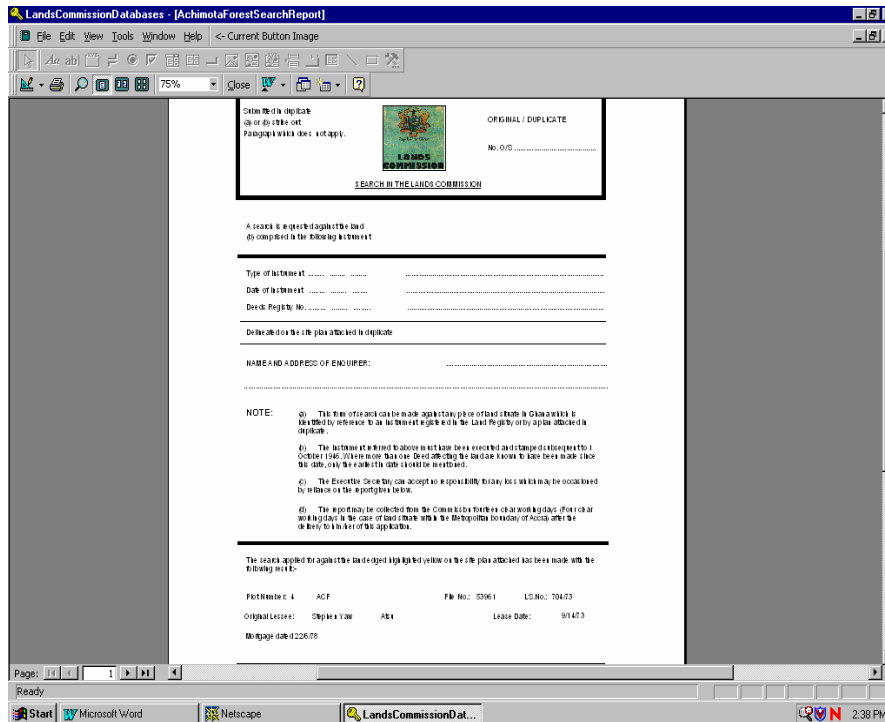
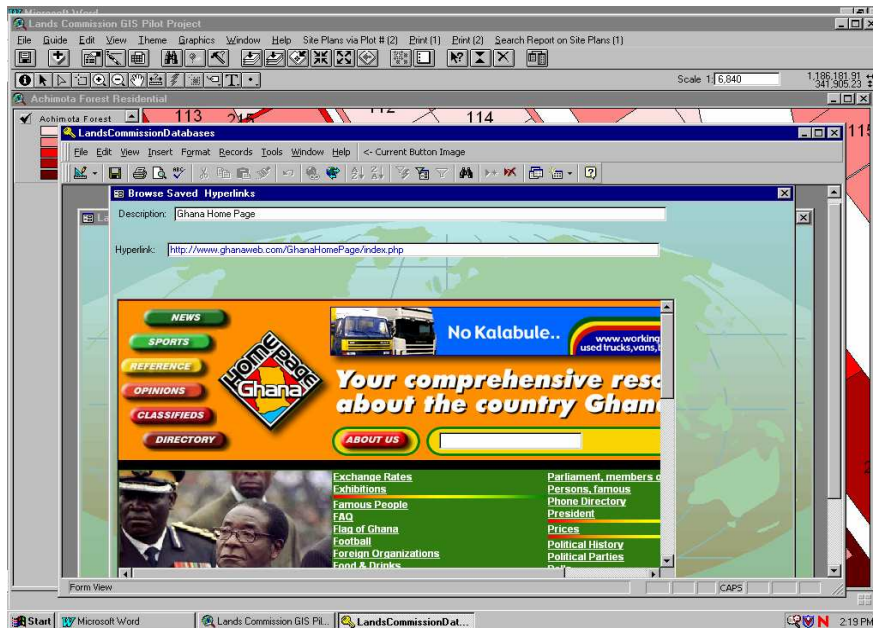


Figure 15 indicates the link to the Internet from the Access interface. Provision is therefore made in Microsoft Access to link the LCS to the Internet (to the Ghana Home Page) where the LCS is expected to develop its own home page in future. Provision is also made for the LCS to have its own home page in Access. ArcView is the core of the prototype and Access is launched from this interface whilst access to the Internet is via Access. Providing support via the Internet or distributing metadata through web pages may appear not practical in Ghana where telephone services are erratic and where electric power outages are the norm rather than the exception. Yet the philosophy is that agencies must 'start small' and 'think big'. Such innovations are relevant but must be pursued with circumspection.

Figure 15: Link to the Internet from Access showing the Ghana home page



Note: The LCS is expected to have its own home page at this web site in future

7 Respondents' Reactions Initial Prototype Software

We will now discuss respondents' feedback on the developed prototype software (see Appendix 5 for the initial selected features in ArcView 3.2). As already mentioned above, six university graduates (of the Lands Officer grade) were selected to provide some feedback on the designed ArcView customised user interface (Plate 10). The choice of such a group was strategic as they are more likely to use or supervise the applications in future and are sufficiently trained in land administration. They have the necessary influence on the operations of the secretariat and will be expected to help impart knowledge gained, to other users of the lower grade. Each respondent was given evaluation forms that helped to structure and elicit some feedback on the testing. The form was so designed to provide comments besides sample user interfaces developed whilst the respondents tested them. These comments were evaluated as a first step towards improving the software. Each respondent was made to choose a suitable day and time for this exercise. Respondents spent between one and half to two and half-hours to test the software (see Appendix 6 for individual reactions to the initial prototype). The researcher(s) was always in attendance. We will first give an overview of the general impressions on the application software.

Plate 10: Testing LANDADMIN (ArcView user interfaces)



When asked whether the software delivered will *'help perform the selected tasks of the Accra LCS better'*, all six respondents gave the affirmative. All six again indicated that the software would *'help perform their task faster'* than previously. Five *felt comfortable* using the prototype software with one feeling *'very comfortable'*. When asked which application respondents *liked most* only one respondent gave the affirmative to all the features. One respondent each *'preferred mostly'*, application 7 (quick maps for inspections); application 1 (user name and password); application 2 (theme and plot selections as site plans); application 3 (plot selections by user input as site plans – alternative to application 2); and application 5 (search report). When, however, respondents were asked to declare which applications they *'did not like'*, one was indifferent, one did not respond and four indicated none, meaning they had no dislike to any of the applications developed.

The applications were *'not confusing'* to four respondents with two citing Application 10 (lodging Avenue scripts as text files in directories) as confusing. Incidentally no comments were proffered. Two respondents wanted application 5 (search report) and application 6 (instant layout) to be *'presented in a better way'*. One was of the view

that the search report could be presented in a form that would be “easily and attractively readable”. Another was of the opinion that the layouts should be in landscape form and the site plans should indicate the acreage, cadastral plan number and the name of the area as a caption. Three thought the application *could be improved* with an equal number indicating their tacit acceptance of the applications as they stood. None *rejected* the applications.

