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DEVELOPMENT OF A GIS-BASED LAND REGISTRY SYSTEM FOR THE GAZA STRIP

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Abstract:
Gaza Strip suffers from a lack of advanced techniques that help and support land registration such as GIS technology. The currently-used-system for land registration in the Gaza Strip is extremely traditional and not able to meet the increasing demand. Conflicts between data on maps and on ground are frequently faced and decisions relating to these problems cannot easily be made. Such an out of date system leads to difficulties in tracking and updating land owners and identifying the actual current owners. This research aims to suggest a new automatic land registration system in the Gaza Strip. Through a multi users unified database with identified access per each user, this new system will ease land registration for both Gaza citizens as well as the Palestinian Land Authority's (PLA) employees. A user-friendly web-based GIS tool is developed to accelerate the land registration process, in addition to providing a decision support system through easily managing and interpreting attribute and spatial data in a precise logical way. The aforementioned new developed tools will create and maintain an accurate, secure and comprehensive land registration system in the Gaza Strip.

Keywords: Gaza Strip; GIS; Land Registration; Palestinian Land Authority; SWOT Analysis; Web User Interface.

1. Introduction

As much as the term of land registration has definitions, Williamson's [1] defines land registration is more superior; the process whereby land and every single detail about it may be effectively managed. Land registration saves information about lands to provide when needed, to people with interest in real estate and information about those interests like nature, weather, period of land registration. It also includes a certain detail such as ownership, location, size, improvements and value.

The currently-used-system for land information, in general, and land registry, in particular, in the Gaza Strip is extremely traditional and does not reflect the changes occurred regarding land information management. The use of GIS for this purpose is limited as well as data for land property and history is unavailable. Conflicts between data on maps and on ground are frequently

faced and decisions relating to these problems cannot easily be made. Therefore, a strong need to enhance this traditional system is strongly recommended [2].

The key feature of GIS technology is the full support for spatial Data Base Management System DBMS. Thus, applying of GIS technology to the Land Registration System LRS in the Gaza Strip would be a suitable solution, provided that its advantages and shortcomings are well understood. This is possible during developing a tool for the purpose of land registration to help decision makers to deal with the available data quickly, accurately and efficiently.

This research aims to develop a new LRS using GIS technique by which an objective methodology with clear stages that can enhance land registry and can enable to facilitate land management and consequently saving time and efforts. In addition to, a new GIS user friendly web tool is to be created to manage and maintain this registry system accurately and securely.

2. GIS and Land Registration

Through considering the internet and the internet solutions, the latest generation of National Land Information System NLIS are supplying wider access to geographical information. The advantage of this technology is that the users can login to the information using standard internet browsers [3]. Successful NLIS needs spatial referencing standards and appropriate GIS technology to support spatial data servers, federated DBMS, temporal management, efficient WAN (Wide Area Network) technology, and efficient client customization tools. Therefore, the application of GIS technology to the land registration activity in Gaza would be a suitable solution provided that its advantages and shortcomings are well understood. Proliferation and development of GIS or any other technology should rather be seen as a social process involving an organizational/financial/ responsive agreement between stakeholders involved [4]. As challenges facing developing countries in GIS diffusion, many governmental as well as private organizations have introduced GIS concepts and technology in their daily work, mostly through development projects. Many of these efforts are project-specific, carried out in isolation and therefore have not been very effective. Some of the progress, challenges, barriers and lessons learned has been documented in a report by the National Research Council of National Academies [5].

Karikari et al. [6] state that acknowledge the serious lack of indigenous expertise but suggest that effective GIS project design and implementation will only occur when indigenous people are fully involved. The method applied in technology transfer needs to be human centered and led much less by the technical prescriptions than donors have rapidly pursued and governments of developments of developing countries have allowed [7]. There has been over-confidence in technology and an underestimation of the associated human and institutional problems [8]. So, it is imperative that the diffusion and application of GIS which designed for especial institutions in the developing world and that usage is made of indigenous expertise where possible. That means the new objectives must be set for GIS development in relation to land administration and other sectors in developing countries. As for the developing countries, data capture and the creation of a cost effective way of keeping data up to date is the crucial issue. This problem happens when converting a certain land records in to digital form, as existing systems are producer-driven, rather than demand driven, and the agencies appear not to have sufficient resources to cope with the consequent increase in the number of dealings.

