REVENUE DEPARTMENT

3.4   Computerisation of Land Records in Karnataka – BHOOMI

Highlights

'Bhoomi' a land information system was implemented to facilitate issue of accurate record of rights by updating changes like transfer of ownership, creation of database of irrigation facilities, natural calamities, etc., for effective revenue administration, land reforms and development planning at grass-root level. The project was implemented with incomplete original records and inadequate Information Technology (IT) controls leading to creation of a system that did not ensure reliability, safety and security of data and other IT assets. Consequently, the system did not aid issue of accurate record of rights and achieve other objectives such as planning at grass-root level etc.

There was no mechanism for off-site back up of data and to record that the back up was actually taken and periodically tested independently that they were retrievable.

(Paragraph 3.4.7.1)

The system lacked various controls to ensure complete data accuracy and reliability.

(Paragraph 3.4.8)

Names of the land owners in 99,186 cases and khata numbers in 53,055 cases were recorded as junk characters in 3 taluks test-checked.   Extent of land was recorded as zero in 53,069 cases in 3 test-checked taluks. Also data in several fields were found incorrectly captured.

(Paragraph 3.4.8.1)

The incomplete data in original records carried to the database needed to be cleaned up to facilitate achievement of objectives like planning at grass-root level, *etc.*

(Paragraph 3.4.8.3)

There were delays in updation of crop data; updation was also incomplete.

(Paragraph 3.4.8.4)

3.4.1   Introduction

Government of India (GOI) conceived the scheme of Computerisation of Land Records (CLR) for implementation by State Government to overcome the problems inherent in the manual system of maintenance and updating of land records (1988-89).   In Karnataka, Gulbarga District was chosen for implementation as a pilot district. By 1996, the project was extended to cover all the districts of the State. According to the State Government, the project

fizzled out, among other reasons, due to the fact that the funds under the project were sanctioned for capturing data only, without any funds for computers at taluk places. However, the State Government mandated that computerisation process must be completed in all the taluks by March 2002 and an application package called BHOOMI[23] was got developed from National Informatic Centre (NIC), Bangalore. The scheme was operationalised by implementing it in all 177 taluks and 26 special taluks of the State by March 2002. Currently, the farmers are issued only computerised RTC[24] and the issue of manual certificates has been banned (from June 2002 onwards). BHOOMI is a fully online system to carry out mutations on land records data. It is also provided with finger print biometrics to ensure fool proof authentication. First in First out mutation process has been built-in to eliminate favouritism. Further efforts are on to introduce issue of digitally signed RTC with a public key infrastructure to establish the system with non-repudiation.

A significant portion of the work was financed by GOI (Rs.22.28 crore) out of Rs.29.27 crore incurred so far on the project.

3.4.2 Organisational set-up

At Government level, Principal Secretary, Revenue Department heads implementation and monitoring of BHOOMI. A state level committee on computerisation of Land Records was set up to decide on all major policy issues referred to it. The Secretary to Government of Karnataka, e-Governance also nominated as Special Secretary, Bhoomi, was monitoring the project since inception.

The Deputy Commissioners were assisted by a few Assistant Commissioners at the District level. At taluk level, Tahsildars were assisted by Deputy Tahsildars (Shirastedar)/Revenue Inspectors and Village Accountants. Every Deputy Commissioner was also assisted by a technical consultant hired for day to day technical support.

The Department has set up a Bhoomi Monitoring Cell in the Revenue Department secretariat which monitors the day to day activities in the entire State.

3.4.3 Audit objectives

The audit objective of the IT review was evaluation of controls built in, to ensure data integrity, security of data, systems and other IT assets apart from assessment of the efficiency and effectiveness of the system in achieving the stated objectives and adequacy of good practices of IT governance.

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[23] BHOOMI - The land records management software
[24] Record of Rights, Tenancy & Crop Inspection Certificate

3.4.4   Scope and methodology of audit

The project has been fully operational in 203 locations in the State. Data of 20 million records have been captured over a period of five years. Performance audit of the project was undertaken by test-check of records in the offices of Bhoomi Monitoring Cell at State level, four Deputy Commissioners[25] and seven Tahsildars[26]. The sample data contained in data tables of Taluk Offices furnished was scrutinised using the Generalised Audit Software IDEA[27]. Entry and Exit Conferences were held with the Department in February 2007 and November 2007 respectively.