Questions such as *‘what applications do you want added in future’* were added in the questionnaire to help, if necessary, in the expansion of the application to cover other areas. One view was that *“rent management”* in government residential areas was a priority and ought to feature in such prototype software. Another wanted an application that would *“automatically calculate ground rents”*, one to *“list all lessees in arrears for a given period”* and an application for the processing of documents *“so that an applicant can actually trace his/her documents after it had been presented”*.

This exercise strengthened our belief that potential users must be involved in the design and implementation of GIS from the very beginning so they have a feeling of ownership of the system. Such views can be identified and accommodated by involving users in the design process itself. It is proven that system development that does not involve user participation has mixed adoption rates (Cavaye and Cragg, 1993). Systems built in reaction to needs expressed by users are adopted more quickly than systems built in the absence of expressed need. *“The link between organisational culture and implementation emphasises that change cannot be effectively introduced if it is imposed or controlled. GIS implementation would involve much more subtle processes of nurturing and cajoling change”* (Campbell and Masser, 1995).

Land use changes occur frequently and it is recognised that the functionality of GIS need not be restricted to static displays. It is our intention that later versions of the software facilitate the representation and modelling of phenomena such as encroachments on public land, a major issue in land management in Ghana, as a mechanism for advising Government decision-making. Data on encroachments will need to be collected and combined within the GIS to show their spatial extent and their location in relation to other properties and infrastructure. The system would allow vulnerable structures to be identified and earmarked for immediate demolition.

8 Conclusions

It is important that organisations in the lands sector contemplating GIS use consider the general definition of what GIS is (database, analysis and visualisation) in terms of what functions these systems may have within the specific agency and within its broader social context. Individual perceptions of the nature and utility of the *“particular technology is likely to vary considerably according to personal, organisational and cultural circumstances”* (Campbell and Masser, 1995). The ability for GIS to do spatial analysis gives it geo-spatial prowess and distinguishes it from Computer Assisted Design (CAD) systems that are more suited for design and presentation. In the case of land sector organisations, any definition that emphasises the institutional aspect, yet deals with the technical aspects as well, is seen as generic and therefore suitable for adoption.

Much reported research has either been ‘anecdotally based’ (research not conducted under controlled conditions) or centred on retrospective single case studies of successful implementations. There is little by way of research to show the use of empirical methods in a more systematic study of GIS/LIS diffusion in developing countries. *“Much could be learned from prospective studies as new classes of users learn about the potential application of these tools to their fields”*. This work recommends a procedure of study aimed at examining prospective process of adoption’ (Onsrud and Pinto, 1991).

There are fundamental similarities between GIS/LIS and information science (IS) or information technology (IT). To be able to develop an acceptable theoretical framework for GIS/LIS diffusion, the state of the art in IS or IT or even information management (IM) would have to be employed. There are different types of methodologies that lend themselves to GIS research. Whilst the choice of methods may be critical, the review of literature suggests a suite of methods or an eclectic approach to the selection of these methods. No one method is most appropriate for studying a broad or complex research problem. Each method or combinations of methods have *“advantages and disadvantages as well as different assumption biases and degrees of usefulness”* (Williamson *et al.*, 1998). A common approach is to use several research methods that compensate for each other’s weaknesses. Such

methodologies should cover both performance and functional needs of the organisation and must be applied under an acceptable conceptual framework.

There is general agreement on the fact that major problems to be overcome in improving land information practices in developing countries are organisational, managerial and human based. *“It is the manner in which the responsibility for land data is allocated and distributed between institutions, how records are maintained and administered and the experience and education of the people who run these systems that determine their success and failure, not the technology used”* (Zwart, 1990; Taylor, 1991). It is clear that GIS technology is a ‘western artefact’. Any wholesale ‘diffusion’ of this tool therefore without critical analysis and without considering the socio-economic and institutional background of developing countries may be a counter-productive approach. Such critical analysis should include awareness creation among users and feasibility studies including a pilot project preceded by prototype software development. It should also include learning from the past, development of systems required, project proposal, systems testing and evaluation, start-up and finally systems operation and review tailored to specific agencies.

GIS installations in developing countries have mostly been donor designed and implemented exclusively by consultants. Governments are now demanding and receiving more control over project design and implementation. Ironically, the literature suggests that there is still lack of experience of experts from developing countries on the GIS/LIS diffusion processes and *models* for such countries. The development of new models and the refinement of existing ones to suit these countries are therefore necessary. Whilst in many countries there appears to be a ‘hoarding of information’ and therefore little information exchange, effective project design should look at arrangements for data and information sharing. User needs assessment and training are also critical in the design process. Participation by NGOs and the private sector (as the engine of growth) in the use and production of geographic information must be encouraged.

Ghanaians have a strong attachment to land. The need to establish and develop GIS and networks among related land agencies and to encourage internal co-operation and

support in all aspects of land policy and administration engages the attention of the Government. Along with this increased awareness has come a heightened awareness of the difficulties that often exist in trying to introduce GIS within land sector organisations in Ghana. The successful implementation of GIS to support land administration in the lands sector in Ghana is confronted with a series of challenges including the need: to provide frameworks within which GIS can evolve as a tool in an orderly way in the LSAs; to find ways to democratise GIS in land administration and management systems and structures within Ghana; to generate designs that are innovative and practical so they will meet specific land sector needs; and to provide support infrastructure and services that will enable GIS to operate effectively and efficiently in the lands sector. Research should relate to an understanding of not only the technical problems inherent in constructing GIS applications but also of the socio-economic and political context within which GIS is to be adopted. This work has examined a *prospective* process of GIS adoption by using a variety of fieldwork methods to identify the needs of the LCS as well as those factors deemed by existing staff to be critical if GIS implementation is to be successful. This paper has also outlined the development of the prototype software that will provide a system for much improved administration of routine land management tasks in the LCS, as well as offering the opportunity to undertake very useful monitoring of encroachments.