There is another major problem lies in data processing and analysis. Nearly all cadastral and LRS have focused on record management, instead of information exploitation. While there has been much promotion of GIS/LIS. GIS technology has not been used for real to any great extent in land administration, except for drawing maps. By overcoming the problems successfully, many countries computerizing their cadastral records and creating a large national database. The databases about land-related are now being integrated, analyzed and distributed in ways which until now were not possible. The computerized system will guide users and thus minimize the possibility of any malpractice. Searching information will be easily, very fast and efficient from the database. Lately updated GIS will give the possibility to produce print-outs, maps, forms, reports and statistics easily, accurately and fast.

3. Land Administration in Palestine

After Oslo agreement, land in the West Bank was divided into three security categories. (i) Area A, 18% land coverage came under Palestinian control of civil administration and security, (ii) Area B, 24% land coverage came under Palestinian control of civil administration only, and (iii) Area C, 58% land remains under full Israeli control. The system used in the registration of land transactions in both the West Bank and Gaza is based on complex manual processes, which may take long period of time. This is a very tiresome processes on employees and citizens, in addition to, the registration process is too expensive for some landowners. That encouraged the use of informal unsafe ways like contracts for the sale at the lawyers, which in turn adversely affected the registration records in not matching with the current owner of the land [9].

Through a field survey, it is found that only 48% of current owners match the registration records. In addition to that, there are many disincentives for recording land transactions, such as complex processes which take a long time, conditions before registration and payment of delayed taxes dating back for generations [10]. The current registered areas of land are shown statistically and are based on a total of 5,598 km^2 of the occupied lands of Palestine [11], incomplete and unregistered land therefore totals 3759.57 km^2 (67.1%), which includes 3108.62 km^2 (55.5%) of land that does not have any registration record as illustrated in Table 1.

Since 1991, the Surveying Department has not made any procedures to update cadastral maps referred to it in the records of the land registry, and many often divisions parcels and equivalence do not reflect the current situation. LRS works in the West Bank are in a decentralized manner. There are ten registration offices are independently responsible for the registration of land in their home state, and there is a paper registration system in use, where it is manually registered in books and contracts. Fortunately, there are some common data exist; parcel number, block number, the name of the village, which help to determine the parcels with a minimum of confusion.

Table 1: The registration of land in Palestine [10].

Land Category	Registered land		Incomplete Registration		Non-Registered Land	
	km2	%	km2	%	km2	%
Area A	499. 68	8.9	112.71	2.0	387.56	6.9
Area B	285.78	5.2	132.17	2.4	782.68	14.0
Area C	1053.06	18.8	406.07	7.2	1938.38	34.6
Total	1838.52	32.9	650.95	11.6	3108.62	55.5

The Gaza Strip is under Area A, with full security and administration sovereignty of the Palestinian Authority, and records show that 98% of the area is unregistered on the cadastral maps. Nearly 30400 of ownership titles, only 239 have registered addresses. The transactions are classified and procedures in the Gaza Strip offices differ from their counterparts in the West Bank offices. Gaza does not follow the same procedure where citizens go directly to the Gaza Strip to the registration office (reception department) and do not have to wait, they fill in model of two, either to apply for information or registration services. So, he might fill himself or go out the office for writers to write [11]. The administration of land registration in the Gaza Strip involves three departments, namely; the Reception Department, the Audit Department and the Registration Department.

4. The Developed Methodology for Land Registration

The new strategy is based on previously available data as a source in order to implement the new method. The new strategy has been developed in order to provide easier and simpler technique which intended to be precise and accurate. It will also achieve good level of satisfaction among dealers and among the various departments of PLA.

The new approach provides an automated service for land registration process in order to save significant time and cost by all stakeholders involved in the process. For example, in case of missing documents, the system will stop the application process and inform the client to provide the required documents in order to re-process the application. Both SMS text and email will be the communication channel between land registration authority and the client. Lands' owners will have an online access to their files where they can check their information and track any applications in the process.