The audit findings are discussed in the following paragraphs;

3.4.5   Objectives of the project

According to Government of India guidelines (1988-89), the main objective of CLR scheme was that landowners should get computerised copies of Records of Rights (RORs) at a reasonable price. The ultimate objective of the scheme was 'on-line management' of land records in the country.
The guidelines were revised in 1999 as under:

* To facilitate easy maintenance and updating of changes which occur in the land data base such as changes due to creation of irrigation facilities, natural calamities, consolidation of land holdings or on account of legal changes like transfer of ownership, partition, land acquisition, lease *etc*.

* Computerisation of ownership and plot-wise details for issue of timely and accurate copy of the record of rights to the land owners. Creation of 'land information system' and database for effective land reforms, revenue administration and development planning at the grass-root levels.

* Low cost, easily reproducible storage media for reliable preservation for longtime. Fast and efficient retrieval of information, both graphical and textual.

3.4.6   Implementation of the project

Even though computerised RTC are being issued major objective of digitizing spatial data was yet to be achieved

The ultimate objective of the scheme of 'On-line Management' of land records required spatial data consisting of maps of the agricultural lands along with non-spatial data like details of ownership *etc*. Out of 177 taluks, scanning of cadastral survey maps[28] was taken up only in 26 taluks at a cost of Rs.1.50 crore. Work in remaining taluks was yet to be taken up and the objective of capture of spatial data and making it available to all beneficiaries was yet to be achieved.

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[25] Bangalore (Rural), Bidar, Kolar and Madikeri
[26] Bangarpet, Bidar, Hoskote, Madikeri, Nelamangala, Ramanagara and Siddlaghatta
[27] IDEA – Interactive Data Extraction and Analysis
[28] A cadastral map is a map showing details like boundaries, ownership, survey number, *etc*., of a land

Government replied (October 2007) that objectives of the BHOOMI programme could not be taken to be the objectives of the new scheme of Land Reforms Management System. The reply is not tenable as Government of India guidelines of 1999 included the work of fast and efficient retrieval of information, both graphical and textual and therefore spatial data was required to be dovetailed to textual data.

3.4.7 General Controls

While developing an IT system all user requirements are to be documented and taken care of; documentation must also be available for the initial system design and subsequent changes *etc.* Audit observed the following:

∗ Feasibility study and User Requirement Specification (URS) were not formally documented.

∗ System Design Document (SDD) was not approved before the commencement of the work.

∗ There were no specific arrangements for safe disposal of e-waste.

∗ None of the test-checked taluks had provided for a helpdesk with feature like customer query escalation/monitoring and their clearance *etc.*

3.4.7.1 Off-site storage and test of backup data

Inadequate arrangements for back up could lead to avoidable loss of data and time in case of crashes

Back up of data was being taken at the end of each day in a weekly cycle and stored in the same building in some of the test-checked taluks. The data of all centres in the State was being backed up in the State Data Centre (SDC) of the e-Governance Department on a daily basis. There was no procedure to ensure that the data relating to the periods where a particular centre was out of the VSAT link was also backed up. An off-site back up could avoid losses in case of any disaster at the centre. No mechanism for such off-site backup was available.

Further, even though backup was taken on DAT cartridges no mechanism was in place to record that the back up was actually taken and periodically tested independently for retrievability. Back up procedures needed to be reviewed for safe custody of the first copy in strong room/steel cupboards, considering storage of a second copy in off-site location as also a system for a regular check of the retrievability of the back up data of both taluk centers as well as back up taken at the SDC.

Department stated that periodical test of retrievability of the backup data will now be carried out and documented and directions will be issued to that effect.

3.4.7.2 Back up power supply

Inadequate backup power supply arrangements could affect the health of Servers, replication of databases via V-SAT

State Level Committee had decided that all taluks would be supplied with generators (December 2001). However, 26 taluks were yet to be provided with generators. In the test-checked taluks the generators were not working in some places and details of amounts spent/quantity of diesel used were not maintained. An analysis of reported downtime of generators between April

2006 and October 2007 revealed that there were 38 instances when the generators were not functioning, ranging from 24 hours to 20 days in 26 taluks. The UPS backup capacities were as low as 10 minutes in some places. The absence of continuous power supply could affect the health of the Servers as well as replication of the data bases at SDC via V-SAT. Government replied (October 2007) that generators were working in all 177 taluks and UPS provided were able to cater to the needs, in 26 non-taluk centres.

