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Developing a Framework for Improving the Quality of a Deteriorated Land Administration System Based on an Exploratory Case Study in Pakistan

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Abstract. *As in numerous other countries, the present Land Administration System (LAS) in Pakistan is not up-to-date and can even be considered as deteriorated. It is entirely based on paper land records and maps lacking standards with outdated information stored at different administrative levels of the responsible agencies. Such practice restricts the usefulness of reliable and quality land information for supporting tenure security to citizens, socio-economic development, and urban/rural development including infrastructure.*

To be able to understand, analyse and ultimately improve the present situation, this paper develops a framework for improving the quality of LAS. It gives ample attention to elements of an institutional and of a technical nature. In order to identify such elements to be included in the framework, theoretical perspectives on both institutional and technical aspects are firstly discussed. The selection of elements is done which is based on this in combination with the results from the case study.

The exploratory case study was conducted in the North-West Frontier Province (NWFP) of Pakistan. The main outcomes of this case study are described here, leading to two results. On the one hand, an initial picture of the institutional and technical situation of the LAS in Pakistan is depicted (to be detailed in further research). On the other hand, this picture is used to select the elements to be included in the framework for improving the quality of a deteriorated LAS. The selected elements are presented including their application to the case of Pakistan. Finally, the framework is developed that will help to describe, analyse and ultimately improve a deteriorated LAS.

Keywords: *land administration systems, institutional elements, technical elements, framework for quality improvement*

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1 Introduction

Land and the way governments deal with land are issues of major importance in the development of a society. This also does not go unnoticed at the global level. In the Global Plan of Action for Sustainable Development, as adopted by the Rio Conference 1992 (Agenda 21), the global objectives of combating poverty, sustainable settlement, sustainable agriculture and forestry are directly related to land issues. For these purposes, van der Molen (2006a) indicates that strengthening legal frameworks for land management and land ownership is strongly recommended to facilitate access to land for the urban and rural poor, to create efficient and accessible land markets, and to establish appropriate forms of land tenure that provide security for all land users especially for indigenous people.

The traditional ways of operating a land administration system (LAS) is considered to be too complicated, too slow and too expensive. As such, LAS favours only the elite groups in a society and hardly functions well for the benefits of the poor and other groups in society. Therefore, new approaches are needed to meet the requirements of all groups and to maintain relevant land data efficiently and effectively in such a way that quick access to data is possible for all (van der Molen, 2006b).

Recent advances in geo-information communication technology (Geo-ICT) and changing societal needs for land administration have increased demand for a reliable and effective shared framework for developing, operating and maintaining land information systems in developing countries. This is due to the fact that existing systems can no longer cope with current demands due to policy shifts in land issues and geo-information technology (Tuladhar, 2002). Such a shared framework will lead to the design of land administration processes through a quality process design, process simulation and benchmarking techniques which are simple, cheap and transparent (Radwan et al., 2001).

There is hardly any internationally accepted or standardized method or quality framework for improving, evaluating or comparing land administration systems around the world. This may be largely due to the fact that the land administration systems reflect the cultural and social values of the societies of the prevailing country in which they operate (Steudler et al., 2004; Williamson and Fourie, 1998). In some cases, institutional arrangements within the same country may not be optimal for efficient land administration systems. While, in other areas, organisations face significant challenges in introducing modern technologies that are also constantly changing over time (Auzins, 2004).

Some studies indicate that the focus of cadastral issues has changed from purely technical ones, to institutional, social, political and economic ones (Dale, 1985; 1990; Zevenbergen, 1998). Dale (1985) argues that ‘‘unlike other aspects of land surveying which are depersonalised, a cadastre is as much about people as it is about land, law and technology’’. To this end, three important aspects: the technical, legal and organisational are emphasized. However, the success of a system largely depends on the organisational aspects. Other studies reveal that technical, legal and organisational aspects have a dramatic effect on the

functioning of land registration systems (including cadastral surveying and mapping) and achieving their goals (Zevenbergen, 2002; 2004). The World Bank (2001) indicates that land administration systems are usually operated within distinct social/cultural norms and values. Therefore, it is important to develop a framework that takes into account both institutional (including organisational) and technical aspects for implementing land administration systems in the context of land policy development.