References

- Acquaye and Associates (1989) *Study of Institutional-Legal problems associated with land delivery*, Final report, Accra, Government of Ghana, UNDP and United Nations Centre for Human Settlements (HABITAT).
- Asigbetse, W. (1986) Records Management at the Lands Commission Secretariat, *Unpublished Diploma Dissertation*, University Of Ghana, Legon, Accra.
- Avison, D. and Wood-Harper, A.T. (1990) *Multiview: An Exploration in Information Systems Development*, Blackwell Scientific Publications. Oxford.
- Brobby, K.W. (1991) *Improving Land Delivery Systems for Shelter*, Final Report of Land Policy Consultation, Accra, Government of Ghana, UNDP and United Nations Centre for Human Settlements (HABITAT).
- Brobby, K.W. (1992) *Improving Land Delivery Systems for Shelter*, Report of Land Policy Consultation, Accra, Government of Ghana, UNDP and United Nations Centre for Human Settlements (HABITAT).
- Burns, T., Eddington B., Grant C. and Lloyd I. (1996) Land titling experience in Asia, Unpublished Paper.
- Campbell, H. and Masser I. (1995) *GIS and Organisations: How Effective are GIS in Practice*, Taylor & Francis, London.
- Carter, J.R. (1989) On defining the Geographic Information System, in Ripple, W.T. (ed.) *Fundamentals of Geographic Information Systems: A Compendium*, Falls Church, VA.
- Centre for Democracy and Development (CDD) (2000) *Corruption and Other Constraints on the Land Market and Land Administration in Ghana: A Preliminary Investigation*, Survey Report, Number 4, Accra.
- Chan, T.O. and William, I. P. (1999) The different identities of GIS and GIS diffusion, *International Journal for Geographic Information Systems*, 13: 267– 281.
- Davies, G.B. (1982) Strategies for information requirement determination, *IBM Systems Journal*, 21(1): 4-30.
- Eason, D.K. (1993) Planning for change: introducing a GIS, in Medyckyj-Scott, D. and Hearnshaw, H.M. (eds.) *Human Factors in GIS*, pp. 199-209.
- Flynn D.J. and Warhurst, R. (1994) An empirical study of the validation process within requirements determination, *Information Systems Journal*, 4: 185 – 212.

- Huxhold, W.E. and Levinsohn A.G. (1995) *Managing Geographic Information Projects*, Oxford University Press, Oxford.
- Huxhold, W.F. (1991) *An Introduction to Urban GIS*, Oxford University Press, Oxford.
- Kasanga, R. K., (1990) *Institutional/Legal Arrangements for Land Development: Case study, Three Secondary Cities of Ghana*, Final Report, Government of Ghana, UNDP and United Nations Centre for Human Settlements (HABITAT)
- Kasanga, R.K., Cochrane, J. King, R. and Roth, M. (1996) Land markets and legal contradictions in the peri-urban area of Accra Ghana: informant interviews and secondary data investigations, mjroth@facstaff.wisc.edu; lucuw@facstaff.wisc.edu (accessed in January 2002).
- Keen, P.G.W. (1981) Information systems and organisational change, *Communications of the Association for Computing Machinery*, 24, 24 - 33
- Larbi, W. O. (1995) The urban land development process and urban land policies in Ghana, *Our Common Estate*, The Royal Institution of Chartered Surveyors (eds.), August.
- Larbi, W. O. (1996) Spatial planning and urban fragmentation in Accra, *Third world Planning Review*, 18(2), May.
- Mansell, G. (1991) Action research in information systems development, *Journal of Information Systems*, 1: 29-40.
- Masser, I. and Campbell, H. (1996) Gt. Britain: The dynamics of GIS diffusion, in Masser, I., Campbell, H. and Craglia, M. (eds.) *GIS Diffusion: Adoption and Use of Geographic Information Systems in Local Government in Europe*, Taylor & Francis, London.
- Masser, I. and Onsrud, H. (eds.) (1993) *Diffusion and Use of Geographic Information Technologies*, Kluwer Academic Publishers, Dordrecht.
- Maxwell, D., Odame, L.O., Lamptey, G.A., Zakariah, S. and Armar-Klemesu, M. (1999) Farming in the shadow of the city: changes in the land rights and livelihoods in peri-urban Accra, *Third World Planning Review*, 21(1), February.
- Mills, A.P., Pender, J., Quashie-Sam, S.J. and Boateng, K.K.O. (1997) *KUMINFO – Kumasi Peri-Urban Data Management System: Kumasi Natural Resources Management Project, Seminar Handout*.

- Ollennu, N.A. (1962) *Principles of Customary Land Law in Ghana*, Sweet and Maxwell, London
- Onsrud, H.J. and Pinto, J.K. (1991) Diffusion of geographic innovations, *International Journal of Geographic information Science*, 5: 447-467.
- Rogers, E.M. (1995) *Diffusion of Innovations*, Fourth Edition, The Free Press, New York.
- Sahay, S. and Walsham, G. (1996) Implementation of GIS in India: organisational issues and implications, *International Journal Of Geographical Information Systems*, 10(4): 385-404.
- Scholten, H.K. and Stillwell, J.C.H. (eds.) (1990) *Geographic Information Systems for Urban and Regional Planning*, Kluwer, Dordrecht.
- Somevi J. K. (2001) The effectiveness of institutions in land registration in Ghana *Our Common Estate*, RICS Foundation, London .
- Taylor, D.R.F. (1991) GIS and developing nations, in David, J.M. *et al.* (eds.) *Geographical Information Systems Vol. II: Applications*, New York, pp. 71-83.
- UNCHS (HABITAT) (1990) *Global Strategy for shelter to the Year 2000*, Nairobi, (HS/185/90E).
- UNCHS (HABITAT) (1990) *Guidelines for the Implementation of Land Registration and Land Information Systems in Developing Countries: with Special Reference to English Speaking Countries in Eastern, Central and Southern Africa*, Nairobi.
- Wasmund, M. (1993) Implementing critical success factors in software reuse, *IBM Systems Journal*, 32(4): 595-599.
- Zaltman, G., Duncan, R. and Holberk, J. (1973) *Innovations and Organisations*, New York, John Wiley and Sons.
- Zwart, P.R. (1993) Embodied GIS – a concept of GIS diffusion, in Masser, I. and Onsrud, H.J. (eds) *Diffusion and Use of Geographic Information Technologies*, Dordrecht, Kluwer Academic Press.

Appendix 1: Scoring “Factors” (Critical Success Factor Method)

Goal: *To introduce a GIS that would support land management applications, have querying capacities and report generation; leading within 5 years to increased revenue base, efficiency and timely processes, and high customer confidence in the Commission’s work processes.*

Factors (Criteria) – very important (10); Important (8); Not so important (5); Disregard (0).

