A Co-Ordinated Approach to Land Information Management

The Fiji Land Information System - 'Tukutuku ni Vanua kei Viti'

Kemueli Masikerei,* Anselm Haanen, Graeme Crocker*****

*Fiji Land Information System Support Center, Department of Lands and Surveys PO Box 2222, Government Buildings, Suva, Fiji. Tel. (679) 314399, Fax. (679) 305029

**Terralink NZ Ltd Private Bag 2767, Wellington, New Zealand Tel. (64) 4 4710380, Fax (64) 4 495 8450

***Land Information New Zealand Private Box 5501, Wellington, New Zealand Tel. (64) 4 460 0100, Fax. (64) 4 472 2244

1. Abstract

"*LAND is our most valuable resource and the means of our existence. It is therefore very important that it is carefully preserved and managed and accurately described and recorded".*
Ratu Mosese Volavola (1990).

Fiji, like many other countries in the world, has recognised the need for better and more informed land use management and in 1992 embarked on the development of a national land information system. Considering the challenges in a traditional culture and administrative environment, the developed national strategies have generated significant investments in the automation of land data recording systems within the central government. The adoption of a coordinated and standardized philosophy across all concerned agencies has reaped considerable benefits and efficiencies in land management. This, in turn, contributes to the economic and social well being of all Fiji's citizens. This paper describes Fiji's experiences.

2. Introduction

The Republic of Fiji lies wholly within the southern tropics between the equator and the Tropic of Capricorn. The area included within Fiji's Exclusive Economic Zone (EEZ) is 1,163,272 square kilometers but most of this area is ocean with only 18,272 square kilometers of land.

While there are over 300 islands with an area of more than 2.6 square kilometers (1 square mile), no more than 100 of these islands are permanently inhabited, although many more are visited periodically by native owners to fish or to gather coconuts.

The majority of the population of 750,000 people lives in the two main islands of Viti Levu and Vanua Levu. The only two cities are located in Viti Levu (the biggest island) and include the capital Suva located on the south eastern side with a population of over 170,000

(including greater Suva area), and Lautoka on the north western side with a population of over 46,000.

The main domestic export is sugar (38.38%); followed by garment production (21.46%); gold (9.53%); fisheries (8.50%); and forestry (2.41%). Tourism is also a major contributor to the Fiji economy earning $F392.5 million in 1994.

Land ownership and use are vital matters in Fiji as in other countries, and although it can be said that the machinery exists for the equitable solution of land problems, the slowness with which the machinery sometimes works has been an obstruction to development.

Approximately 83% of the land area is Native Land with Crown (State) Land and Freehold Land accounting for the remaining 9% and 8% respectively. It should be noted that the Crown and Freehold Lands generally include the better and easier to develop land when compared to Native Land.

The **Administration** of land is the responsibility of four authorities:

- *Native Lands and Fisheries Commission (native land ownership)*
- *Native Land Trust Board for Native Land (on behalf of the native owners)*
- *Department of Lands and Surveys for Crown Land*
- *Registrar of Titles for Freehold Land.*

This means that common land related data (both graphics and non-graphics) reside in various agencies with varying degrees of accuracy, currency, consistency, and completeness. At the same time, the manual recording systems suffer from continuous duplication of effort in storage, updating and dissemination of land related data. Although they support day-to-day administration they are typically difficult to access for users.

To improve in-house operations, some government and non-government organizations had opted for computerization thereby establishing ‘stand-alone’ systems. This may improve and streamline procedures within the organization but it does not solve the problem of duplication in collection, storage, updating, analysis and supply of land related information, different standards, formats and layout, difficulty in accessing data, etc. typical in the manual systems.

3. FLIS Establishment

New Zealand has had long term government to government relations with the Pacific Island nations in the survey and mapping disciplines and many of them, including Fiji, have based their programs on the New Zealand model. The Department of Survey and Land Information (DOSLI, and its predecessor the Lands and Survey Department), has supported Fiji with training, the development of specifications and legislation for land title surveys and cadastral and topographical mapping since the early 1950’s. Since the 1970’s New Zealand has assisted with the metric conversion of Fiji’s survey and mapping systems.

It was through this association, and the fact that New Zealand was developing its own Land Information System, that Fiji extended an invitation to DOSLI to prepare a LIS development strategy for Fiji.