The concept depicted in Figure 1 provides a method for developing a framework to improve the quality of LAS. In this paper, tenure system plays important role in quality services and products provided by LAS followed by institutional and technical aspects.

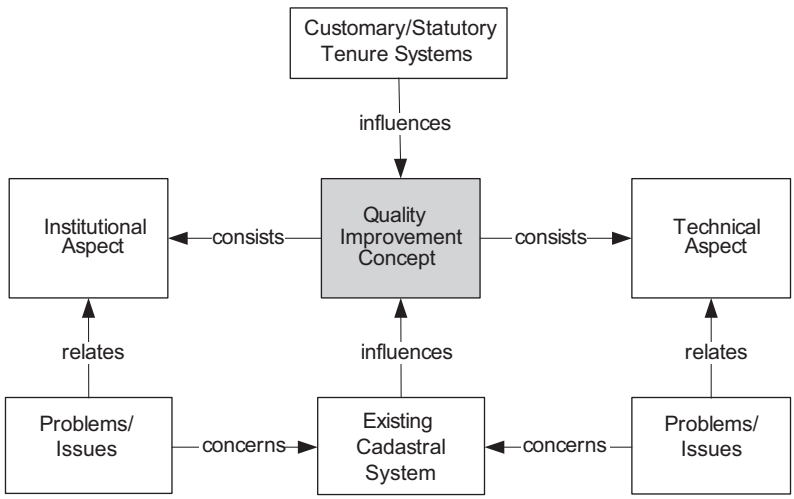

Figure 1. *Quality improvement concept.*

The intention of this paper is to discuss elements of such a framework from the view point of institutional and technical aspects that provides critical understanding of the quality of land administration system. These elements are thus considered as the 'basis of a framework' for improving the quality of a deteriorated land administration system in general and especially in Pakistan.

This paper uses an exploratory case study approach in which qualitative and quantitative data are collected in the urban and rural areas in Swabi, Chitral and Peshawar districts of the North-West Frontier Province (NWFP) in Pakistan. It focuses mainly on analysing institutional and technical aspects for developing a framework to improve the quality of LAS.

2 Research method used

The research conducted by Silva and Stubkjær (2002) shows that the methodologies used in cadastral research are largely those of the social science domain. That fits with the notion that cadastre relates as much to people as it relates to space and tenure rights. Such relationships are normally shaped by social, political and

economic conditions, as well as by legal and technological factors. But due to the varied nature of these relationships, a case study approach is used as a research method in most of cadastral research studies (Tan 1999; Ting and Williamson, 1999; Williamson and Fourie, 1998; Zevenbergen, 2002). A case study fits in cases where the primary purpose is to investigate related issues rather than to implement a system or improve an operational environment (Onsrud et al., 1992). It is also an ideal methodology when a holistic, in-depth investigation is needed (Feagin et al., 1991).

Research by the case study approach can be positivist, interpretive or critical. The positivist research can be descriptive, exploratory (theory building) or explanatory (theory testing) and each of those three approaches can be either through a single or multiple-case study (Paré, 2001). In this study, an exploratory case study approach was assumed to be a better choice for gaining full insight into the phenomenon and developing a framework for improving the quality of LAS with its possible elements. It was based on fieldwork results and lessons learned.

In designing an exploratory case study, this research defines an initial question that allows us to investigate the present situation of the land administration system in Pakistan. This initial question is broadly formulated as, what are the possible elements contributing to the technical and institutional aspects for developing a framework to improve the quality of the land administration system?

For this study, the land administration organisation called Board of Revenue (BOR), in the North-West Frontier Province (NWFP) was chosen for detailed analysis. The BOR offices at Peshawar, Chitral and Swabi districts in the NWFP were visited in this case study. These districts are highlighted on the provincial map in Figure 2.