4.1. The Used Software

ArcGIS software (ArcMap, Arc SDE, and Arc Sever) should be used to create a friendly user online LRS. At a high-level ArcGIS can be thought of as software that helps to take our geographic information and make it available to others, easily. This data can be distributed over the Web or through traditional GIS desktop software like ArcGIS Desktop. ArcGIS Desktop present digital maps with layers including lands, parcels, blocks besides other geographical features. Microsoft SQL creates a graphical user interface (GUI) for data entry and editing to be linked with both of Website and arc GIS Desktop through Arc SDE. All of the above-mentioned software will be used in developing an online LRS in the Gaza Strip. Fig. 1 shows the linkage between the various software and the database. The user interface is the outer layer, the visible part of the system through which users interact with the software and data. In reality, digital LRS have multiple user interfaces for different functions and different groups of users.
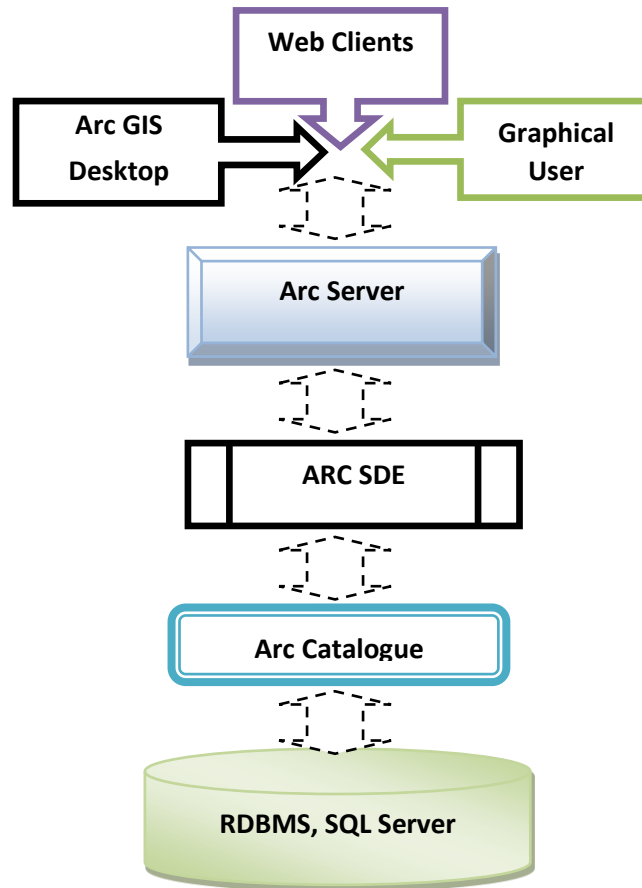
Figure 1: The linkage between the various software and databases

4.2. The Methodology Framework

The new registration depends totally on a fully automated computerized methodology for all the operations and it will replace the traditional manual procedures. Due to utilizing SMS's, land registration transaction will be easily followed via connecting registration server with internet. Data about type of transaction and status will be accessible on a website connected to the registration system.