Two New Zealand experts reviewed the land data systems in Fiji and concluded that the initial automation of the core processes and indexes to the land records was appropriate based on several important factors:

- *The use of computers for technical applications in 1990 was almost non-existent. This led to a requirement, not only to introduce computers to simple tasks, but also to provide a comprehensive training program to bring staff into the computer age.*

- *It was vital that before the processes were fully automated that the data quality was evaluated. Hence the need to initially computerize indexes.*
- *Politicians and senior Government officials had no clear goals for automation. There were some expectations that automation, being a worldwide trend, would provide efficiencies in the land-related disciplines, but little comprehension of how far and how fast to move.*
- *There was little knowledge of the costs involved. The computer industry was in its infancy in Fiji, and applications were generally limited to financial management and word processing. Technologies required for the technical applications were non-existent.*
- *There were a number of Government initiatives planned (ALTA and the 1996 population census) which required the assembly of national land-related datasets in fairly short timeframes and manual skills were in short supply. Officials perceived that automation could accelerate the responsiveness to such initiatives and, if successful, could obtain a continued commitment by Cabinet to the program.*

The Strategy developed by the New Zealand team provided a framework for development at relatively low cost and with achievable and measurable milestones. It consisted of a 3 year Stage I period followed by a 2-year Stage II.

It was also sufficiently robust to support a request for Official Development (aid) Assistance from the New Zealand Government. The key points were:

-
- *The identification of sub-projects, managed on a modular basis, which would provide land data management efficiencies in several Government departments.*
- *An implementation program which paralleled a multi-level structured training program for staff from all operational sectors*
- *An organizational structure which ensured commitment from Cabinet and Departmental heads (the FLIS Council), and a permanent base to manage the technical developments on behalf of all participants (the FLIS Support Center).*
- *A realistic budgeted and phased development plan with defined outcomes.*
- *Ownership of the program by Fiji through its providing 50% of the funding or aid-in-kind for all activity and thus making it attractive to the Aid donor.*
- *The use of overseas expertise, consisting of a NZ based program manager, a full-time resident Advisor and two LIS/IT experts who undertook the systems design and development work.*

Because of Fiji's ownership of the program, the data conversion and the migration from manual to automated processes has been well managed. The changes were designed to blend manual with digital practices, but not to supersede the manual systems totally until staff were trained and competent to move to the digital environment. The latter step could take a number of years and could be managed by Fiji, once the skill base was developed.

4. The Fiji Land Information System

The **FLIS Strategies** were based on studies and investigations carried out jointly by the New Zealand Department of Survey and Land Information (DOSLI) and its counterpart in Fiji. They provided directions and a framework for the development of the FLIS and ensured that developments and projects were carried out in a coordinated fashion, and that the goals and projects were realistic and achievable. The Strategies included the organizational structure in which the systems operate, the human resources that operate and maintain the systems, the data that sustains them and the technology that drives them.

Our **Vision** states that:

The Fiji Land Information System will be an integrated land information infrastructure encompassing, in a cooperative environment, all agencies dealing with land-related information in order to support:

- *the social and economic development, and environmental management of Fiji*
- *effective and efficient administration, management and planning.*

Our **Mission** states that:

The Fiji Land Information Council will provide the human, data, technology, and administrative structures to maximize the benefits obtainable from land information.

The FLIS **Goals and Objectives** include:

- *The Information / Applications:*
  - to develop efficient, integrated sub-systems in FLIS agencies that support and improve land management and administration,
  - to develop information systems to support the resolution of ALTA lease issues,
  - to ensure that the fundamental land information databases are provided, and maintained, kept up-to-date, and secured from disasters.

- *The Systems:*
  - to develop and maintain the information and communications technology upon which the sub-systems operate.

- *Fiji Capacity:*
  - that FLIS becomes self-reliant, in terms of overseas support
  - to ensure the commitment of adequate resources, both within FLIS agencies and through the support Center
  - that the costs of land information management be recovered wherever possible
  - that individual FLIS agencies be encouraged to take prime responsibility for their data, systems and people.

- *The People:*
  - to ensure that FLIS agencies have staff with the skills required to develop and maintain the FLIS.

- *The Organizational Structure:*
  - to provide a strong organizational framework that ensures the cooperative and coordinated development of the FLIS
  - to improve awareness of the role of the FLIC and recognition of the importance of land information
  - to encourage the development of the private sector.
- *Access to Data:*
  - to maximize community access to land information with due regard to issues of privacy and confidentiality.

The FLIS program is based on a principle that all land data must be geographically related. The **Computerized Cadastral Mapping System** (CCMS) is a GIS database that defines surveyed land parcels which comprise the under-pinning land tenure system, and the utilization layer which defines the extent of registered leases. This system provides the primary spatial framework for the other cadastral systems.

