Technological Aspects of Land Administration Systems in the West Balkans

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Key words: Land Administration and Cadastre, ICT, Business Alignment

SUMMARY

The Real Estate Cadastre and Registration Project in Serbia, will build a more effective property registration and cadastre system, with the intention of contributing to the development of effective real property markets. The Republic Geodetic Authority (RGZ) of Serbia is responsible for Cadastre and Land Registry (Real Estate Cadastre, REC) in Serbia.

In the preparation phase to this project advice has been given by international consultants in 7 major areas: legal reform, registration, cadastre, information technology, training, finance management and economics and monitoring and evaluation.

This paper provides an overview of an approach for development of information and communication technology (ICT) for the Real Estate Cadastre in Serbia. The paper gives a short overview of the project, highlights some developments in Geo-ICT, presents an analyses of user requirements (partly based on literature, partly based on interviews with -potential- users of cadastral and land registry data), gives an outline a proposed organisational change for RGZ -based on the concept of business alignment with ICT-, presents a vision based on this concept, gives a global overview of the ICT strategy and its implementation and presents conclusions and recommendations.

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1. INTRODUCTION

Property records and land administration in Serbia are incomplete and not really reliable in this moment. Seventy percent of the apartments are not registered, land transactions in rural areas are often not registered, and about 200.000 'illegal' structures exist in Belgrade. The government has recognised that an effective national property rights system is a prerequisite for economic growth and broadening economic prosperity through, among other things, land and housing development, increased use of property as collateral for credit purposes, increased property tax collection, and efficient land markets (www.worldbank.org.yu).

The Real Estate Cadastre and Registration Project in Serbia, a World Bank funded project, will build a more effective property registration and cadastre system, with the intention of contributing to the development of effective real property markets. The Republic Geodetic Authority (RGZ) of Serbia is responsible for Cadastre and Land Registry in Serbia.

In the preparation phase to this project advice has been given by international consultants in 7 major areas: legal reform, registration, cadastre, information technology, training, finance management and economics and monitoring and evaluation. This paper focuses on the information technology.

2. THE REAL ESTATE AND CADASTRE REGISTRATION PROJECT

Serbia's turbulent history, combined with nearly 60 years of socialism, have left its property records and land administration in a poor state. Over 70 percent of apartments are not registered in a viable registration system, and land transactions in rural areas are often not legally registered, for example. The government has recognized that an effective national property rights system is a prerequisite for economic growth and broadening economic prosperity through, among other things, land and housing development, increased use of property as collateral for credit purposes, increased property tax collection, and efficient land markets.

This project will build a more effective property registration and cadastre system, with the intention of contributing to the development of effective real property markets. The project has two components (see: www.worldbank.org.yu):

- the first component deals with operational development and support. It will allow the Serbian Republic Geodetic Authority (RGZ) to speed up completion and maintenance of the real estate cadastral system and deliver quality services to all constituencies. It will support RGZ to complete the system in an accelerated time frame in the priority urban

and related rural areas, and further develop the ongoing property registration system, focussing on improving customer service
- the second component provides capacity building and institutional strengthening for the RGZ. Specific tasks to be undertaken in this component include strategy and business plan development and implementation; customer publicity and information campaigns; training and human resource development; and monitoring and evaluation, customer surveys, and special studies.

From these components a need for *alignment* between business strategy and ICT strategy (resulting in business processes supported by ICT) can be derived.

The Law on State Land Survey, Cadastre and Registration as passed in 1992 and further amended (particularly as amended in May 2002), provides a solid foundation for the project. The law provides a unified cadastre and registration agency; a unified land and building cadastre, as well as defined rules and procedures for the adjudication and systematic registration of titles. Furthermore RGZ has responsibilities in maintaining and information supply on addresses and spatial units. From all (*authentic*) information domains a wide range of products and services can be developed with huge potentials in supporting taxation, legal security of tenure, the development of a mortgage market on which a functioning economy depends, promoting an active land market and productive land use.

3. GEO-ICT

Recent developments in Geo-Information and Communication Technology (ICT) have a serious impact on the development of cadastral systems and geo-spatial data infrastructures (GSDI). Both theoretical and practical developments in ICT such as the ubiquitous communication (Internet), data base management systems (DBMS), information system modelling standard UML (Unified Modelling Language), and positioning systems will improve the quality, cost effectiveness, performance and maintainability of cadastral systems. Furthermore, users and industry have accepted the standardisation efforts in the spatial area by the OpenGeo-Spatial Consortium and the International Standards Organisation (e.g. the ISO T211 Geographic Information/Geomatics). This has resulted in the introduction of new (versions of) general ICT tools with spatial capabilities; e.g. eXtensible Mark-up Language/ Geography Mark-up Language (XML/GML), Java (with geo-libraries), object/relational Geo-DBMS including support of simple geographic features.