Factor	Meaning	Score
Hardware & Software	Purchase equipment (computers) and accessories, upgrade software	
Maintenance	Backup availability, malfunction and correction reporting (repairs and replacements of equipment)	
Education & Training	Training (in-house and abroad) to create appropriate mind set and establish technical skills	
Motivation	Running incentive programmes to motivate staff (e.g. Award schemes)	
Remuneration	Wages/Salaries (as they relate to revenue generated?)	
Accounting/Auditing	Recording all transactions, associated costs and savings (revenue/expenditure)	
Progress Control/Updating	Definition of progress made, provision of checkpoints/milestones chalked; data current and up to date, security	
Current Budget	LCS to depend on own generated financial resources as much as possible	
External Funding	Initial solicitation of funds only – Donor funding support (e.g. World Bank) for take off only	
Discipline	Behaviour of staff as they relate to extortion, corruption and to the public, and disregard for authority	
Autonomy	Status of Accra RLC (to operate like all the other regions as required by Act 483)	
Transport (mobility)	Vehicles for inspections and for transporting staff to and from work	
Communication (Networks)	Communication channels between land-related agencies and possibly the public	
Political leadership	Role of government especially as through the Ministry of Lands and Forestry (Political interference)	
Staff Number Reduction	Implies excess workers, leading to underemployment and minimal work loads	
Leadership Style	The way LCS has been organised by various ESs (last 10 years) – consultative? or Paternalistic?-(in the name of a father often usurping individual responsibility) or autocratic?-(absolute unrestricted authority).	

Appendix 2: Questionnaire for Key Decision-Makers and Technical Staff

Part One: Questionnaire - Organisational Issues

Goal: *“introducing a GIS that will support land management applications leading within five years to increased revenue base, efficiency and timely processes and high customer confidence in the Accra LCS work processes”*

Interpretation: The questionnaire below indicates the frequencies of the responses to the closed questions in the appropriate response boxes. Some reasons and explanations given to open questions are edited and quoted to give meaning to some of the answers given. Interpretation of questionnaire responses is as follows:

Questions

Meaning

1 – 12, 16

This relates to mainly ‘yes’ and ‘no’ responses with occasional ‘unsure’ and ‘uncertain’ responses as well. Others are ‘agree’/‘disagree’ responses aimed basically at awareness creation. The frequency of the responses is shown for each question. For example, to question 1, 15 responses were ‘yes’ and none ‘no’. As there were 17 respondents who were to attend, it indicates that 2 were absent and did not participate. Where the total of responses is less than 15, it means some responses were not given.

13 – 15

These are responses other than ‘yes’ and ‘no’ or ‘agree’ or ‘disagree’ aimed mainly at seeking confirmation of facts on the ground.

17, 18

The values in the boxes are aggregated total scores and values in parenthesis represent derived means. For example, only one person scored the maximum value of 6 for ‘public interference’ in question 18 with a derived mean of 6.

1. Do you agree with the goal set as stated above? Yes No
2. Do you agree that introduction of a computer-based information system would play a crucial role in the work of the LCS? Yes No
3. Such a change would involve a different way of doing things and I am prepared to give it a try. Yes No Unsure
4. I agree that political pressure from the MLF shapes the work processes of the LCS. Yes No Uncertain
5. I agree that point five (5) above has a positive effect Yes No Uncertain

Can you give a reason why you chose the above, please?

(Yes) "The Lands Commission, like all other MDAs, needs a sense of direction or policy direction which must fit into the overall aspiration of the nation...through occasional political interference/intervention";

(No) "The work processes of the LCS changes to suit the pressure from the MLF even if what the MLF is demanding may not meet the policy requirements of the LCS"; and

(Uncertain) "The political pressure is present, but as to whether it is positive or negative, I cannot tell as it could be positive at times and negative at other times".

6. The LCS must receive autonomy and be insulated from governmental Control (Governments role must be catalytic (speeding up the work processes only) Agree Disagree Unsure

Can you give a reason why you chose the above, please?

(Agree) "This will enable land administrators carry out their duties without fear and devoid of politics";

(Disagree) "The LCS should rather be semi-autonomous since it falls under the MDAs and has a constitutional mandate to manage public lands"; and

(Unsure) "The LCS having total autonomy I don't know if we are ready for such a responsibility, having been under government control for so many years. The Commission should be given some control over its own affairs e.g. as a quasi-government organisation before being given full control".

7. All directives from government must be rooted through the National Lands Commission (Note: the Executive Secretary is Secretary to the Commission). Agree Disagree Unsure

Can you give a reason why you chose the above option, please?

(Agree) "The functions of the Commission make it mandatory for all government directives to be rooted through it. By adopting this policy, the Commission will be better placed to advise government on issues pertaining to land";

(Disagree) "Operations of the Commission may be stifled should every matter be first referred to the National Lands Commission"; and

(Unsure) "At present, the National Lands Commission has not formally been inaugurated, so if this directive was in place, how would the government give directives and instructions?"

8. The size of the LCS is unnecessarily large and therefore has to be trimmed.

Agree Disagree Unsure

9. I agree that excess workers lead to under-employment and minimal work loads.

Agree Disagree Unsure

10. Wage levels are low and must relate to the level of production.

Agree Disagree Unsure

11. Inter-personal behaviour and individual behaviour of the LCS is

Good Bad Unsure

Give Reasons?

(Good) "Most of the Staff are on good terms with each other and relate well with the public too. However, there are others who don't exhibit these qualities. We have more room for improvement.

(Bad) "Because of the low remuneration of workers of the LCS"; and

(Unsure) "At certain levels (usually senior level), behaviour is good and other levels (usually junior level), it is bad – so it is difficult to say it is totally good or totally bad".

12. Conflicts (as is normal with all organisations) exist between:

The Estates Section/Legal Section	Yes	<input type="text" value=""/>	No	<input type="text" value="1"/>
The Legal Section/Accounts Section	Yes	<input type="text" value="0"/>	No	<input type="text" value="12"/>
The Accounts Section/Technical Section	Yes	<input type="text" value="0"/>	No	<input type="text" value="12"/>
The Estates Section/Accounts Section	Yes	<input type="text" value="10"/>	No	<input type="text" value="3"/>
The Technical Section/ Estates Section	Yes	<input type="text" value="5"/>	No	<input type="text" value="7"/>
All Sections	Yes	<input type="text" value="0"/>	No	<input type="text" value="11"/>

13. The conflicts relate to:

Leadership style and roles (A)	<input type="text" value="5"/>
Work processes (B)	<input type="text" value="3"/>
Relationships (C)	<input type="text" value="0"/>
Policy Issues (D)	<input type="text" value="0"/>
A combination of above (A) & (B)	<input type="text" value="4"/>
(A), (B), (C), & (D)	<input type="text" value="1"/>

Others such as:

“Some staff have remained on their schedules for far too long and have become tin gods. This affects productivity”; and

“The idea that only the estates section can rise to the position of the Executive Secretary creates enmity between the estates section and other sections especially with the legal section”.

14. Management Style for the past 10 years has been:

autocratic paternalistic consultative

Any explanations, please?