Figure 2. *Location of fieldwork study areas on provincial map.*

Peshawar is the provincial capital city of NWFP, and the BOR has its provincial headquarter in this city. Meetings and interviews were arranged with the BOR officials as it is the headquarters for all BOR offices at provincial level. The topics of meetings were mostly about policy and management issues with the higher authorities of BOR including Member Board of Revenue (MBR), Director Land Records (DLR), and Secretary. At Chitral, the settlement Officer (SO) and land administration agency officials (i.e. Tehsildar, Naib Tehsildar and Patwaris) at operational level were interviewed. In the Chitral and Swabi districts, field visits were also carried out for interviews and meetings with clients including law professionals and land owners.

During the data collection process, a variety of techniques including snowball concept and individual and group interviews were applied to collect the data from the stakeholders in all the three districts. The units of analysis were stakeholders/ clients who were concerned with tenure rights on land, and organisations that operate the land administration system in the study area.

The qualitative data were collected from open interviews with stakeholders including the land administration agency officials, land owners, and law professionals. The quantitative data were collected through structured questionnaires. On the analysis of transcribed qualitative data, appropriate questionnaires were designed for further quantitative data from the stakeholders in these districts. These questionnaires were designed on the basis of the LAS issues to analyse the present situation of the land administration system in the study area. These questionnaires were distributed among the stakeholders including the clients (law professionals and land owners) and land administration officials (high officials and field staff).

While conducting the case study, three main data sources were continuously used. These included interviews with the stakeholders, collection/analysis of archival documents and investigator's observations. Data were collected through structured and semi-structured interviews with the stakeholders during different offices visits at the Board of Revenue (BOR) which is the main land administration agency in the province.

To understand the actual practices carried out by the land administration agency officials, field visits were also carried out while visiting Chitral district. Furthermore, information were collected through literature review and interviews with stakeholders in the study area.

Once data were collected, a thorough review of the historical documents, official documents, reports, news articles and interviews with stakeholders were carried out to cover a major part of the qualitative data to understand the present situation of LAS and its concerned issues. The detailed findings from this exploratory case study are presented in section 4.

3 Theoretical studies

Land Administration System (LAS) is concerned with social, legal, economic and technical framework within which land managers and planners operate. Since LAS has the ability to influence societal and institutional behaviour (including

that of individuals), professional competence and human resource development are an important component of LAS (Enemark and van der Molen, 2008).

The FIG statement on cadastre defines a list of the cadastral issues which are legal, technical and operational issues to create, maintain and improve a cadastre (FIG, 1995). Further research work in this area has been done by many other researchers (Barnes, 2003; Tuladhar, 2005b; UN-ECE, 2005; Zevenbergen, 1998). Steudler et al. (2004) use an evaluation framework for land administration systems with a holistic approach in which levels of the organisational pyramid, regular review of objectives and strategies, and other external factors have an influence on LAS. In all previous research, the elements for improving the quality of LAS have received much attention.

For the purpose of this paper, we categorize all policy, social tenure, legal, economic, organisations, technical systems and the operational issues under either institutional or technical aspects, together with core elements for improving the quality of LAS.

3.1 Institutional aspects

Institutions are defined as "the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interactions" (North, 1990). The players of the game are the 'organizations'. The costs of reducing uncertainty in human interactions are dependent on the quality of the institutions and how seriously these are enforced (van der Molen, 2003). The (World Bank, 1998) considers the land titling, land registration and information supply in general as examples of institutional development.

There are three basic categories or aspects of institutions, namely the constitutional order, institutional arrangements and normative behavioural codes (Feder and Feeny, 1991). These categories directly affect the quality of LAS and provide clues if current systems are operating in accordance with society's requirements and users needs.

a. The fundamental rules about how society is organized are based on, "the rules for making rules" (Feder and Feeny, 1991). From the early days of history, man always had a relationship with land. Such a relationship leads to so called "land tenure" which defines how land is to be held and used. This arrangement always differs from one country to another and even within one country, as it is often influenced by history, politics, culture, religious/social systems, and the economic situation. The relationship between an individual or a group of people or communities and a unit of land through a bundle of rights (or property rights) is the most important part of land tenure and the administration thereof (Tuladhar, 2004). A land tenure system is the institution that shapes the interaction of the people and land within a social context to come to better land management and dispute resolutions.