It is the first time ever that such a set of worldwide-accepted standards and development tools are available (UML, XML, Geo-DBMS, Open Geospatial Consortium standards). This creates new perspectives in both the development of new cadastral systems and in the improvement of or extension of existing cadastral systems. At the moment, the first Internet-GIS applications are already operational in a cadastral context. In the near future this will be extended to mobile GIS applications based on cadastral information (sometimes also called location-based services). Imagine mobile phone or PDA (personal digital assistant) users, such as a civil servant of the municipality, a real estate broker, or a policeman, with their

mobile using up-to-date cadastral information for their day-to-day tasks in the field: 'who is the owner of this building?', 'when was this building sold and what was the price?', etc.

Recent developments in Geo-ICT have important implications for the development of cadastral systems and GSDI surrounding cadastral systems. The developments in ICT in general, and specifically the Geo-ICT can improve the quality, cost effectiveness, performance and maintainability of cadastral systems.

GISs are used within (local, regional, central) governments, utility and other companies to support their primary business, which often depends heavily on spatially referenced data. Until recently the spatial data management was handled by GIS software outside the DBMS. As DBMSs are being spatially enabled, more and more GISs (Arc/Info, Geomedia, Smallworld) have been migrated towards an integrated architecture: all data (spatial and thematic) are stored in the DBMS. This marks an important step forward that took many years of awareness creation and subsequent system development. It can be observed that many organisations are currently in the process of migrating towards this new architecture. This is a lot of work and will still take many years. The next step will be the creation of a common GSDI for related organisations; the so-called information communities. Instead of GSDI the term Cadastral Infrastructure could be used. This can replace, in the long run, the exchange of *copies of data sets* between organisations. It requires well-defined protocols, standardisation such as the Open Geospatial Consortium web mapping specification. But also the role of the Geo-DBMS gets more important, because not a single organisation depends on it, but a whole community. The main use will be query oriented (and less update oriented, only the owner of the data is doing updates, others are only doing queries). An important component is the network infrastructure (bandwidth) itself.

4. ANALYSES OF USER REQUIREMENTS

The UN/ECE Land Administration Guidelines highlight the importance of addressing user requirements. Before altering an existing system or introducing a new one, it is essential that the requirements of those who will use or benefit from the system are clearly identified. Naylor (1996) relates this to the current market oriented approach applied to land information. Products and services must certainly satisfy the user needs.

In order to be able to operate as a supplier of information products in a changing environment in the long term, RGZ must understand the economic dynamics of information production. Technically, digital information products offer considerably more possibilities *for perfect reproduction and fast, inexpensive and easy distribution.* In addition, it is important to realise that a product does not have the same value to every customer and that as a consequence not every customer is prepared to pay the same price. A pricing policy based on customer-group or product differentiation is, could be considered. *Variation* in the product range is possible in many ways: by differentiation in access to the information, for instance (time, place, duration); or by differentiation in the actuality, completeness of or extent of detail in the information; or by differentiation in the possibility for the user to download and store the information, to multiply it, print it, or in any possible way edit it. In addition, differentiation

is possible in the speed of delivery, in user-friendliness, and in support. The variants can besides be used separately as well as in combination with each other. In view of the specific business characteristics, an information supplier should aim for *standards* (of distribution, exchange and usage) and *product flexibility*.

Customers want to be served in a professional way, user-friendly tools, information that is timely, up-to-date, reliable, complete, accurate, relevant, if necessary customised, *well-integrated with other relevant data sets of other suppliers*, good value for money, systems that are compatible with the customer's working procedures.