(Autocratic) “...Leaders usually form their own empire when they come to power. Others who do not belong to the empire are usually not consulted. This was what happened for the past ten years until now...”;

“(Paternalistic) – no explanations; and

(Consultative) “No individual section stays in isolation. We do consult with each other...”

15. Authority definition and hierarchy is: Clear Unclear Neither

3	11	0
---	----	---

16. The Accra Regional Lands Commission must have a distinct role from the Head office as envisaged by the LC Act (483).

Agree Disagree Unsure

Any explanations, please?

(Agree) "The Head Office is virtually performing the duties of the Accra Regional Lands Commission. The Regional Lands Officer is somehow handicapped in performing his duties e.g. granting of leases, consent to assign, mortgage etc."

17. Please could you give an indication of how these factors have led to corruption OR extortion charges often made by the public on LCS staff by rating them on scale 1 – 5 (5 being the most important?)

Low level pay	55	(3.9)
Sheer Greed	30	(2.3)
Indiscipline	39	(3.25)
Pressure from Public	37	(3.08)
Culture of the LCS	22	(1.8)

18. What do you want changed most (*for the better*) in the LCS? – Scale 1 – 6 (6 being the most important):

Promotions	44	(3.66)
Wage Levels	64	(4.57)
Leadership Style	43	(3.58)
Work Processes	54	(4.5)
Appointment to the ES position	46	(3.83)
Any others? Physical structures	11	(5.5) – 2 respondents only
Public interference	6	(6) – 1 respondent only
Attitude to work	12	(6) – 2 respondents only

Reasons for the above choice(s), please?

(Wage levels) “In organisations with high income levels, the productivity has always been appreciable. But in the Lands Commission motivation and reward for handwork are hardly available. For example staff are not even entitled to allocation of government plots. That is a foundation of corruption”;

(Work processes) “The work processes should be shortened for when it is long it encourages corruption as some staff take advantage to extort money from applicants... ”; and

(Public interference) “There is too much public interference resulting in low production of work”.

Appendix 3: Questionnaires for Key Decision-Makers and Technical Staff

Part Two – Application Issues

Goal: *“introducing a GIS that will support land management applications leading within five years to increased revenue base, efficiency and timely processes and high customer confidence in the Accra LCS work processes”*

Interpretation: The questionnaire below indicates the frequencies of the responses to the closed questions in the appropriate response boxes. Some reasons and explanations given to open questions are edited and quoted to give meaning to some of the answers given. Interpretation of questionnaire responses is as follows:

Questions	Meaning
1 - 14, 16, 18, 19	This relates to mainly ‘agree’ and ‘disagree’ responses with occasional ‘not sure’ responses as well. Others are ‘often’/‘sometimes/never’ responses aimed basically at determining training needs. The frequency of the responses is shown for each question. Where the total of responses is less than 15, it means some responses were not given.
17, 20 – 23	These are responses other than ‘yes’ and ‘no’ or ‘agree’ or ‘disagree’ aimed mainly at seeking confirmation of facts on the ground.
15	The values in the boxes are aggregated total scores and values in parenthesis represent derived means. For example, 14 persons scored a total aggregated score of 120 for ‘searches’ in question 15 with a derived mean of 8.57.

1. Have you used computers in your work before?

Often Sometimes Never

2. What software have you used before?

Spreadsheets e.g. Excel

Often Sometimes Never

Database Management System e. g. Dbase IV, Access

Word Processing e. g. Word Perfect, Word

GIS (vector) e.g. Arc/Info, ArcView, MapInfo

GIS (raster) e. g. Ilwis, Idrisi

3. Have you heard about Knowledge Based Systems or Decision Support Systems?

Yes No

4. What about Geographic Information Systems (GIS)?

Yes No

5. Do you have any training in GIS especially?

Yes No

6. I agree that upon introduction of GIS in the LCS, training is critical and I am prepared to undergo training.

Agree Disagree Not Sure

7. Training must be tailored to suit the LCS needs and all employees must be computer literate

Agree Disagree Not Sure

Any reasons for your choice, please?

(Agree) "GIS can only operate in an environment where all employees are computer literate, among other factors. This is so because there can be no GIS without computers and people must be trained to man the computers" and

(Disagree) "Not all employees (of the LCS) are trainable".

8. The filing system in the LCS is poor and has to be improved:

Agree Disagree Not Sure

9. The issue of misplaced files is common

Agree Disagree Not Sure

Any reasons you may want to assign, please?

(Agree) "There is no effective central monitoring unit for dealing with the movement of files. All officers have files in their offices that cannot be traced from a central source. Thus a lot of files appear to be 'missing' when in actual fact they are in the system"; and
"Due to the manual handling of files, the volume of work is so much that sometimes files are misplaced. When records are computerised, it will make records keeping less cumbersome".

10. There is generally lack of storage space in the LCS

Agree Disagree Not Sure

11. There is lack of transparency in working procedure

Always Sometimes Never

Any reasons you may want to assign, please?

(Sometimes) "Due to parochial interests"; and
There are sometimes conflicts and power struggles between the various departments of the LCS and because of this the various departments are reluctant to be transparent in their (working) procedures".

12. Dust is a problem in my work

Always Sometimes Never

13. Unreliable electricity power supply is a major problem Agree Disagree

14. Transportation is another major problem to address Agree Disagree

Any other serious limitations you have observed, please?

"The lack of a proper reception area to limit the loitering around the offices of staff";

"The security of documents is not very well taken care of. The public has access to storage areas that should not be the case";

"...Information is so scattered that it becomes very difficult in getting the right information";

"Punctuality and absenteeism";

“Delayed promotions”; and
“No clear cut training for staff”.

15. Of all the type of work done, this is the one I want done by the computer.

(Scale 1 – 9, 9 being the most important)

Presentation	<input type="text" value="56"/>	(4.3)
Searches	<input type="text" value="120"/>	(8.57)
Leases preparation including consents	<input type="text" value="82"/>	(6.31)
Stool lands processing and concurrent	<input type="text" value="68"/>	(5.67)
Family/Private lands processing	<input type="text" value="56"/>	(4.67)
Statutory Declarations	<input type="text" value="56"/>	(4.67)
Rent assessment and Collection	<input type="text" value="104"/>	(7.43)
Site plans	<input type="text" value="66"/>	(5.5)
Plotting	<input type="text" value="88"/>	(6.77)
Registration	<input type="text" value="37"/>	(3.7)

16. I agree that information/data on the LCS must be seen as a corporate resource (LCS must share data with other agencies)

Yes No Not Necessary

17. Such Information/Data given to other agencies must be:

Subsidised At Market Value Free

Any reasons, please?