   There are different forms of tenure including statutory tenure, customary tenure and informal tenure that shape human interaction with land in different societies. In Islamic countries, the Islamic tenure system

largely influences 'what' and 'how' the tenure rights be exercised (Gulaid, 1990; 1991; Nuzhat, 2000). LASs have to cope with the registration of rights that must obey the country's laws and constitution with its tenure system.

b. The institutional arrangements are created within the rules specified by the constitutional order such as laws, regulations, associations, contracts, and property rights in land (Feder and Feeny, 1991). There are also specific institutional arrangements like land administration (land registration) and land management (land consolidation) to support and activate the institution of property rights (Sevatdal, 2002). Land management involves the implementation of fundamental policy decisions about the nature and extent of investments in land. From an institutional perspective, land management includes the formulation of land policy, the legal framework, resource management, administrative arrangements, and land information management which include technical aspects (see 3.2). It entails both government and private initiatives (UN-ECE, 1996). Thus the institutional arrangements include property rights, land policy, legislation, land use planning, organisations and financial elements for handling property rights and data in LAS. Institutional arrangements work as a backbone for developing LAS in a society within rules defined by the constitutional order.

   Land policy is a part of the national policy of a country. Such policy generally relate to economic development, social justice and equity, and political stability. The land policy promotes the provision of security of tenure and provides measures to prevent land speculation and land disputes (UN-FIG, 1996). The coherency of a national land policy with policies in other sectors reflects the quality of a system that supports the customers' needs and society's requirements.

   For assessing the effectiveness of land management and land administration systems, the responsible authorities must address a number of major issues, such as: intergovernmental co-ordination, centralization/ decentralization, the roles of the public and private sector, mechanisms to ensure that user needs are met, management of the particular organizations, relevant information and human resources, training and research, education and international co-operation (Auzins, 2003).

c. The normative behavioural code refers to the cultural values that legitimize the arrangements and constrain behaviour. According to Scott (1995) "Normative systems include both values and norms. Values are conceptions of the preferred or the desirable together with the construction of standards to which existing structures or behaviour can be compared and assessed. Norms specify how things should be done; they define legitimate means to pursue valued ends." In this way, 'values' are closely linked to 'goals' and the 'norms' are the 'acceptable means' to achieve these pre-defined goals as per user needs and society's requirements. The normative

behavioural code include the legal framework for co-ordination, definition of operational rules, responsibilities, user needs, LAS processes, access to information (timeliness, clarity, simplicity, fairness and quick responses), data organisation (privacy and data protection), public awareness, and data pricing.

LASs have to operate within a social and political environment. These systems should address institutional aspects to recognize the customers' needs because different customers may need different forms of product or services. Furthermore, the success of any broad-ranging land administration system depends on a number of institutional aspects to be addressed (UN-ECE, 2005). Hence the institutional aspects must be taken into consideration while designing a quality framework for cadastre and land administration system within the country's environment.

3.2 Technical aspects

A substantial amount of the land administration activity is of a technical nature (UN-ECE, 2005). A land administration system contains, on one hand, the database containing spatially referenced land data, and on the other hand the procedures and techniques for systematic collection, updating, processing and distribution of the data to the end users in an efficient manner. The technical aspects play important roles in all parts of the land administration system including system development, data (capture, maintenance, access) and process designing. All these aspects are most important to improve the efficiency of LAS by considering pace of technology change and societal needs within a certain environment.

However, it is important to know about the LAS objectives in relationship with the opportunities offered by the geo-information communication technology (Geo-ICT) before going to adopt this technology in LAS. In this connection, the conceptual model of MIT's 'strategic alignment model' (Henderson et al., 1992) provides a line of actions/thoughts for establishing a technical strategy that links a relationship between institutions and supporting technologies to achieve organisational goals and objectives. The adoption of Geo-ICT in LAS can be looked at three levels: the strategic level, management level and operational level in accordance with user needs.

a. It is argued that strategic level requires exclusive links with changing views of Geo-ICT. Its recent developments have a strong impact on the development of land administration systems and sharing of land data among various stakeholders usually known as spatial data Infrastructures (SDI). Both the theoretical and practical developments in technologies such as different remote sensing satellite images and geographical information systems (GIS) including database management concepts can improve the quality, cost effectiveness, performance and maintainability of land administration systems (Aleksic et al., 2005). The adoption of these technologies provides enormous opportunities to share land related information in a more easy way than the old fashioned technologies/ methods in which the information

is managed and shared through manual records and procedures. The FIG (1995) stresses the selection of an appropriate technology for mapping and maintaining geometrical cadastral information within the strategic objectives. This can really reduce the chance of duplication in data creation and updating for better performance of the organisations dealing with land information and management.