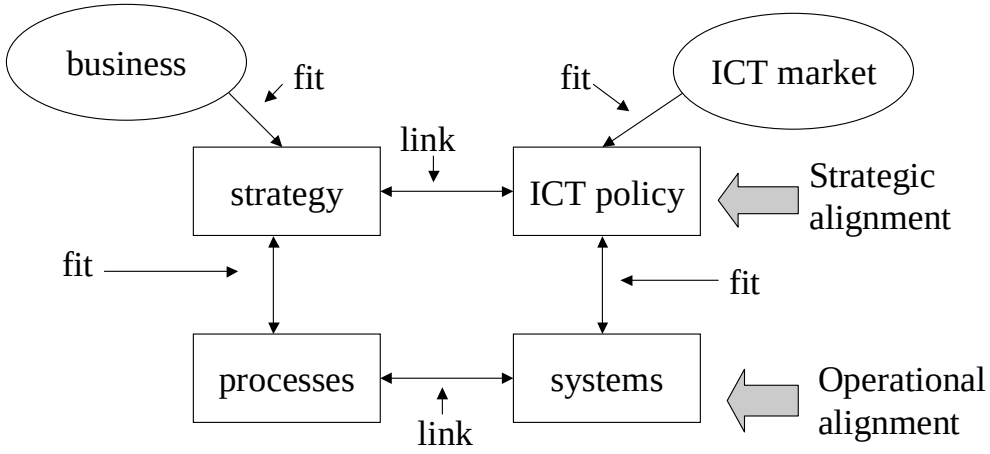
The following requirements are based on the interviews and are of a more general nature. Some of these requirements can also be interpreted as conditions for development of stable systems to run for a long time. Here it should be remembered that life-time of data is 50 years or more, of software 10 years or more and of hardware 3 years or more.

- All users prefer the RGZ REC data to be delivered digitally, remote access to RGZs databases is required. In case of digital data delivery to RGZ this includes a demand for digital signatures, data encryption etc. The user interface should be web based.
- There is a need for cooperation over who collects and coordinates data, what technology should be acquired so that *all components of the system are compatible*, how common standards and procedures can be developed, and other system-related decisions. In this moment the users of RGZ data in Serbia are not involved in data-, process and system specifications.
- It should be considered to integrate workflow management in the RGZ REC Information System. This allows flexible integration of external data producers into the business processes of the organisation. Cadastral Surveying and Mapping are included in the RGZs business processes. It should be possible to perform these activities RGZ internal or external: private companies.
- *Data protection* has to be covered in a land administration system. This is a critical factor for success and is not really recognised as such.
- S*trata titles* (relating to the ownership of apartments, etc.) are recognized; identification and ownership of common areas is a problem.
- The application of new technologies, such as GPS (Galileo), should be assessed from an economic rather than a technical perspective. Provisions must also be made to accommodate future changes in the network that may occur as a result of technical improvements. These may affect *all coordinate based systems*.
- A key component in any land administration system is the parcel identifier or (guaranteed) *unique parcel reference number*. This acts as a link between the parcel itself and *all records related* to it, also external. It facilitates data input and data exchange. There could be a technical requirement for cadastral data collection: the need to change the parcel identifier during the data collection process (first related to aerial photographs, later related to the administrative subdivision of the country). Apart from the unique parcel identifier a unique building identifier, apartment identifier, 'common area' identifier, right identifier and subject identifier are relevant. Subject identifier is not a RGZ responsibility.

- Orthophotomaps may be used to identify 'illegal objects' (both the orthophoto's and the 'illegal objects' could be separate 'layers' in the REC GIS).
- A digital data catalogue is required to get an overview of the availability of REC data.
- Scanned cadastral maps have to be included in the GIS nation wide, object labelling and vectorisation software is required; this includes software to computerise exiting co-ordinate registers.
- The inclusion of scanned legal documents into the REC could be considered.
- When data collection starts it is important that an *updating process* should be installed at the same time.
- Whilst more and more users require cadastral information that is frequently and quickly updated in real-time, the need to *secure data quality* should not be underestimated. One important aspect here is the management of topology integrated with geometry and other attributes.
- There are opportunities for greater cost-effectiveness in areas such as subcontracting work to the private sector; sales of information, and taxes; and by *linking* the existing land administration records with a wider range of land information. Further the link address – coordinate is relevant.
- Data should be accessible per parcel, per administrative unit or per user defined polygon.
- Generation and delivery of standardised REC updates within *user defined polygons* and within a *user specified frequency* and *eventually a user specified data content* is a requirement.
- Most REC attributes can be visualised on maps. This type of products requires attention.
- Registration *services* are requested.
- Copyrights have to be developed.
- Conditions on *use and price* of data have to be shown to the user before data are delivered. (e.g. on parties, delivery, liability, price, payment, right to use, intellectual property of the data, system of legislation applicable, disputes on delivered data)
- Inclusion of values of objects in RGZs databases is a request from the taxation department.
- E-Payment will be a requirement in the future.