The fact remained that working of generators needed to be monitored.

3.4.7.3 Inadequate emergency response procedures

There was no well developed business continuity plan to take care of IT assets in case of disasters

No business continuity and disaster recovery plans were drawn up. Moreover, no guidelines, emergency procedures, response and recovery procedure to bring business back after a disaster, co-ordination procedure with public authorities, customers and media were in place to retain source documents so that data was reproducible and to facilitate reconstruction in case of disasters which exposed the department to losses due to disasters.

Department stated that action would be taken to engage a consulting agency and create Comprehensive Disaster Recovery Management and Business Continuity Document covering all relevant points.

3.4.8   Data accuracy/Completeness

It is pertinent that the database of any computerised system has to be correct and complete in all respects. For which, it is necessary to ensure that the procedures and controls reasonably guarantee that (i) the data received for processing are genuine, complete, not previously processed, accurate and properly authorised and (ii) data is entered accurately and without duplication. Data validation is a process for checking transaction data for any errors or omissions and to ensure the completeness and correctness of input.

3.4.8.1 Creation of databases

Payments made by district officers for data entry work without adequate verification resulted in many discrepancies in the database

Databases were prepared from the manual records. However, no efforts were made to ensure correctness of manual records before these were entered in the system. This coupled with inadequate and ineffective input control mechanism like 'Supervision of data entry' *etc.,* resulted in the data containing inaccuracies and impossibilities as indicated below in this paragraph;

Data entry was entrusted to outside agencies for capture of all land records in the State at a cost of Rs.5.52 crore. The agencies furnished checklists after data entry, for check by departmental officers. Checklists were to be verified with original records by Taluk Offices and discrepancies communicated for effecting corrections to the database. In the test-checked offices, audit observed that the verified checklists were not returned to taluk offices. Thus, it could not be verified, whether the discrepancies pointed out were actually

rectified. While verification of checklists was to be carried out in Taluk Offices, payments to agencies for the work were made by the district officers without documenting the quantity of work involved, progress of work done, extent of check lists generated and verified.

Government mandated that the first set of printed RTC were to be checked with manual records by higher officers at different levels (Village Accountants-100 *per cent* to Deputy Commissioners 1 to 2 *per cent*) to ensure accuracy of the data captured. A total of 2,89,489 applications for corrections were received in seven districts in the year immediately after creation of databases which goes to show that errors in data entry were not substantially eliminated before payments were made for data entry**.**

In one village, audit observed four cases of difference between manual records and printed certificates. Differences were also observed between manual and printed RTC's, in various columns like individual extent (10 cases), wife/daughter (4) crop grown (2), acquisition mode, khatha number, land utilisation, mutation number, source of irrigation and total extent of land.

In two test-checked villages, total number of RTC's as per original records varied from what was captured in BHOOMI. In one case, a new RTC was found in BHOOMI database measuring 34 acres which did not exist in original records.

Similarly, data capture errors were observed in 21 cases in 10 test-checked villages. In three test-checked offices, 53,055 instances were found containing junk characters for 'khatha' numbers. Fathers' names of owners of land and owner's names were found entered as junk characters in 99,186 cases. No irrigation/soil type details were captured for 112 and 137 villages respectively.

Government replied (October 2007) that many of the applications for corrections were due to insufficient data in original records. Further, there were no junk data other than in about 10 cases.

However, audit observed that at least 200 cases of junk characters captured for names which were furnished to Bhoomi Monitoring Cell.

Government further replied that the number of applications received was far less compared to the number of records keyed in. Similarly, the number of errors observed was stated to be very few compared to total record captured in the State. However, no details such as the number of errors observed vis-à-vis the number of applications received for correction was furnished in support of the contention of the Government.

Audit observations were only on a test-check. In any case complete data accuracy is to be ensured.