The elements influencing the quality of a deteriorated land administration largely depends on two strategic elements. The first element is about the analysis of user requirements including their roles. The second element is the adoption of latest technologies on land administration processes/services to achieve high quality of products that are easily accessible and reliable for land data supply. Both these elements would then bring system architecture that needs to be aligned with the elements of institutional aspects specifically on land policy, and laws for property rights and privacy issues. Elements for improving the quality of LAS would be: the adoptability of technologies in the organisation, involvement of users, needs and their roles, use of international quality standards (such as ISO/TC211, OpenGIS), development and understanding of a system architecture for LAS, and availability and use of a strategic plan.

b. Information system concepts for data modelling and process modelling are the most prevailing elements in term of organisational structure (see section 3.1), as they relate to how quality data are gathered, processed, stored and disseminated at affordable cost with many data access points such as a front desk or the internet. On system development side, the cadastral modelling, such as Land Administration Domain Model (LADM), is considered as a basic tool for facilitating appropriate system development and forming the basis for meaningful communication between different (parts of the) systems (van Oosterom et al., 2006). On the data capture side, due to advancements in Geo-ICT, the traditional surveying concept has taken on a new shape from discipline-oriented technologies such as geodesy, surveying, photogrammetry, and cartography into a methodology-oriented integrated discipline of geo-information science. These are based on the global positioning system, high resolution remote sensing images and digital photography (Tuladhar, 2005a). A participatory geographic information system (PGIS) combined with remote sensing images is quite interesting for gathering quality data with the involvement of land owners, tenants and other stakeholders.

Similarly GIS and database technologies are to be employed for land data processing, updating, storing and dissemination. The integration and sharing of geo-referenced data becomes more and more crucial, and there is an increasing need for efficient and reliable data exchange (Steudler, 2006). In this context, OpenGIS and GML/XML are important tools for efficient and transparent data access and developments for land administration activities.

At this technical management level, most important elements of a framework for improving the quality of LAS would be the system development approach, systems/data/process models, distributed databases, access to land information, resource allocation, national data standards based on international standards, service quality, and spatial/non-spatial data quality.

c. The processes and techniques for data capture, data maintenance, data access, data storage, and data dissemination are the backbones for quality data products and services at the operational level. Workflow management and secured databases are basic components of functional land administration systems. Standard operating instructions for each step of workflow should be developed and implemented as a part of total quality framework. Important elements of such operational systems and workflows are those concerning steps required for the workflows, involvement of users in land transaction, amount of land transaction in a day, time required for registration and surveying, availability of services in case of fraud or conflicts, and timely availability of data.

Since databases of cadastre and LAS reside in different organisations and data are gathered using different sources, the data quality needs to be transparent for users and stakeholders. Different elements of geographic data quality must be defined like positional quality, temporal quality, completeness, data status, logical consistency, lineage and timeliness (FGDC, 1994; Stanek and Frank, 1993).

4 Case study of LAS situation in Pakistan

The land administration system in the Indo-Pak sub-continent is very old. The *Arthsastra* is supposed to be the first Indian work to mention the village officers known as *Gopa* that are responsible for preparation of various registers for the village fields, transfers, and due taxes but that was at a very rudimentary level. Attempt to reform the system was first made by *Sher Shah Soori* (1534–1545) whereby land was categorized, measured and a schedule of crop rates fixed. The system was reformed during the Mughal *King Akbar* reign (1556–1605). *Todar Mal* as an adviser to *King Akbar*, initiated the regularization of land record management for the first time and devised elaborate method for agricultural tax assessment on rational basis. The subsequent colonial rule by the British implemented the system on scientific lines whereby large scale cadastral surveys were conducted to demarcate the boundaries and extent of each individual landholding. Soil fertility was also classified to formulate and rationalize the levy and collection of land revenue from landholders of each and every village (Raza et al., 2005).