(Subsidised) “This will ensure effective collaboration and co-operation with other agencies and also promote efficient land administration”;

(At market value) “To recoup the resources invested in the collection and storing of information and to ensure financial self sufficiency”;

“...Other agencies will always ensure that they come for data that they actually need”; and

(Free) “Information should be freely made available without any hindrances whatsoever”.

18. Do you want to see the private sector getting directly involved with our work e.g. being responsible for rent collection for the LCS? Yes No Sometimes

Any reasons, please?

(Yes) "A lot of rent defaulters. The LCS must engage an agency to retrieve all rents";

(No) "The LCS can do the work if given the necessary logistics. If the funds and logistics given to the Office of the Administrator of Stool Lands had been given to the LCS to improve that sector, we could have done the job better"; and "What is needed is public education. Some lessees' claim that they are not aware of any obligation in the lease to pay rent every year, but come to pay when they are told".

19. GIS must be a unit (department) in the LCS. Yes No

Any reasons, please?

(Yes) "So that there can be some permanent staff in the unit to see to the day to day updating and management of spatial and attribute data".

"To give full attention to the data processing and mapping involved".

"There is the need to have a central point to co-ordinate the information....".

20. The quality of **maps** in the records is:

poor fair good very good

Any explanations, please?

(Poor) "Too much handling and poor storage making the plans deteriorate in time and therefore resulting in loss of vital information";

(Fair) "Due to the constant use of the maps for records information, the wear and tear is high. The LCS does not have the staff to produce and replace these maps on a periodic bases"; and

(Good) - No explanation given

21. The quality of **data** (records) is:

Poor fair good very good

Why did you choose any of the options, please?

(Fair) "Most of the maps were produced in the colonial era and since there has not been any proper updating, this has led to the deterioration of most of the sheets"; and

(Good) "Even though there are lapses and conflicts in our data base, to a large extent they can be relied upon".

22. The reliability on **maps** in my estimate

is: 80-100% 60-79% 40-59% 20-39% 0-19%

Reasons, please?

(80-100%) "The maps produced are accurate, so once your site plans are incorrect, the information will most often not be accurate";

(60-79%) "This is because some of them are old and have some parts torn off or mutilated. As such some form of information may be lacking";

(40-59%) "Most of them don't conform to what is on the ground. They are outmoded and need to be updated or modified"; and

(20-39%) "Records information cannot be relied on because of illegal plottings and unreliable plans received from applicants".

23. The reliability on **data** in my estimate is:

Poor fair good very good

Any explanations for your choice?

(Fair) "Accessing and retrieval of data is extremely difficult. Also some site plans annexed to documents are highly inaccurate, not reflecting the exact situation on the ground"; and

(Good) “Data in our records have been built up over the years and have been of immense help to the various land agencies, the private sector and to the public in general. But for lack of proper storage area which has resulted in the destruction of some of the data, it could have been very good”.

Any general observations you would like to give?

“For effective land administration to prevail, records management ought to be given high priority. The data must be accurate and accessible. That is why I would recommend that computer training and introduction of GIS will go a long way to improve upon the work of the Commission”;

“The manual system of working leads to delays and defacing of papers containing information. There will be the need to train all category of staff in modern office management, computer and public relations to enable the staff render quality service to the public”;

“The Commission should be re-engineered on its works ethics to enable staff improve upon performance aimed at customer satisfaction”; and

“For an efficient GIS programme, the Commission must be a self accounting body with the ability to employ and to sack, and pay its staff very well to minimise corruption and stealing of official time for their own private assignments”.

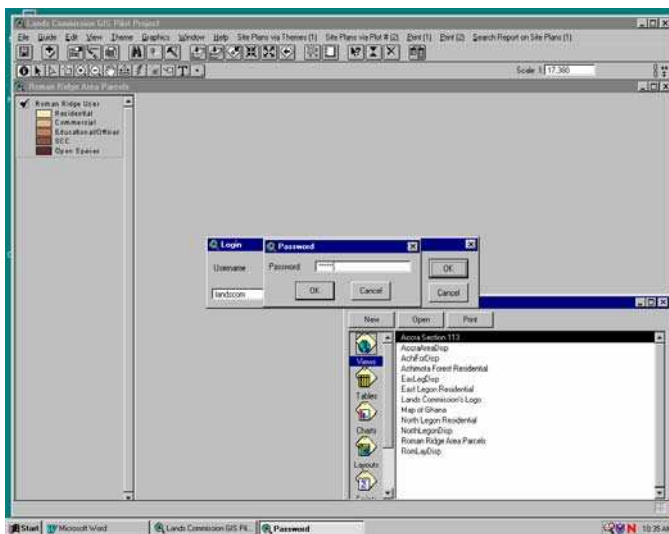
Appendix 4: Questionnaire for Prototype Users – Evaluation Form (Technical)

This prototype is a PhD research project being undertaken in the School of Geography, University of Leeds, UK. It is aimed at automating the processes of the Lands Commission. You may find that it tries to ensure timely and efficient processes but is still at a rudimentary stage. Your contribution in completing this form is to help evaluate and improve this prototype software.

To help in structuring feedback, this form has been designed to enable you provide comments besides samples of user interfaces provided to the left. A couple of specific and general questions follow.

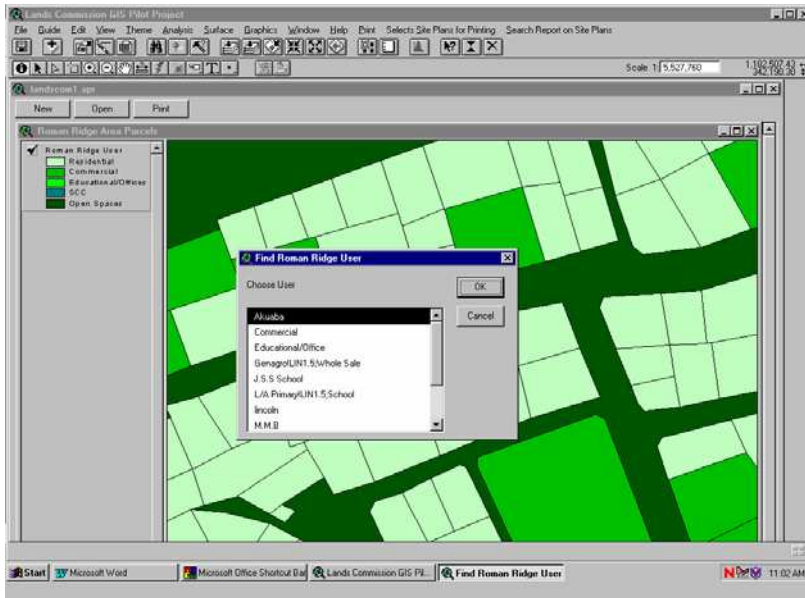
1. User name and password to provide security and display the Lands Commission logo

Comments:



2. Profile and selections. This enables you select themes (residential or commercial etc) that then allows you to select the relevant plot number. You are presented with a zoomed in and highlighted site plan that can be printed. This is alternative to (3) below.