In addition, the following was observed about the databases

Inadequate input controls resulted in many deficiencies in data capture

i) There was no documentation about creation of master tables, including the steps followed, persons authorised and dates of their creation.

ii) There were duplicate codes in the master table and codes existed even for irrelevant entries containing blanks and junk characters.

iii) There were missing master codes about which the Department stated that this could be due to non execution of scripts issued to add some codes and stated that cases pointed out would be examined and errors rectified.

The RTC among others depicted owners name, cultivators name, total area of land holding and area of land held by each owner. Data analysis revealed the following:

* Aggregate area of individual owners holding more than the total area for a piece of land (8 cases)

* Aggregate area of crop grown more than the area of a piece of land (11 cases)

* Entry of names of cultivators other than the owners name in single owner cases (7 cases)

* Entry of cases with area of land as "Zero" (53,069 cases)

Government replied (October 2007) that differences were in the original records and could not be handled by the project, as the procedures as per revenue laws were to be followed to correct the same in any way. The owners and cultivators' names could be different for specific reasons.

Reply is not acceptable as the monitoring checks could have been built-in and pursued till finality. Differences in names of owners and cultivators had to be controlled by employing suitable codes for isolating the differences and clearance by close monitoring.

3.4.8.2 Operation of Defaults

To facilitate capture of data, a default value was set for some of the data fields. Such value should have automatically been recorded, if no other value was keyed-in.

* Default values for lands were set as 'private'. It was observed in three test-checked offices that, 1,623 cases of Government lands were marked as 'private' and 43 cases of private lands were marked as 'Government', indicating that the correct data was not keyed in.

* Default defining sex of the owner was set as 'Male'. It was observed that in 1,041 cases, 'Female' owners were found recorded as 'Male'.

* In 27,265 cases of transactions, default set up did not operate as blank data was found involving four fields where defaults were set.

Government replied (October 2007) that default values for sex, government/private marking only affected Management Information System Reports and did not affect title of the property.

Audit is of the opinion that it still remained an incorrect data entry.

3.4.8.3 Errors in original records

As the original records were maintained over decades, many errors had inadvertently crept in them. The Department stated that such differences were needed to be retained until they were removed through an order, as and when a case was observed during a mutation, they would be rectified.

In such cases action has to be expedited to rectify them, within a definite time frame by escalations to higher officers, as otherwise errors would continue for a long time in cases where no occasion for mutation arises. The inaccurate and incomplete data affected the achievement of objectives of BHOOMI like creation of irrigation facilities, consolidation of land holding and reforms, revenue administration and planning at grass-root level.

3.4.8.4 Updating of data relating to crops

Lack of second level checks and verification of final checklists could lead to inaccurate data

Every season, the village accountants submit, a set of land holdings where crops grown were different than the previous season. The taluk office marks all such cases in the database. A soft copy of the data so marked was handed over to outside agencies for crop updation work. Printouts of check lists were taken by the agencies in which village accountants entered crop data by field visits. The crop data was then imported into the database.

It was observed that the checklists were not received back from the data entry agencies and preserved in any of the taluks test-checked. Thus there was no way to ascertain whether the data fed in the system was accurate or not.

It was observed that there was no second level checks of making crop updation and authentication of collection of crop data. No records were maintained regarding progress of crop updation work in the test-checked taluks.

According to Bhoomi State Level Committee's decision in December 2001, the crop updation had to be carried out at the end of each of the three seasons of Kharif, Rabi and summer. The committee felt that putting data on BHOOMI every season would make such entries irreversible. Further, it would be of tremendous help to user departments like Agriculture, Economics & Statistics, Banks and Co-operative Societies who could be, even charged fees for provision of data.

Audit observed that data for only one/two seasons were captured every year in a taluk (Mandya) that had full irrigation facility. In one district the data of a season was captured after a lapse of one year.

Non-capture/delayed capture of data affected the beneficiaries getting benefits like farm credit and also resulted in non-availability of timely data to user departments.

The department stated that the crop updation was ensured to be done within the stipulated time. A calendar of events had been drawn up. In case of crop updation not being undertaken and completed within the stipulated time, BHOOMI blocks mutation processes. This ensured that there was enough pressure on taluk staff to update crop data in time.

Government replied (October 2007) that crop updation was done for one, two or three seasons in a taluk depending upon whether crops were grown in one, two or three seasons.