4.1 Description of LAS

The Land Administration System (LAS) in Pakistan is organized on the traditional system of land registers and maps that are organised and maintained at provincial level in all the four Provinces. The Board of Revenue (BOR) is the only organisation

in the country at provincial level which is mandated with all matters concerning the administration of land, collection of land revenue, preparation of land records and other land matters. The BOR is also the highest court of appeal and revision in revenue cases within the Province. In this paper, organisational structure of the BOR in the North-West Frontier Province (NWFP) is considered and discussed.

The organisational structure of BOR at provincial level in the NWFP as shown in the Figure 3 has three highest members, namely the Chief Land Commissioner (Senior Member Board of Revenue), Chief Settlement Commissioner (Member-I) and Provincial Relief Commissioner (Member-II) under the Provincial Revenue Minister.

The Chief Land Commissioner is responsible for recovery of government dues/ agricultural income tax, land revenue, water rate, ushr (religious tax), mutation fees, stamp duty, registration fee, copying fee, and arrears relating to banks, Agricultural Development Bank of Pakistan and cooperative societies. He frames the laws/rules/ policies relating to the revenue matters and also provides guidelines for maintenance of record-of-rights, periodical record for use of the right-holders/revenue department. He also supervises revenue work of Commissioners, Deputy Commissioners, Assistant Commissioners and other officers/courts in the province. He notifies new administrative units such as divisions, districts, sub-divisions, Kanungo, and Patwar Circles. Finally, he deals with all service matters relating to revenue staff.

The Chief Settlement Commissioner is responsible for preparation and execution of policies for disposal of state land for different purposes such as agriculture purpose in rural areas, residential purpose in rural/urban areas, commercial, industrial, charitable and religious purposes. He is also the appellate/ revisional authority for revenue cases.

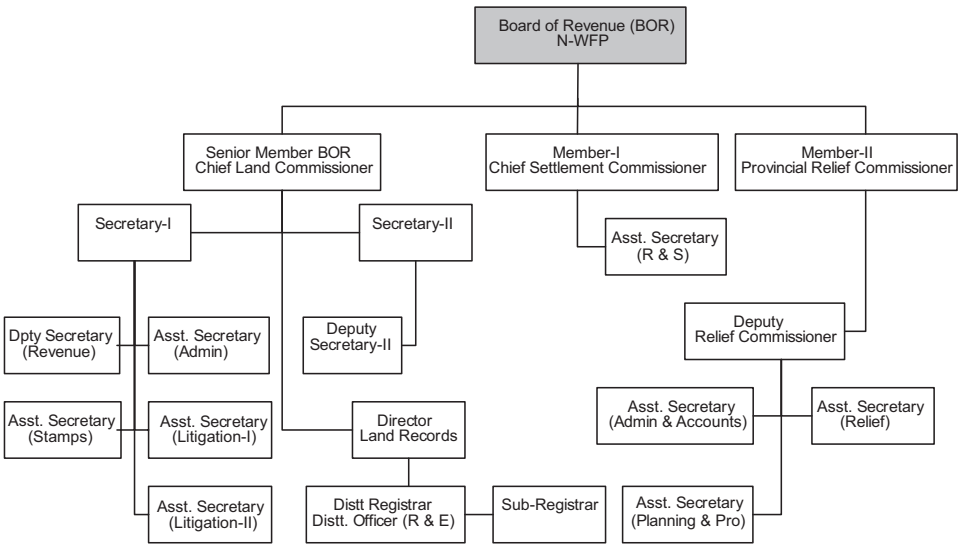

Figure 3. *Organisational structure of Board of Revenue at NWFP.*

The Provincial Relief Commissioner is appointed under the Prevention and Relief Act 1958. He has the responsibility for laying down policies and plans for disaster management in the province. He provides maintenance and restoration of law and order in areas affected by calamities for extending relief to the affected population.