A total of fourteen separate, some are linked, systems were developed (see table 1). These systems consist mainly of textual databases operating in specific roles on a common

platform (Advanced Revelation). The three spatial (GIS) databases, the CCMS, topographic ("FijiTopo") and Census Mapping databases, also share a common platform (Intergraph's MGE linked to Oracle) and comprise a significant portion of the total effort.

As a first step in the spatial integration, the parcels mapped in the CCMS are linked to the parcels in the other systems through the **Central Index**. This Central Index acts as a 'hub' into which the key fields from the relevant systems are passed and matched to the others based primarily of the land appellation and area.

It is planned that the spatial view of the parcel based data in these systems will provide a valuable tool in confirming the integrity and consistency of the datasets as well as ultimately providing a spatial interface to both access and view the data.

Table 1 - The FLIS Systems

	System	Description	No. of Records	Location
1	Central Index	The hub that links most of the systems, holds the key data from each, and provides for their maintenance.	410,000 parcel based records	FLIS Support Center
2	Computerized Cadastral Mapping System	The GIS database that holds the spatial representation of all cadastral boundaries	90,000 parcels	Dept of Lands & Survey
3	Titles Journal	A system that captures the details and movement of documents through the Registrar's Office	50,000 dealings	Registrar of Titles Office
4	Titles Index	Contains key information for all Certificates of Titles, Crown Leases, Native Leases, Crown Grants, Native Grants, and Sub-leases	93,000 titles	Registrar of Titles Office
5	Survey Plan Journal	Holds details of every parcel and every approved plan, and tracks those plans through the approval process	37,000 plans	Dept of Lands & Survey
6	Valuation Records	Holds all valuation assessments made by the Dept of L&S, as well as details of property sales.	64,000 assessments	Dept of Lands & Survey
7	Road Index	Textual details of all legal roads in Fiji.	2,468 roads	Dept of Lands & Survey
8	Crown Lease Administration	Contains details of Crown leases and related actions and file movements.	38,000 files	Dept of Lands & Survey
9	State Land Register	Contains an inventory of all land that the State has an interest in (e.g. as either landlord or tenant).	15,000 blocks	Dept of Lands & Survey
10	Native Land Register	Contains a complete record of all native land, and links to the associated land owning units	10,000 Tokatoka 7,000 Mataqali 15,000 Blocks	Native Lands & Fisheries Commission
11	Vola ni Kawa Bula	A record of all indigenous Fijians referenced to their Tokatoka	495,000 people	NLFC
12	Planning Applications	Holds details of all planning applications, including processing and conditions	15,000 applications	Department of Town & Country Planning
13	Census Mapping	Holds records of National Census Boundaries - 1976, 1986 and 1996.	1,346 EA Boundary Maps.	FLIS Support Center
14	FijiTopo Database	GIS of fully structured topographic data derived from 1:25,000 scale national mapping	100 1:50,000 sheets 18,000 km^2 land	Dept of Lands & Survey

The **FijiTopo database** is being built from the 1:25,000 scale plots used to produce the published 1:50,000 scale maps. Data is being scanned and vectored from the existing manually produced maps, and captured digitally off the photogrammetric plotters in the case of new maps. To achieve this the NZ government has assisted the Department of Lands and

Survey in obtaining national 1:50,000 aerial photographic coverage and the capability to capture photogrammetric data digitally off the plotters.

These systems, particularly the CCMS and FijiTopo spatial databases, provide the necessary framework for the economic, environmental, and social development of Fiji. The use of FLIS data to support the resolution of the ALTA leases issues and the 1996 Census provide excellent examples of this:

- The Native Land Trust Board has been undertaking a massive exercise compiling all available data on Native Land ownership and tenancy as part of the ALTA resolution process. CCMS data has been used extensively to support this task.
- Using CCMS and FijiTopo data, the Department of Lands and Survey has digitally mapped the 1346 enumeration areas used for the August 1996 census. As well as assisting the Bureau of Statistics in undertaking the enumeration, this spatial data will provide the necessary base for a socio-economic mapping system.

FLIS acknowledges that it "owns" little data but that it sponsors the sharing between and exchange with potential users. The implementation was therefore at all times supported by the development of **Standards** - for data, hardware and software - and the preparation of user documentation, developed by local staff for improvement of access to the information contained in the various systems. A suite of standards has been formulated and adopted by the FLIC, published and used by member organizations. Other agencies, where necessary, are encouraged to use these standards.