The fact remained that the crop updating was not being carried out for three seasons in a year even in one well irrigated taluk. Close monitoring was needed for timely crop updating with introduction of second level check for making the data more accurate.

3.4.8.5 *Reconciliation with survey Records*

The land records built-up and maintained from survey operations in the survey department contained Village wise and Hobli wise (group of villages) area computed with an analysis of nature of lands. The data captured and stored in the Bhoomi Databases, varied with those of survey records as illustrated below:

Place	No. of villages Data Checked	Area recorded in (in acres)	
		Survey Records	Bhoomi Database
Ramanagara	8	10,817.86	11,422.60
Bangarpet	5	5,996	4,680.19
Bidar	12	39,580.60	39,439.43
Nelamangala	3	2,853.61	3,005.35
Hoskote	5	2,846.42	1,999.09

Number of land holdings were not linked to survey records as in two villages test-checked, number of holdings as per the database (473) were less than those recorded in survey records (508). Such inconsistencies in data affect their reliability.

Department stated that after mutations, records are sent to survey Department for reconciliation with Survey data and RTCs are created or modified appropriately keeping in mind the provisions of Karnataka Land Revenue Act.

The reply was not tenable as the properties undergoing mutations were only a small portion of the database and unless the reconciliation with survey records was cent *per cent,* the reliability of the BHOOMI data base would be affected.

3.4.9   IT Security

3.4.9.1 Data Safety/Security

Data, crucial to an organisation need to be protected from every possible threat. Thus the security and safety of data has to be strengthened by restricting access to the data and data centre both physically and logically and by keeping and reviewing proper logs and audit trails.

3.4.9.2 Hiring of agency for review of security

In April 2003, Government of India approved a release of Rs.10.28 lakh for "Software Security Vetting for BHOOMI Project" through NICSI, New Delhi. M/s Ernst and Young were engaged by NICSI, to review various processes and general IT controls relating to Bhoomi.

A work order for a sum of Rs.9.35 lakh was issued for the work by M/s. NICSI, New Delhi to M/s. Ernst & Young in April 2003. The firm submitted a preliminary report for discussion in October 2003. The State Government in March 2004 recommended 75 *per cent* of payment to M/s. Ernst & Young subject to furnishing the final reports.

The firm had not furnished the final report and action on the following points was yet to be taken by the Department:

* Preserving administrator's password in a sealed cover
* CMOS password to be implemented in all taluks
* Disabling of floppy disk drives and CD ROM drives
* Restricting entry to server rooms
* Keeping back up media under lock and key

Department stated that action would be taken on all the points raised by M/s. Ernst & Young.

Government replied (October 2007) that action is being taken on restricting entry to server rooms and keeping back up media in treasuries. Early action was needed to take care of all security aspects.

The following points regarding data security were observed in audit:

3.4.9.3   Physical access controls

Server room was not kept under lock and key in the test-checked taluks. Computer systems were installed in the server room and printing activities were carried on. A log book for monitoring the activities of server operations, its security, problems of facilities and speed of the network *etc.*, was not maintained in the taluk offices test-checked.

3.4.9.4 Logical access controls

Lack of review of access controls could lead to misuse/loss of data

Log-in identities with passwords created for various users of BHOOMI package were not periodically reviewed as IDs of many users relieved of their duties were not deleted or deactivated. The package allowed creation and change of passwords only by the administrator and not by the users themselves. No written instructions were issued regarding change/coinage of passwords.

Log-in identities for every user of the application package were created in the operating systems of each taluk-server to which, bio log-on software was interfaced. Security definition in the operating system was set as 'only with finger print authentication' for all users. Every user had to therefore register his fingerprint and authenticate on log-on and at important stages of modifying/saving changes to database.

The database recorded the IDs of users creating/saving records. However, a continuous review carried out by comparing user-IDs created and actually used (database) along with security definitions set in those cases was critical.

While such reviews could not be carried out at taluk level due to lack of access/privileges, neither the BMC nor the SDC documented that any such review was carried out.

Similarly, reports regarding security breaches like system resources, view or change security definitions and rules, status change of system security were also not being generated periodically and reviewed and placed on record.

Department stated that bio-log on IDs were created only in BMC. Further, details get replicated to the central active directory at SDC.