5. ORGANISATIONAL CHANGE

A common characteristic of Land Administration organisations is the great deal of effort they devote to the determination, registration and dissemination of information pertaining to the ownership, use and evt. value of land. This involves a large amount of data that is subject to many changes, needs to be kept up to date, and must be accessible for consultation. Consequently these operations constitute a highly transactional environment. The efficient and effective performance of these duties is possible only with the support provided by Information and Communication Technology (ICT). However what is the appropriate approach to the organization's objectives in relationship with the opportunities offered by ICT? MIT's 'strategic alignment model' [Henderson & Thomas, 1992] is of use in deciding the approach to be adopted.



The strength of this model lies in its ability to establish a *relationship between the strategic and operational aspects of the organization's objectives and its ICT policy.*

It reveals that in contrast to the past – when the organization's objectives were specified prior to the selection of the requisite technology that would provide for the achievement of those objectives – nowadays developments in technology in part determine the nature of the organization's objectives.

As stated above strategy development, policy development, development of business goals, and improvements in products and cadastral business processes can only be done in alignment with the development of an ICT strategy and the development of ICT systems: business alignment. On the other way around: it might be complex to develop and maintain an ICT strategy without notion on business strategy, policy, goals on products and processes. This concerns both the policy and operational level.

In the RGZ organisation, where the ICT component will have a more and more dominant position, this requires a very good co-operation between cadastral, land registry, financial, office management, resource planning and ICT experts. This need for this co-operation should be understood and should be supported by all employees and should lead to a comprehensive synergy in the (near) future. This can be considered as a critical success factor for implement integration on the desktop of different functions.

Customer orientation, feasibility studies, business alignment, development and exploitation of new products/services could be realised under an organisation structured as follows:

- sector for Cadastral and Land Registry Policy. This function could be positioned under the existing REC sector
- sector for ICT Policy and Projects. This could be a separate sector or it could be integrated with the sector for ICT Services
- sector for ICT Services (system development could be outsourced)
- sectors(s) for Finance and Control, Personnel and Organisation and Office Support
- operational Units in the municipalities (CO) and supported by regions (RC)

In the Sector for Cadastral and Land Registry Policy the primary focus is to the cadastral market. 'Input' from the market, concerning newly desired products, new services, new registrations, new ways of information supply, etc., is recognised by this department. Based on this information the consequences for the ICT environment are analysed in a feasibility study in good co-operation between the Sector for Cadastral and Land Registry Policy, the Sector for ICT Policy and Projects and the Department ICT Services. The Sector for ICT Policy and Projects has the responsibility for the realisation of this study. If the added value is positive it has to be decided by the top management whether the required functionality will be developed and implemented to the organisation. The Sector for ICT Policy and Projects has the responsibility of the project management in this development and will manage the implementation in the Operational Units in the municipalities/regions. After implementation the functionality is available to the cadastral organisation and to the market. From this moment on the Sector for ICT Services, which must be represented in all levels (central/regional and local) of the organisation, is responsible for system exploitation, (geo-) information supply from the central database to the Serbian market and support to internal and external users. The Department on Cadastral and Land Registry Policy can monitor the 'level of satisfaction' of the users of cadastral data.

The Sector for Cadastral and Land Registry Policy is responsible for *marketing and strategy development*, agreements with customers on data delivery, for the *global* definition of required functionality, has the supervision on the budgets for ICT developments and gives the assignments on development of new functionality to the Sector for ICT Policy and Projects. This sector is 'owner' of the application software.

The Sector for ICT Policy and Projects is responsible for development and maintenance of ICT strategy, for realisation of feasibility studies, planning, cost calculations, priority setting, project-management of new functionality to be developed, design of application architecture and selection of ICT tools.

The Sector for ICT Services is 'owner' of the standard software (operating system, data base management system, geographic information system, network software's), manages the human resources for developments, is responsible for support to the users (internal and external), co-ordinates contracts with hard- and software suppliers and *is* 'owner' of the ICT infrastructure to be exploited and for the realisation of the (geo)-information supply to the Serbian market. Of course invoicing is included in the (geo)-information supply, but the

Financial sector is responsible for the development of the functionality to complete of those financial transactions.

In general it can be stated that the evolution to a mature ICT environment is attended with a continuous process of changes in the organisational structure. This should be explained as a very positive development with many new opportunities to the employees. A long way has to be gone, although the urgency for the implementation of a Sector for ICT Services is obvious. The 'stage of maturity' in this moment is in the neighbourhood of 'initiation'.