Two **Liaison Groups** have been formalised namely: the *GIS/Remote Sensing User Forum,* and the *Utility Forum,* which has now been formally established as a subcommittee of the Council**.** Membership consists of technologist, technicians and vendors involved in these areas. Both groups meet once a month to discuss issues such as data sharing, updates on their systems development, training opportunities, standards, hardware and software issues, problems, etc. The forums also promote the spirit of cooperation and coordination and create points of contact in each agency. Reports and recommendations are presented to the FLIC for support and initiation.

The FLIS Support Centre also publishes a quarterly newsletter "FLISnews" which is widely distributed both within Fiji and overseas.

5. Issues / Challenges Faced

During the course of the FLIS development a number of issues arose, many of which had not been encountered in NZ.

- Fiji still operates its public service using a centralised model whereby appropriate departments administer or provide services to other departments. For example the Public Service Commission determines all staffing issues and all revenue goes into the consolidated fund. Under this system departments are generally willing to assist each other in the national interest. Organizationally FLIS has thrived in this environment through the **cooperation** and spirit of goodwill that is effected through the Council.

- The principle of **custodianship** was adopted early in the development and is an underlying principle of the LIS, but has not always been well grasped by the participating agencies. With the development of Council's charging and data sharing policies recently, FLIS has taken the opportunity to educate government departments on the implications of this approach for their management (particularly in relation to revenue!).

- Due to the low-level perception of the role of computerisation, the initial developments were driven by FLIS and the NZ team, rather than by the users. While this was highly effective in the early stages, the individual agencies needed to take **ownership** of their systems if they were to prove effective and supportable in the medium term. To achieve this FLIS has been steadily educating the agencies in this principle, requesting them to commit their resources (particularly staff and money), as well as involving them in the further development of their systems by identifying their user-requirements.

- There is a natural tendency for agencies to treat data as their own, often by limiting access. Early experiences revealed some fear that the computerised systems would threaten this **control of the data**. This applied particularly to the traditionally sensitive data held in the Native Land systems. Through exposure of the systems, FLIS has steadily built up the departments' confidence in the systems and alleviated these concerns

- The **machinery of government** in Fiji has not been geared up to handle IT acquisition and management. While this has often been a matter of frustration, approving agencies now have a high level of confidence in FLIS and their competence. This is in part due to perceived successful profile of the programme that has been built up at both the departmental and political levels.

- As a fledgling nation in terms of computerisation, FLIS has adopted a **"keep it simple"** approach to its technology. All systems have been PC based, using reliable peripherals, and fully supported locally. Current developments utilize readily accessible and supportable Windows 95 based applications wherever possible. With only a small internal IT team, FLIS has had to carefully monitor and manage its vendor support and maintenance to ensure that it is obtaining high quality advice and value for money.

- Most of the initial systems development included major data capture exercises as well as the establishment of systems to capture new data on a day-to-day basis. The digitisation of these records has often revealed major issues relating to the **data quality and consistency**, usually in the manual records - notwithstanding the early adoption of standards. Considerable effort has been subsequently expended in cleansing these records to ensure confidence in the data. With any new data capture exercises, considerable effort is placed in quality assurance at time of capture to ensure that data does not need to be revisited.

- **Staff skills and retention** is still a major hurdle for Fiji. The training programme has ensured that staff in the operational areas are becoming increasingly more competent with the systems. Specialist IT staff have been employed but being in high demand internationally, are often attracted to other employment. Against a government policy of reducing the size of the public service, FLIS will have to maintain a core of good people if the LIS success is to be maintained. Similarly, management personnel must be exposed to the IT issues and computer technology to ensure that Fiji can continue its developments in stand-alone mode.

6. Benefits

Considering the level of funding, personnel, and resources that were utilised and the expectations of the management, it was imperative that some tangible benefits should be realised even before the whole project was completed. The focus was on obtaining visible

benefits early: and identifying and overcoming barriers to this. As it turned out, the benefits came sooner than expected.
By streamlining the processes in land management, the turnaround time has often been reduced drastically which in turn saves time and energy to do other work. For example, the registration of a document with the Registrar of Titles has been reduced from 2 months (manual) to 2 weeks.
It has been most gratifying to witness the responses from users once they became familiar with the systems. One area of current national importance that has been supported successfully is assisting in the resolution of the Agricultural Landlord and Tenants Act (ALTA) leases by the Native Land Trust Board. Other benefits include:

- trained and developing staff (at both management and operational levels). Large numbers of staff are becoming computer literate thus improve overall usage.
- satisfying management and users. This includes improved internal administrative processes and reporting, responses to Cabinet questions, application of CCMS to utilities (Water and Sewerage, Fiji Electricity Authority, Telecom Fiji), as well as other users such as the Fiji Sugar Corporation, Native Land Trust Board, University, etc.
- improved internal processes (e.g. Titles Journal, Plan Journal, etc.),
- "cleaner" more reliable records
- linked (integrated) systems (mainly through the Central Index) to improve user's access to various data - "one-stop-shop" concept,
- improved accessibility to data (dial-in access, district offices, users)
- accelerated topographical and cadastral mapping (imperial to metric scales), and more.