Comments

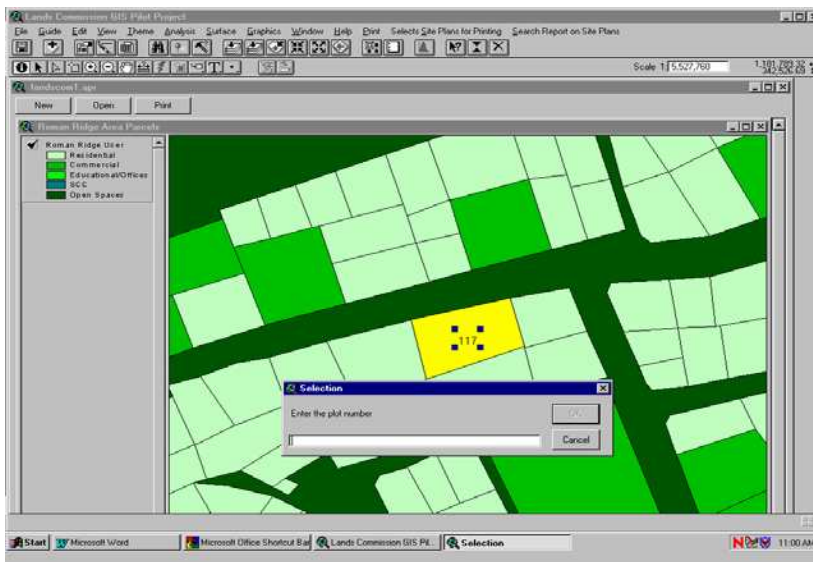


Do you prefer this (2)?

OR this (3)?

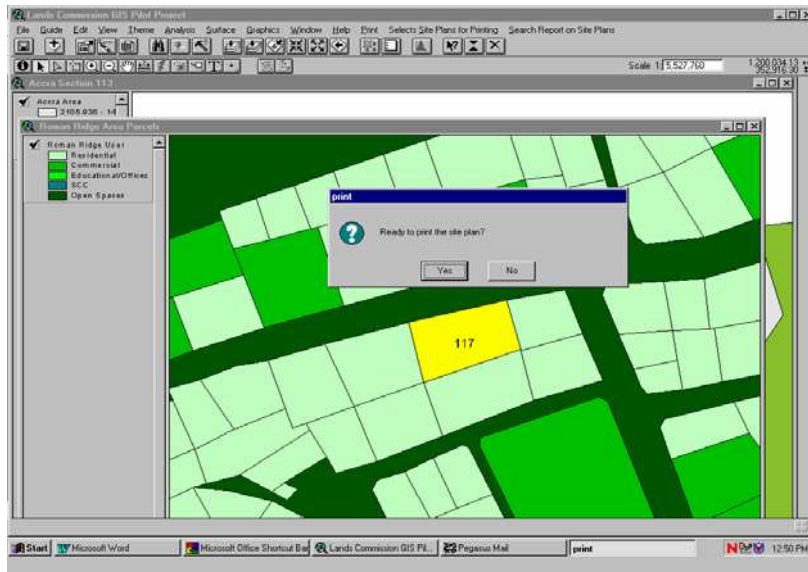
- This allows you to input the plot number yourself and provides some message boxes for confirmation before site plan is presented just as (2) above.

Comments

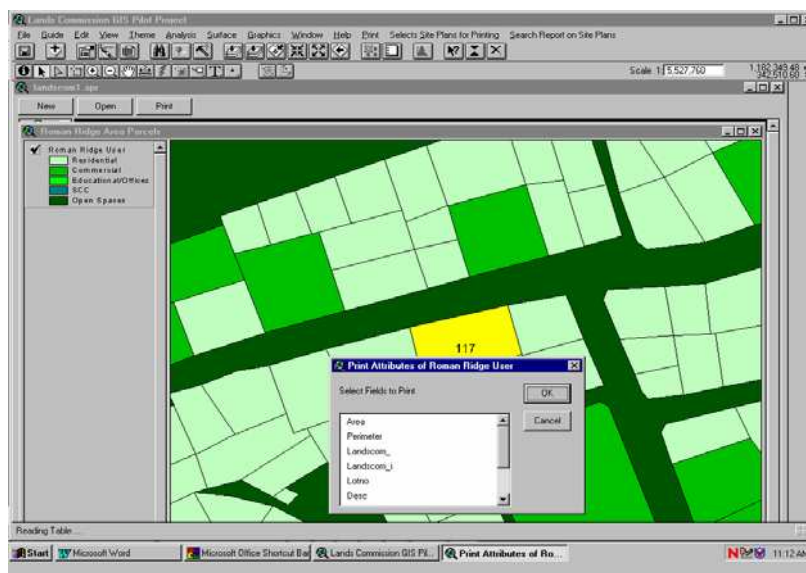


4. This interface enables the printing of the active site plan

Comments



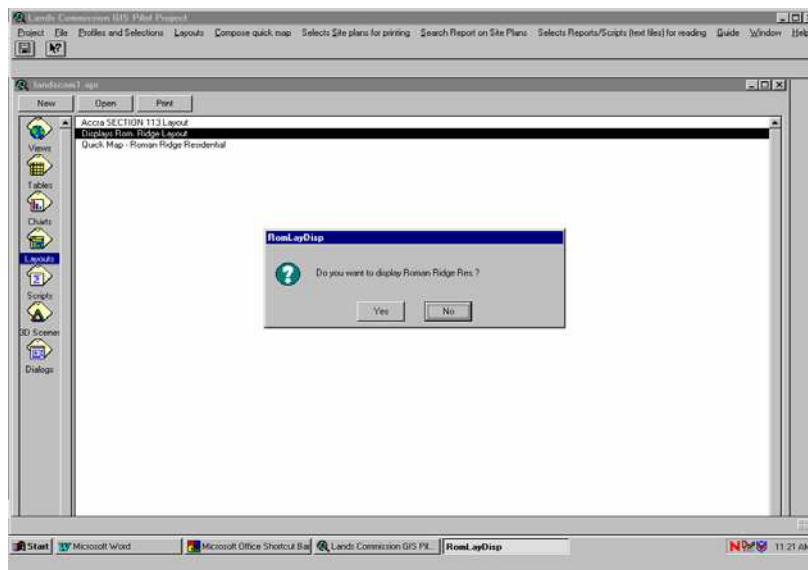
5. This enables you to select attribute data from a coverage that can be attached to site plans (2 or 3) as SEARCH REPORT.