In this paper, the functions of the Director Land Records (DLR) are considered for detailed analysis. The DLR under the direct supervision of the Chief Land Commissioner is in charge of all districts in the NWFP. In each district, the staff under the DLR includes the Chief Settlement Officer, Settlement Officer, Tehsildar, Naib Tehsildar, Kanungo and Patwari. The DLR supervises both the Patwari and Kanungo Agencies and inspects the record-of-rights and statistical record compiled through its means. He makes the posting of settlement Kanungos and Mappers. He checks the record of crop, price/weather reports, rain gauges, cattle census, crop experiments, and return of wages and of agricultural statistics carried out by the District Officers. He has control of certain charges such as mutation fees, copying and inspection fees of Patwaris record and all expenditures related to any work carried out by Kanungo and Patwari.

At tehsil level, a 'Tehsildar' is the name given to an officer in charge of a tehsil. Tehsildar is primarily a revenue officer and is responsible for the collection of land revenue and other dues payable to the government. He is constantly on tour to keep in touch with subordinate revenue officials to observe the seasonal conditions and condition of crops to take note of the difficulties of the cultivators. He draws up reports and recommends remission or suspension of revenue, brings the land records up to date, sits in court to settle disputes regarding tenancy, arrears of rent, ejectment of tenants, and entries in account books. The duties of the Tehsildar and Naib Tehsildar do not substantially differ except that a Tehsildar is vested with the powers of an Assistant Collector 1st grade, where as a Naib-Tehsildar is vested with the powers of an Assistant Collector 2nd grade.

The Kanungo supervises the work of Patwaris. He is the only link between the Tehsil Officer and Patwari. Each Tehsildar is assisted by an Office Kanungo whose main duty is to consolidate the information on different matters. Patwari is the lowest functionary of the revenue department. He maintains and updates the record pertaining to his Patwar Circle (revenue area). Patwari carries out field survey/crop inspection twice a year in the months of March (Rabi) and October (Kharif).

4.1.1 Legislative framework

There are several Laws and Acts that deal with the land, relationship between landlord and tenants, mortgagor and mortgagee, assessment and collection of land tax, agriculture income tax, local rates, and land acquisition for public purposes. All theses acts are administered and maintained by the BOR. The main acts are administered by the BOR as follows:

a. *Land Revenue Act 1967:* This Act was passed during the one-unit times but has been adopted and amended by all of the provinces together with the necessary changes. It deals with the issues of record of rights and land

revenue. The Land Revenue Act was revised in 1967 having XV Chapters and 184 Sections.

b. *NWFP Tenancy Act 1887:* All the provinces have adopted this Act. It deals with the relationship of landlord and tenants regarding produce of land and ejection of tenants due to non-payment of rent or produce by the tenant to the landlords. It is the only legislation which deals with various aspects of tenancy rights in Pakistan.

c. *Pre-Emption Act:* This law has become operative by revenue department after promulgation of para-25 of the Martial law Regulation (MLR-115) in 1972 which has given the first right of pre-emption to a tenant. Normal cases of pre-emption of land are dealt with by the civil courts. The revenue courts entertain only those cases in which a tenant brings a pre-emption suit. Pre-emption laws give certain preferential rights to neighbours in matters of sale of land.

d. *Land Acquisition Act:* This act deals with acquisition of land needed for public purpose and determining the amount of compensation to be paid on account of such acquisition. Whenever any land is acquired by the government for any public purpose or by a company, the proceedings are undertaken by the District Collector under the jurisdiction of this Act.

e. *Registration Act 1908:* This act deals with the registration of various documents (including those relating to land) with registration authorities. Normally revenue officers (as detailed in Land Revenue Act 1967) are declared as registration authorities. Under this act various documents are executed and registered in the office of Sub-Registrar like sale deeds, mortgage deeds, lease deeds, power of attorneys, partnership deeds, and other deeds. Deeds are entered in the relevant registers after the documents are properly stamped, checked and duly witnessed.

f. *Land Consolidation Act 1960:* In order to achieve better agriculture yields, the government has passed a law known as Land Consolidation Act 1960. The purpose of this act is that with the consent of the land owners, exchange of land takes place in a consolidated shape. It provides law relating to consolidation of holdings and the matter incidental thereto.