In the proposed organisational structure the Sector for Cadastral and Land Registry Policy has the responsibility on the 'fitness for purpose' of the cadastral system, the Sector for ICT Policy and Projects is responsible for the 'fitness for use' (of course *in very close* teamwork with experts in cadastral data processing and a board of involved internal and external end users) and the Sector for ICT Services is responsible for the 'fitness for exploitation (internal and external)'.

Of course all this has to be supported by the Sectors(s) for Finance and Control, Personnel and Organisation and Office Support. To manage internal processes applications like Enterprise Resource Planning and Office Automation could be used. The implementation of those systems and the integration with the primary cadastral system has to be managed by those domain-sectors in co-operation with the Sector for ICT Policy and Projects, final exploitation is of course the responsibility of the Sector for ICT Services.

6. VISION

Business

The developments within the Serbian Cadastre (Land Information Centre for Serbia) as a consequence of developments related to the REC project are expected to be in the following directions:

- the RGZ will be a customer and market oriented organisation. Adequate and continuous communication with customers on (ICT) developments within RGZ will be a priority. Users/customers will be involved in product and service development. *Finally* the customers will have access to a well performing on line information service to the central data base(s) with legal, administrative and spatial of RGZ
- the costs and revenues will be in balance. Costs are compensated by the revenues from the maintenance of land registry and cadastral data and from the (geo-)information dissemination. The operationalisation of this could require enterprise resource planning and financial systems which can be related to workflows
- the web based application software and related database and GIS technology to support cadastral and land registry processes will extend continuously, more and more new functionality will be required. The same is valid for financial systems, office automation and support of enterprise resource planning activities. This implies a simultaneous growth of the supporting ICT organisation (ICT Policy and Projects and ICT Services)

- the availability of a computerised cadastral data set, including legal/administrative, cadastral geometric and addresses/spatial units data, will increase the demand for those data significantly

This means that, in the near future, the business of RGZ will fully depend on the availability of ICT services and products.

Business Processes

A critical success factor is the conversion of analogue (spatial) data to a computerised environment. Scanning of cadastral maps is a first step, vectorisation of cadastral spatial data and scanning of other documents, e.g. transaction documents can be expected as a logical next step. Workflows will be managed. New workflows will be developed. Performance will be measured and related to indicators, tools will be available to check quality of produced data. A substantial part of the production will be performed by private companies and conveyors. All employees will be trained several times to be competent to work in this new environment. Human Resource Management will be developed to keep a highly motivated and flexible staff.

ICT Policy

The business of RGZ will fully depend on the availability of Information and Communication Technology. The information supply aligned to RGZs business needs to be improved by an efficient and effective use of Information and Communication Technology. An 'RGZ-wide' ICT policy will be developed and maintained based on the ICT Strategy. Implementation of this policy will be project based in a *step-by-step approach* being aware that a well performing nationwide communication network will not be implemented synchronic to RGZs requirements. Innovations within RGZ will be initiated based on *proven technologies* and *sustainable standards* in partnership with system integrators, hard- and software suppliers and facilitators. Mission critical activities will not be outsourced. Complexity in the existing ICT environment will be reduced by redesign and of outdated systems, with a first priority to systems running on DOS platform. New functionality will be provided in a user-friendly and standardised web-based interface to serve external users and to support internal business processes.
Quality-, risk- and communication management will be integrated in the ICT policy.
Communication with users/customers is an integral part of the ICT policy. Customer dissatisfaction can be expected in case software solutions are not implemented in time or in case solutions do not comply with specifications.

ICT Services

Priority in the near future is a continuous availability of ICT services, RGZs primary business depends on it. High quality ICT Services will be provided on the basis of Service Level Agreements. ICT Services will be concentrated and centralised in the future. A helpdesk will be available for internal and external customers.

7. STRATEGY

The movements on today's ICT-market are:

- based on standards and commodity tooling
- web enabling
- development of portals
- introduction of service oriented architecture (SOA)
- customer relationship management (CRM)
- enterprise resource planning (ERP)
- e-payment solution
- introduction of Storage Area Networks (SAN-) technology
- introduction of biometrical identification for security

Amongst others, the following risks have been identified within RGZ in relation to ICT:

- mission critical issues should not be outsourced
- continuous availability of qualified ICT staff
- there is no national platform (User Board) on Land Information
- there is too much attention to geodetic aspects, RGZ will a Land Information Centre, legal/administrative products will be a substantial part of the business
- added value of a 3 level (central, regional, local) organisation
- acceptance of standards

Concepts for central or decentral approaches for ICT management have been worked out in relation to the availability of networks in Serbia. It can be expected that the development of such network might take several years in Serbia. The central approach means all equipment and services to be placed in one central site on which all local offices and regional can connect using this as a service. This site could be at regional level or at central level.
The decentralised approach means spreading equipment and services over all of the local offices which will be autonomous then from an ICT perspective, there should be a central responsibility which providing the guidelines for the operation.