The use made of most of these systems is logged and has shown a continuous increase with time. An indication on the average number of monthly queries on core systems, through both the LAN or WAN is shown on table 2.

Table 2 - Number of Systems Queries - mid 1996

FLIS System	Average monthly queries
Titles Index/Journal	650
Survey Plan Index/Journal	600
Valuation	340
Lease Administration	1,100
Vola ni Kawa Bula (VKB)	1,500
VKB (Provincial Office only)	50

7. The Future

The key to the long-term success of the Fiji LIS is the retention and strengthening of the FLIS Support Centre for at least ten years. This is needed to protect the investment already made, and to maintain a development strategy that will ensure that the Government and its departments progress into the computer age in parallel with the international trends. This will require additional staff, with additional skills, particularly in management, IT, and marketing.

While excellent results have been achieved, there is a long way to go. The program to date has identified some major flaws in the manual processes. Much of the data needs revisiting to confirm consistency and accuracy. The maintenance processes in the manual systems are not appropriate in the computerised environment and the high degree of inter-dependency between the records in the various agencies must be recognised in the design of future system modules. Further developments to more fully integrate the systems will lead to increased benefits and access to data.

FLIS has received considerable support from New Zealand since its inception. With the winding down of this support in 1997, FLIS's ability to fully manage itself will be put to the test. A "continuing links" programme with the NZ Aid donors will help ensure that the benefits achieved to date are not lost.

The structure of Government departments in New Zealand has changed drastically in the past few years with the result that the Department of Survey and Land Information, which has been responsible for the New Zealand support to FLIS, has been split into two new organisations as of 1 July 1996. Future support will come from the new public enterprise, Terralink NZ Ltd, which provides commercially oriented surveying, mapping, and land information services. An issue that remains to be resolved is the form of any government-to-government link through the other new organisation, Land Information New Zealand, which will see Fiji further benefitting from New Zealand's progress in public sector land information management.

Both managers and users of the systems have a high expectation of FLIS that is already leading to demand for further developments (e.g. from utilities, environment, socio-economic, natural resources). With the declining input from New Zealand, FLIS needs to mature and its people require further training, particularly at the decision making level, in order to satisfy these demands.

Many of the FLIS sub-systems offer considerable capability for revenue generation - an issue that is of major concern to government. In the face of a burgeoning demand for data from users, FLIS needs to develop its promotion or marketing capability. As the introduction of charges for data starts to take effect, FLIS has already begun to put in place resources, consisting primarily of skilled staff, to service clients and maintain their confidence in the FLIS programme.

Fiji has commenced a programme of public sector reform that has started with the introduction of accrual accounting. Although these reforms could put the cooperative environment that underpins FLIS at risk, the principles upon which it has been built, particularly custodianship and the charging regime, should see FLIS well placed to thrive in this new environment.

8. Conclusion

LIS, GIS and remote sensing are decision-support systems that must be looked at holistically. For their effective implementation they require an organisational structure, human resources that operate and maintain the systems, data that sustains them, and technology that drives them. These components are bound together by the processes and the transactions that are conducted and maintained within the systems. Justification for and benefits from the systems are found in the applications to which they are put by the users, the decisions made as a result, and the services to the agency or community served.

Fiji is geared to slow and methodical change. Quantum leaps are inappropriate until the economy and the education systems can support such rapid change. In line with world trends, the Fiji LIS is a dynamic development that shows no immediate indication of being "completed." New development strategies place more demands for access to a wider range of land-related data. Therefore, there is still a long way to go, but the success is measurable. Fiji has a scaleable model that other Pacific Island nations can benefit from, both by adopting the framework and from the ability to obtain training and advice at a time when Australia and New Zealand are moving away from the funding of such programmes.

With the determination of Fiji to continue its programme, there is every reason to believe that the Fiji Land Information System will be a world class model for developing countries.

9. Appreciation

The authors wish to acknowledge the generous support of the New Zealand Official Development Assistance programme (Ministry of Foreign Affairs and Trade) without whose help the FLIS programme would not have eventuated.