Comments

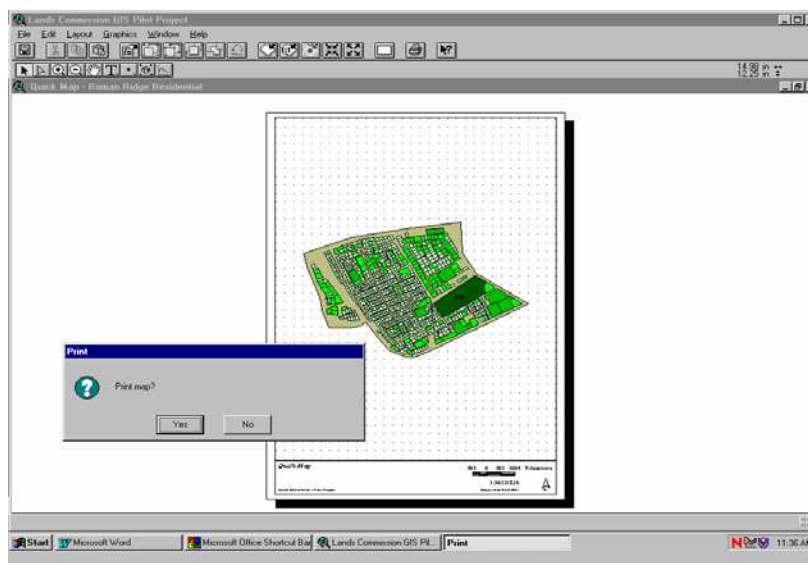
6. This enables you to have an instant layout that can be examined

Comments



7. This enables you to print quick maps for Land Technicians to take along for field inspections (can easily be printed on plotters). You are required to select printer, preserve scale, provide your own title information on the map, and preview the map before printing.

Comments

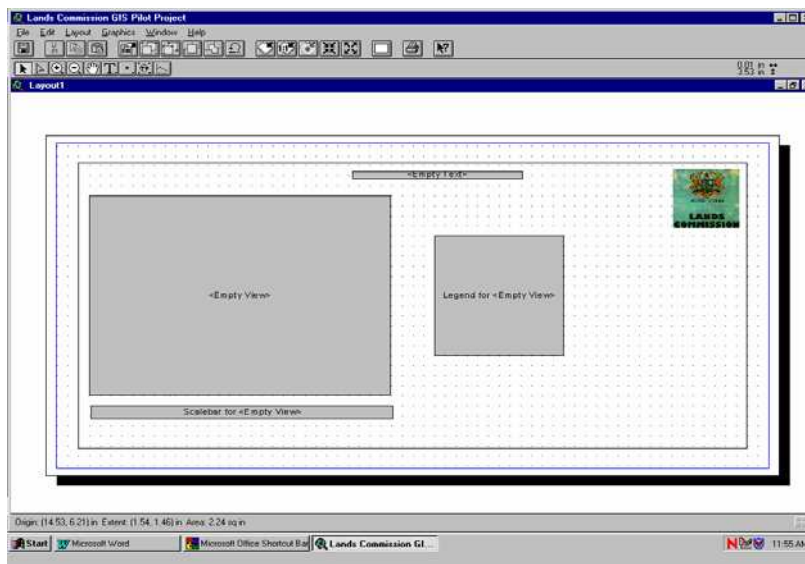


8. The Technical officer is allowed by a click of this menu that composes any map based on available coverages. He is presented with two options ensuring flexibility: (Layout 1 and Layout 2).

Layout 1 allows him to select any type of north arrow, a neatline, a heading (title or map), an empty view to select appropriate coverage, an empty scale bar, an empty legend and a logo of the LCS.

Layout 2 is placed on a template (predefined) and allows him to specify only a heading.

Comments



9. All ArcView AVENUE scripts are compiled as text files to enable reading. This is to top technical staff corrupting scripts (placed on the project window script icon).

Comments

13. Do you feel comfortable using them?

14. Which application do you like most?

15. Which applications do you not like?

16. Which application do you find confusing?

17. Which application do you think should be better presented in a better way?

18. Are the applications generally to be improved, rejected or they are OK? Give suggestions, please.

19. Is there any application(s), which you may like to see, added in the future?

Appendix 5: Initial features of the prototype software for testing in the Accra LCS
(September 2001) – ArcView 3.2 Interface

Feature application ref. number	Name of feature	Function
1.	User name and Password	To provide security and display the LCS logo
2.	Selection via Theme and then Plot Number (Site plans)	Selects themes and associated plot number and presented with zoomed in and highlighted site plan
3.	Selection via plot number only	Selects plot number only and presented with zoomed in and highlighted site plan (Alternative to 2)
4.	Printing of Site plans	Enables the printing of active site plans
5.	Search Report	Selects attribute data from a coverage that is to be attached to site plans as search report
6.	Instant Layout	Enables layouts to be examined instantly
7.	Composition of quick maps for inspections	Presented with printer preserve scale, title and preview dialog and options for quick maps for field inspections
8.	Map compositions	Composes maps on all available coverages by selecting the north arrow, a neatline, heading, an empty scale bar or with scale bar, and empty legend or with legend and the logo of the LCS on two layouts presented. Layout 1 allows user manipulation and layout 2 is predefined and allows input of title only.
9.	Avenue scripts as text files (read only)	Scripts that run the system are compiled as text files and can easily be accessed for reading only to prevent technical staff from corrupting them.
10.	Avenue scripts as text files (placing in directories)	Alternatively, such scripts can be saved as text files and placed in any directory.

Appendix 6: Summary of Individual Respondent's Views on Prototype Software Applications (September 2001)

A	Good & useful	Useful	Prefers 3	Very useful	Useful	OK (enhances viewing)	Useful (flexible)	OK	Useful (make more readable)	Useful
B	Good & useful	Useful (provide grid lines on maps)	Both are useful	Adequate (provide heading to site plan & plot numbers of adjacent plots)	Useful	OK (easily retrieved & ensures durability)	Useful (ensures availability at all times)	Useful	Good check	Useful
C	Good & useful	Speed (highly recommended)	Prefers 2	Good (provide heading to site plan)	Useful	Useful (saves time)	Good	Useful	Useful	Useful
D	Good & useful	Useful	Prefers 2	OK (provide heading to site plan)	Useful	Good (very fast)	Useful	Useful	Useful	Useful
E	Good & useful	Good (provide grid lines on maps)	Both are useful	OK	Good (make more legible)	Good (saves time)	Useful	Very Useful (imaginative)	Very useful	Useful
F	Good & useful	Useful (provide heading to site plan)	Prefers 2	OK (provide heading to site plan)	Useful	Good (saves time)	Absolutely necessary	Useful	OK	OK

Note: Compare Appendix 5