As illustrated in Fig. 2, this methodology passes through several stages, starting from the scribes and lawyers who will start the clients' transactions on the website and upload the required supporting documents. The Reception Department in the PLA will double check the validity of the provided data in addition to identifying the land boundaries, and then feedback the clients via SMS and/or email. The Audit Department will check the land's ownership status. The Legal Department responsibility will be ensuring the legal status of all the supporting documents and feedback will be sent to both Audit and Reception Departments. Guessing committee then will provide an actual price estimation for the land at the date of the transaction in order to identify the exact registration fees. The PLA chief then will approve the whole transaction before the final audit. PLA will provide the client with the feedback on his transaction and archive all of its documents.
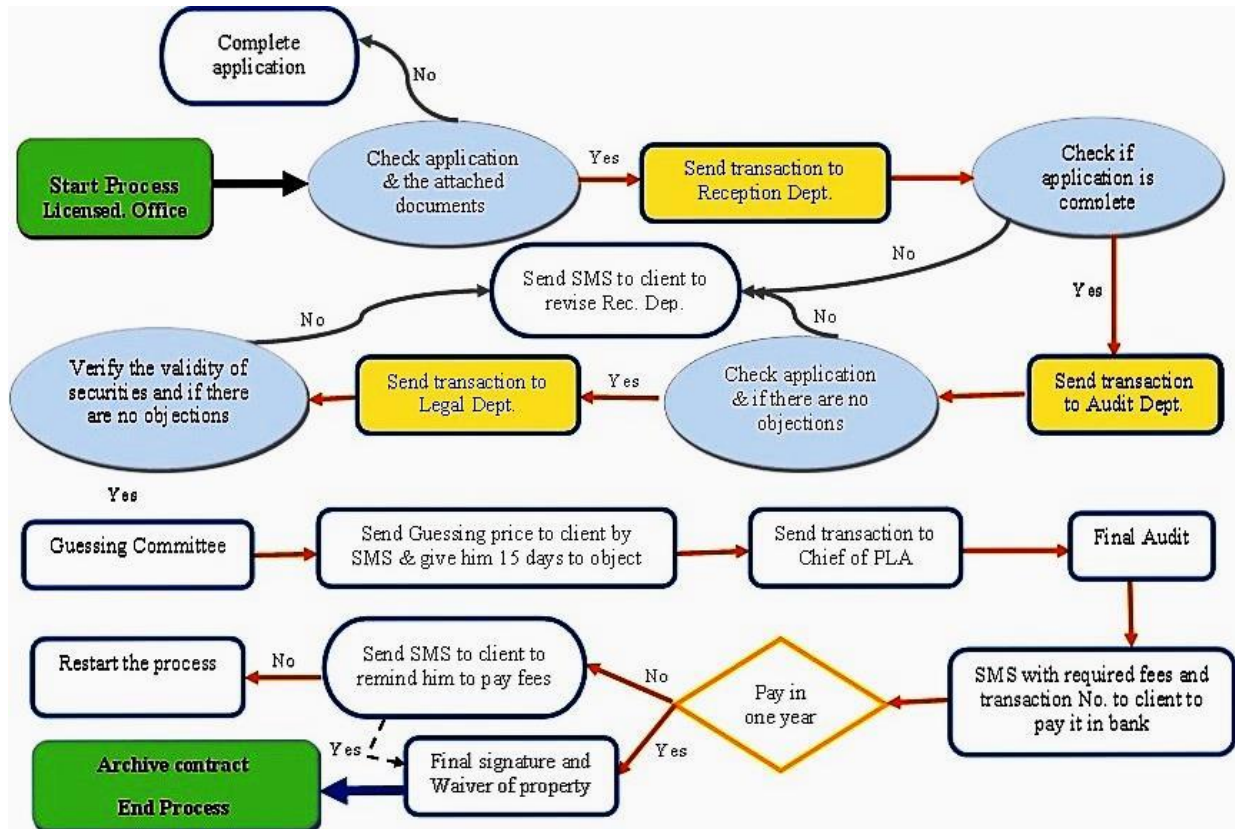
Figure 2: Procedure of the suggested method for land registration.

4.3. The Methodology Stages

The developed methodology involves successive various stages starting from the client stage and ending by the contract book stage and the final printing of certificate of registration. An online web page form is used in each stage. Appendix illustrates all web-based page forms used in all stages.

The Client Stage
The registration process starts by in-person visit for the clients who wants to register a land to his private ownership "Tabu" or to transfer an unregistered ownership of another person to his ownership. The client is firstly expected to go to one of the licensed offices in order to update or open new registration file. The client is expected to provide the following documents; (i) Tax-free certificate, (ii) Original IDs, (iii) Primary contract sale, and (v) Final contract sale "Koshan". The client will be required to provide contact details (i.e. Mobile number and email address) in order to activate an instant-updating-system which enables the client to receive emails and SMS about the progress of the registration application . New application will be attached to a serial number which will be used for future communication between the client and the Land Authority.

Private Registration Offices
Registration offices (RO) are established after a meeting selection criteria set by the Ministry of Interior Affairs. RO will be under continuous monitoring by governmental authorities in order to

ensure full functionality and effective services. RO is expected to be equipped with comfortable furniture for audience. Each RO has access to the main database system which will be used to apply new applications. RO accounts have restricted access enabling them to add, view and edit client's data. RO staff will choose the type of the transaction (e.g. new transaction, updating etc.). RO staff should check all documents in order to start filling in the online application. Within the online application, all documents will be scanned and uploaded. Then, a copy of the application will be printed, stamped and delivered to the Reception Department at the PLA. Thus, the service of the licensed office will end.

Ownership certificate may be requested by PLA in order to check the status of their properties after submitting the online application. Therefore, RO staff will apply for an ownership certificate for the client. In order to get an ownership certificate, the client should provide the following documents; (i) A death certificate or deed legacy if the person to be investigated, (ii) The investigation of a person other than the above mentioned immovable money if there is a court decision, and (iii) Institutions formal or semi-formal right to investigate ownership under the law. The certificate can be then uploaded within the required documents. Then, printed copy of the application will be sent to the Reception Department in order to be processed by the GUI. Then the employee will check the data on the record through the system. In case of any error or differences in the data between the application and the system, Director of Registration Department is the only one can edit the application which will be moved then to the Registry Lands officer in Gaza for signature.