The chosen approach has an enormous impact on the way in which the ICT function can be organised, also in the future. A strategic decision has to be prepared on the approach. This includes standards on LAN and hardware, software (the Government of Serbia has an agreement with Microsoft), ICT procedures (e.g. on system management, database administration, network management, back-up, security, etc.), a thin client versus client/server approach, access infrastructure, browser interface, information architecture.

The implementation of the REC-IS has impact on developments at users side; users have to be involved to realise acceptance. The users platform could be implemented at managerial and technical level. At managerial level the National Infrastructure for Land Information has to be worked out.

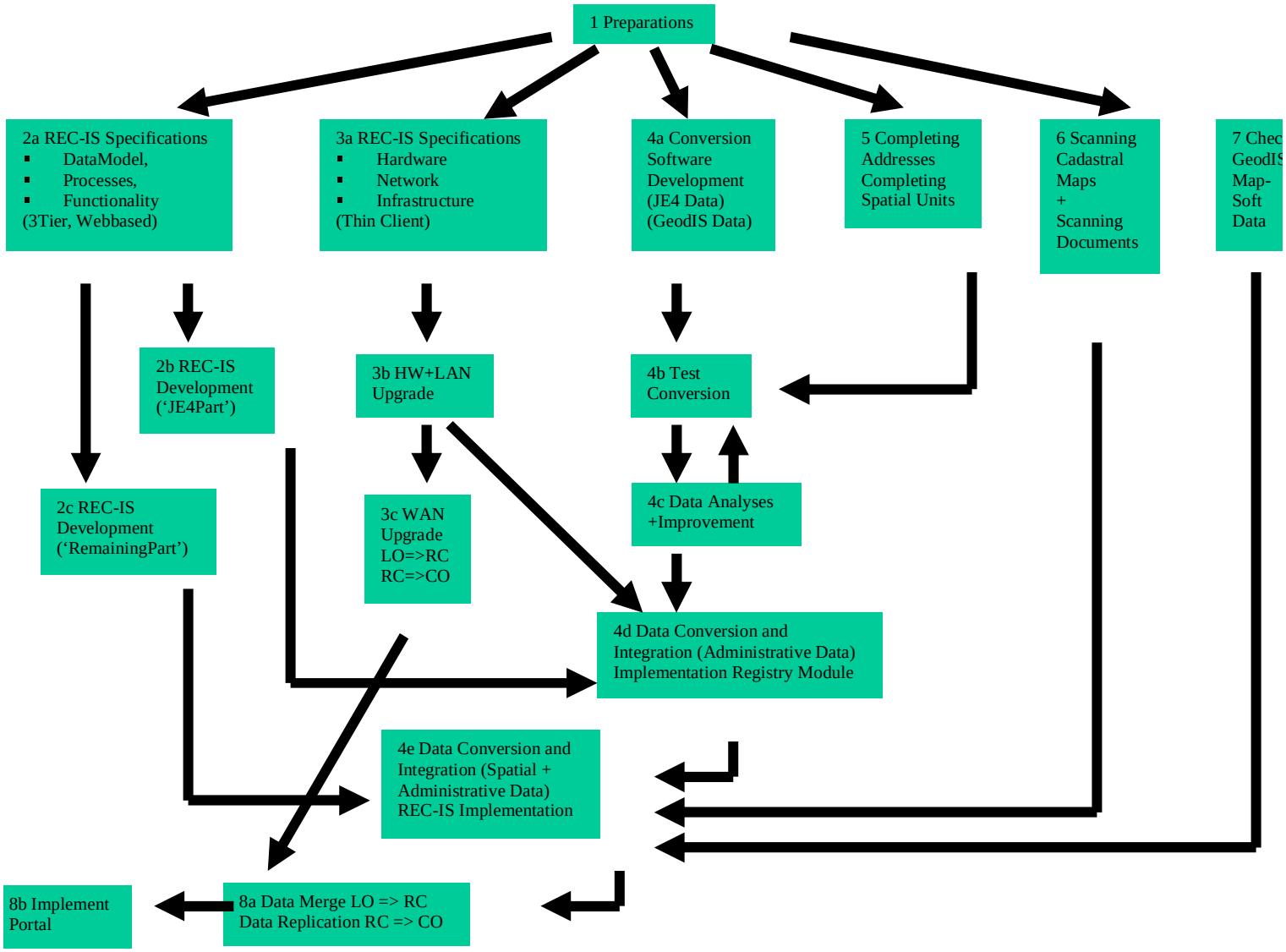
It is recommended to develop forms for requests for registration. A set of documents (legal, technical) can be attached to those forms. Those form are the basis for the design of the user interface for registrations.