Apart from replication, deviations like extra IDs created, IDs no more required are deactivated and long unused IDs are to be reviewed to minimise the risks of unauthorised access. The Department added that it would examine whether un-authorised attempts should be audited.

Department further stated that after the data centre has been put in place, all the computers were part of a single domain. Revenue Department would at an appropriate time, take up audit of the Bhoomi part of the SDC.

3.4.9.5 Review of security settings

In view of the bio-metric authentication details not being integrated with database due to limitation of SQL Server software, review of security setting like conditions of access assumes importance. The privileges in taluk servers have been blocked and all security settings were carried out centrally after setting up of SDC.

Audit observed that documentation of review of deviations of security settings were not being carried out periodically at the SDC which could lead to non detection of unauthorised access and exposed the system to risk of misuse.

3.4.10 Monitoring

3.4.10.1 Use of exception reports

BHOOMI provided for generation of a number of reports for use of local management. Follow up of various exception reports were not documented to the effect that they were pursued till clearance.

Government replied (October 2007) that MIS Reports were being used for monitoring and perfecting the database by Deputy Commissioners.

However, there was no manual/electronic documentation that they were so used.

3.4.10.2 Stock Register of IT Assets

A stock account of all IT assets was not maintained in the test-checked taluks. A periodical physical verification was not carried out as to the availability and condition of the assets. This could lead to misuse or pilferage. Early action was therefore needed in the matter.

3.4.10.3 Internal audit

No internal audit of IT Systems was being carried out periodically. A continuous internal audit helps in getting an assurance that the systems are maintained as per methods, procedures and instructions issued from time to time.

Government replied (October 2007) that instructions will be issued in this regard.

3.4.11 Other points of interest

3.4.11.1 Agreement with Software Developers

It was observed that no formal agreement clearly defining the scope of work, time frame for completion *etc.*, was entered into with NIC. No specific details in this regard like obligations on the part of NIC were documented. Absence of such agreements leads to uncertainty of obligations as regards security and ownership issues.

Government replied (October 2007) that discussions were held with NIC regarding timeliness of completion and that projects were carried out as per timeliness agreed. Reply is not acceptable, as apart from timeliness, security and ownership issues need to be documented.

3.4.11.2 User charges Account

Funds kept outside Government Account due to lack of monitoring of reconciliation

The user charges collected at the taluks were to be remitted to the PD Account of the Deputy Commissioner into the Sub-Treasury on the following day. In one test-checked taluk the user charges were remitted to the Sub-Treasury after a delay ranging up to 66 days involving an amount of Rs.7.87 lakh collected between January 2007 and July 2007 thus keeping the cash outside the Government Account.

It was also observed that no reconciliation was being done between amounts remitted by taluk offices and treasury figures by the Deputy Commissioner's Offices. Government replied (October 2007) that absence of a specific head of account for remittance of user charges posed a problem for reconciliation and Deputy Commissioners would be instructed to reconcile for periods prior to computerisation in treasuries. Early action was needed to reconcile periodically.

3.4.11.3 Touch Screen Kiosks not working

Touch Screen Kiosks were not working in the test-checked taluks

Touch Screen Systems were provided only in 37 taluks out of 203 locations for easy access of RTC information for members of Public. It was however observed in the three taluks test-checked that the systems were either out of order or not installed. Unless early action was taken to repair/install the systems, the farmers would be denied of the facility as also the expenditure incurred on these systems would be unfruitful.

Government replied (October 2007) that the touch screen kiosks were non functional only for some time in two places cited and were now working in all places.

The reply is not acceptable as the data tables for Nelamangala and Ramanagara taluks showed scanty/nil use.

3.4.12 Conclusion

While significant progress had been made in the work of creation of database, digitisation of spatial data was yet to be completed. In absence of adequate controls, completeness and reliability of data as well as safety and security of data could not be ensured.

3.4.13 Recommendations

∗ The data needs to be examined for inaccuracies and corrected. Data updation procedures should be strengthened.

∗ Data safety and security issues need to be identified and attended to.

∗ A mechanism needs to be put in place for off-site backup of data, to record that the back up was actually taken and to periodically test independently for retrievability.

The reply (October 2007) of the Government has been incorporated at appropriate places in the review.