The Reception Department Stage
The main function of the Reception Department is the receipt of applications from licensed RO, in addition to offer inquiry services for clients who are seeking further advice. After the receipt of the application, the RO will inspect the application first, the postage and then electronic check via the system and check the serial number of the application and ensure that the application has right information. Finally, he has to make sure that the land has no legal problems or reservations or objections, and have attachment extractor constraint so that the receptionist to call the courier and request him to bring extractor limitation of Registration Department if they were not present to Reception Department and for the speed of registration. After finishing the inspection process, the Reception Department officer will add the land parcel details (e.g. Geographical Coordinates) to the system. After the completion of data entry, the employee submits the application online after writing his name and, other details (i.e. day, date, time, computer IP).

Additional information related to the legal issues for the displayed file can be viewed by the officer if he found any defect or any incorrect information or problems and reservations or objections on the piece of land or problems with contracts or any condition. Therefore, an employee at the legal department has to clarify the problem and write notes which are visible by the users of the system. If the problem needs further investigation, SMS text will be sent to the client in order to inform him about the status of the application.

The Survey Department Stage
To get land survey after processing the transaction at the Legal Department and verifying the validity of the transaction, a SMS will be sent to the client to hire a certified surveying team to register the coordinates of the land in order to be very accurate data for a fixed fee of space or

number of points. Coordinates can be registered by high-accuracy GPS devices or Total Station surveys so that the information can be recorded in a GIS program with all details of the transaction which will be entered manually. It's recommended to use ARC-Servers to enter the information automatically.

The Auditing Department Stage
The Auditing Department follows the Reception Department. After processing the transaction in the Reception Department, the auditor also reviews the data to make sure of the validity of the data and the absence of any error or the occurrence of any future malfunction that may expose the owner of the land to the problems or legal accountability. The auditor can amend information in the case of spelling and then he can move to the next stage. The client will receive SMS informing him that the application has passed the auditing stage. In the event of any reservations or objections, auditor will send the application back to the Reception Department. A message will be sent to the client to inform him about the action so that he can go to the Reception Department to get feedback.

The Legal Department Stage
The Legal Department is one of the crucial steps to complete the process of land registration by verifying the originality of documents. After meeting the criteria of both Reception and Auditing Departments, the transaction can be moved to the Legal Department. The Legal Department officer will have a restrict access to view all the information provided by the Reception and Auditing Department teams. However, he will not be allowed to modify the data when there are errors or problems with data but he can enter notes in the system to which can be viewed by the relevant employee. So that, employee can check the date and correct it if he can or send a notification to the client to arrange for urgent visit to review his application.

The Guessing Committee Stage
After processing the transaction in the Legal Department, it will be sent to the Guessing Committee which involves the Chief of PLA, two representatives from the Ministry of Agriculture and the Ministry of Internal Affair and two officers from the PLA. The evaluating committee aims at evaluating the land price per meter squared in all areas of the sector in order to estimate the fees required for registration process. This committee is mainly structured to stop citizens who change sale price by typing two different contracts to sell the land, the first one is real price and the other is lower price so they can reduce the registration fees. After estimating the price, a SMS with the required fees will be sent to the citizen. The citizen has the right to object once via e-mail. After a final decision is made by the estimating committee, the client has to receive new SMS with the required final fees and pay it in account of PLA in a certain Bank.

The Chief of PLA Stage
The Chief of PLA that he can sign it electronically through the system after reviewing the transaction. Generally, the Chief of PLA has an access to write any notes or comments which will be sent automatically to the relevant officer in order to review the application. The Chief has no direct access to change the entry by himself but he is the only person who can confirm the transaction.

The Finance Department Stage

As a final stage, the transaction will be forwarded to the auditing team to produce the invoice for the client so that he can pay the fees. The client can pay the fees in any bank which is linked to the system After the payment, the auditing officer will receive a message from the bank confirming the payment. Then, the transaction moves to the Registration Department where it will be reviewed for the last time before the ownership moves to the buyer. This final step should be conducted in the presence of all parties involved in the transaction. The client should confirm the receipt of the full amount of payment by the buyer.

The Contract Book Stage

After signing the final documents of the transaction, the transaction will be recorded in the contracts book as a safety procedure. Each record will be given unique reference number, and calculating the quotas in the area decades widget coupon space. After calculating quotas old contract is modified, and divided into two new recorded contract in the window one to the buyer to the new area that sale, and the other to the residual area to the seller. And also must enter transaction to contracts book that involve number of the contract and contract date, transaction number\year, number of land parcel, governorate, the full name of buyer and seller, the type of transaction, the quota calculated, guessing price and any other comments. Finally, the contract is printed showing the contract number that included in the transaction and the date of registration in the book of contracts.