The steps to be followed in the implementation of the proposed ICT Strategy are depicted in the figure below. The steps can be summarised as follows:

Step 1: Preparations
This includes the appointment of a task force with clearly defined responsibilities. A detailed overview has to be delivered on the existing situation in relation to ICT at RGZ. A start has to de made in relating RGZ employees to the identified information domains. Strategic decisions as described above have to be made.
Note 1: Many of the following steps can be executed in parallel.
Note 2: legal reform, registration, cadastre, training, finance management and economics at RGZ and monitoring and evaluation are not included (but related!) to the ICT strategy.

Step 2: REC-IS Development
This means the finalisation of the Data Model, the design of processes (workflows) and functional specifications (Step 2a) and the development of the new system with a priority to the administrative/legal part -the existing JE4 system is outdated- (Steps 2a and b).

Step 3: REC-IS Hardware specifications
Those specifications include infrastructure, security issues, network topology issues, etc (Step 3a), a physical hardware and Local Area Network upgrade at selected Local Offices and regional Centre, with impact for the Central Office (Step 3b) and a phased Wide Area Upgrade (Step 3b).

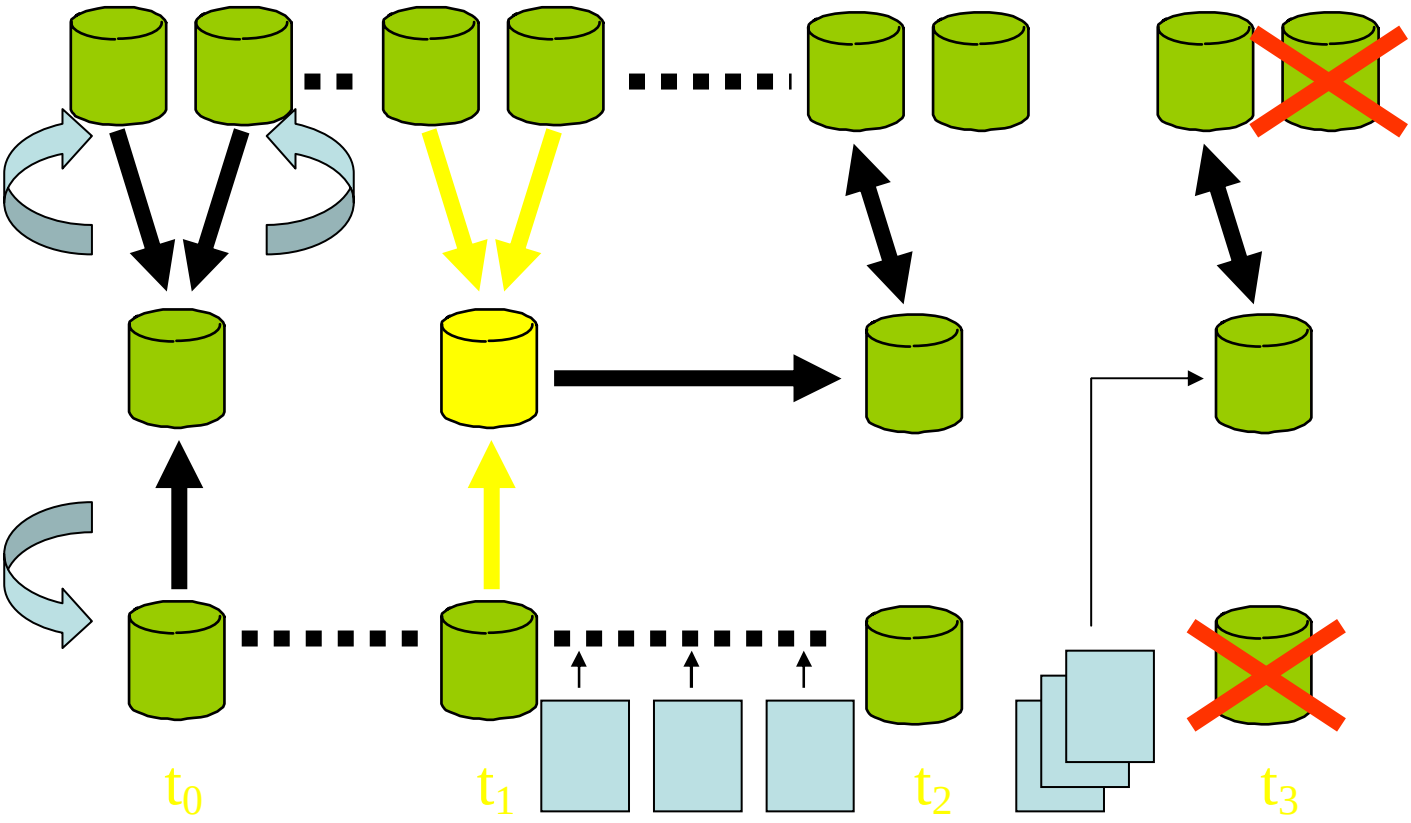


Step 4: Conversion

This conversion software is under in-house development. The conversion is of a complex nature. The JE4 databases contain inconsistent data, local codings, etc. This means the conversion software has to be extended in case of new 'discoveries'. After a conversion (to be performed in Belgrade) information is available for data improvements (to be performed in LO) at the same time the conversion software can be extended. Then the next cycle can start.

In case of availability of good hardware in LO this exercise could be done at LO, in co-operation with an expert from ICT department. (Step 4a), test conversions (Step 4b), data

analyses and improvement after test conversions (Step 4b), data conversion and integration (Step 4d). The figure below gives an impression of the iterations during conversions. Between t0 and t1 the test conversions and data improvements are done in cyclic approach. The final conversion can be done as soon as the JE4 functionality is implemented in the new REC. The address registers and person names have to be integrated with the JE4 data, this will take time (from t1 until t2). At the moment t2 it has to be decided if the LO will be closed to process the applications which arrived between t1 and t2, because otherwise the REC-IS will not be up to date. It should be remembered here that many information supplies are related to recent cadastral applications! After updating the JE4 database and the address registers are end of life. For security reasons it is recommended to keep one JE4 configuration at RGZ central office to access those data in special cases. The LO has the responsibility to keep an overview of the status of *ongoing* transactions during this conversion. The last step is the Data Conversion and Integration -Spatial + Administrative data- (Step 4e)



Step 5: Completing addresses and spatial unit data
The available software applications can be used for a quality upgrade of addresses and spatial units. This is one more reason to in install perform step 3b (Hardware and LAN upgrade) as soon as possible.

Step 6: Scanning cadastral maps + scanning documents
Scanning of existing cadastral paper maps will be done in central office. This requires serious planning, the maps are not available for production purposes for some time.
Scanning of existing legal documents can start in LO as soon as the LAN and HW upgrade is done. Requirements for the digitizing process have been worked out.

Step 7: Checking geometric data (available in GeodIS and MapSoft environment)
As soon as conversion software and the new REC-IS is available the GeodIS and MapSoft data is can be checked on consistency check (topology) in the new REC-IS.

Step 8: Data merge
Data merge of data from local offices at regional level. This can be a smooth transition. There could be problems on the territorial boundaries of local offices with vectorised data. (Step 8a). The next step could be data replication from regional centres to central offices for dissemination purposes. This means a separation between the production database and the information supply database. (Step 8b) and a portal solution (Step 8c).

8. CONCLUSION AND RECOMMENDATIONS

RGZs ICT infrastructure is outdated and has to be replaced as soon as possible, a business alignment model has been proposed as a basis for ICT strategy development, user requirements have been collected as a basis for the development of RGZs ICT Strategy.

Recommendations related to further implementation of information technology at RGZ can be summarised as follows:

- appoint a Taskforce to develop and implement ICT in a co-ordinated way
- make an inventory of the existing ICT facilities
- relate RGZ employees to one or more domains
- develop standards for hardware, software, platform, data management, user interface, etc
- regulate the local and regional ICT management
- implement the ICT organisation incremental, educate RGZ employees for jobs in ICT
- do not outsource mission critical ICT activities
- introduce workflow management
- install standardised hardware and implement a local area network in the local offices, this hardware can be used for data conversion purposes (including legal documents)
- develop the JE4 functionality within the REC-IS with priority
- implement the production database at regional level (starting from local level) and information supply database from central level (portal)
- appoint a Users Platform on managerial and technical level. At managerial level the development and implementation of authentic registrations can be discussed, at technical level standards and data exchanges can be discussed
- maintain the ICT Strategy

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