5. Land Registry GIS Based Tool

A GIS based friendly user interface data entry and modification system is developed. This GIS tool will be used by the GIS specialists and decision makers in the PLA to retrieve data from the web based LRS. Through connecting attribute data with the spatial data, this system will provide an easy technique for data accessibility sharing, tracking and manipulating public requires in a transparent way. As the data will be collected and documented through the land registry web based system, the GIS tool will be used to visualize the actual surveyed lands and their corresponding data, in addition to the interpretation of these pre-entered data. Visual Basic Applications (VBA) language, available in Arc Object via Arc GIS, is utilized in order to develop a proposed GIS based land registration tool.

This tool consists of three main pages including: land, parcel and block. Each main page contains several sub-pages. For example, land main page involves six subpages of data entry and query; land holding data, neighboring land holders data, new landholder data, previous landholder data, land location and general registration data, Fig. 3. Parcel main page includes three subpages; parcel data, parcel boundaries and parcel location while block main page also includes three subpages; block data, block boundaries and block location.

As shown in Fig. 3, the land holding data subpage of the land main page involves information about the piece of land that is to be registered such as: information of parcel and/or parcels that sharing it, the magnitude of its area and use, block/blocks info containing it as well as its history information like transfer date, registering date and transfer reason.

Figure 3: The web subpage interface of landholding data.

6. Evaluation of the Suggested System

To enhance our understanding for the benefits of bringing the new proposed methodology alive, several in depth interviews with the main stakeholders are conducted in order to consult them about this new proposed LRS. The following SWOT analysis is a consolidation for the whole collected data from relevant stakeholders. Strengths factors involve:

- Supported Stakeholder participation and awareness.
- Full integration between "Tabu" information and GIS map.
- System is acceptable/legitimate to community
- Actors' roles and tenure rules/types are clear.
- Improved perception of tenure security.
- Good security of land tenure information.

- Local expertise in land measurement.
- Access to information for the public users.
- Full Automated System.
- Save time and effort.
- Easy to dealing with system.
- Tracking transaction through SMS and E-mail.
- Easy in re-establishing surveyed boundaries to be connected with GIS.

Weaknesses factors involve:
- Take time to systemize the old data with new system.
- Lack of GIS developer in the Gaza Strip.

Opportunities involve:
- Improved LRS.
- Capacity building to current team in GIS developing.
- People will accept and support the new system.
- Improved perception of land security.
- Integrate spatial data with other sources of data.
- Involvement of public organizations/CSOs.

Threats involves:
- Disruption of program.
- Lack of fund to activate the system.

7. Conclusion and Recommendations

This study attempts to suggest an objective approach that creates a web-based and an automated land registration system. The automated LRS can save time and efforts for both PLA employees and the clients as well as providing clients with the opportunity to track their transactions via SMS and e-mail. In addition to utilizing GIS technology, it adds a tool to produce high quality and accurate digital maps. The produced digital maps are connected to the corresponding database which can facilitate the management of the Gaza Strip lands and consequently the decision making process in this field.

This study also reveals the need for developing PLA's technicians and employees' capacities on more advanced GIS and LRS technological based. PLA needs to adopt formal recognized standards for all transactions, and provide quality services to clients with clear promises on time and cost for each type of registration. The PLA should design, printout and publish the forms and procedures for all kinds of registration activities, to meet the needs of the customers. PLA should also adopt a clear client's focus for other agencies. As part of the strategy of focusing on improved service delivery, PLA should improve the service for other agencies and municipalities. These institutional clients should have ready access to PLA records and steps should be taken to provide online access for key institutional clients. Finally, comprehensive public awareness campaigns should be implemented to guide the landholders and businesses and explain the needs to update the register whenever any change takes place.

Appendix

Figure (A1): The web based LRS page used by RO.

Figure (A2): The web based LRS page used by the Reception Department.

Figure (A3): The web based LRS page used by the Survey Department.

Figure (A4): The web based LRS page used by the Audit Department.

Figure (A5): The web based LRS page used by the Legal Department.

Figure (A6): The web based LRS page used by the Guessing Committee.

Figure (A7): The web based LRS page used by the Chief of PLA.

Figure (A8): The web based LRS page used to print registration certificate.

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