g. *Transfer of Property Act 1982:* This act deals with the transfer, sale/ mortgages charges, leases exchanges, and actionable claims in respect of property. This is very important piece of legislation in terms of disputes, but is normally ignored in land matters.

h. *Land Reforms Act:* The Land Reforms Laws have been introduced at various stages including the MLR-64 on 7.2.1959, MLR-115 on 12.3.1972 and

Land Reforms Act: II on 5.1.1977. The main aim of these land reforms was to determine the individual holdings to a manageable size for improving the lot of peasantry. This act gives rights to 'tenant-in-possession' of a certain property.

Several rules are available in order to implement the above acts as mentioned below:

- Land Revenue Rules
- Settlement Manual Rules
- Land Record Manual
- Land Administration Manual

4.1.2 Land administration processes

Different land processes are carried out by the BOR in the province at local level (*Patwar Circle*). The most common processes include as follows:

a. *Gardawari (Binomial Inspection) Process:* Before every harvest season, Patwari makes a survey in his Patwar Circle called Gardawari. The purpose of Gardawari is to collect information about the matured cropped area under different crops sown by farmers in a Patwar Circle. Gardawari provides information about the date on which inspection of each harvest should begin, the kind of soil (Qism Zamin), type of crop (Jins) sown, and the area sown (Raqba Kashta) with reference to the Khasra number (parcel identification number).

b. *Fard Malkiyat (Ownership Document) process:* The document showing ownership of land is called the "Fard Malkiyat". It is prepared by the Patwari concerned or district office on payment of fee as prescribed in schedule of 'copies of extract charges'. It is created from the Haqdaran Zamin (Jammabandi) Register and the incorporations made through any mutation (Intiqal). It is essentially just a copy of a particular part of the Haqdaran Zamin Register.

c. *Fard Badar (Error Correction) Process:* Whenever a clerical mistake is detected in current Jammabandi after it has been finally attested and filed, whether that mistake was originally made in that or any previous Jammabandi, the Patwari makes the necessary entries about it in the columns of the Fard Badar. The Fard Badar process is used for the purpose of avoiding the entry of a further mutation of inheritance in cases where in entering the original mutation some of the holdings of the deceased were inadvertently omitted.

d. *Register Haqdaran Zamin (Land Registration) Process :* Haqdaran Zamin formerly known as the Jammabandi Register is one of the most important documents of the record-of-rights as well as the periodic record in the rural areas. It primarily shows the right holders of land including details on owner,

cultivator, land, soil, and rent. It is created every four years for incorporating recent mutations (Intiqal) that have taken place since the last document was created from the previous Haqdaran Zamin (land owners) register.

e. *Mutation Process:* A mutation is a change in the agricultural land records. There are various types of mutations with different transaction characteristics. The mutation process is a process with many checks and balances. In mutation process, an oral report or application for mutation in writing is made to the Patwari. The key persons involved in mutation process are Patwari, Gardawar / Kanungo, and Teshildar or Naib Tehsildar (Revenue Officer). Changes in the recorded rights and interest are managed at the Patwar level. There are various types of mutations such as sale, gift, devolution of land, mortgaging, lease, and sub-division.

4.1.3 Maintenance of land records

The land record data is maintained at Tehsil offices whereby record sets are developed at the time of settlement. For maintenance of records, the Patwari has to maintain the following maps and registers:

a. *Field Map:* A map of a village called Mussavi is shown in Figure 4. It shows all the fields, duly measured and numbered in a village. This is basically a surveyed paper map at different scales depending upon village area, normally at a scale of 1″=40 *Karam* (about 1:2500 scale or so according to parcel sizes in the village). The yard-stick of measuring a field is called *Karam* which is 5.5 feet in length. Land parcels are labelled with their *Khasra Number* (parcel identification number) and dimension of each side. Each *Khasra Number* is owned by an owner. Mussavi is developed at the time of settlement. No changes can be made in this record-set till next settlement. Subdivision lines break up an irregular land parcel in different regular geometrical shapes. The subdivision lines are generally represented with dotted line and defined for the area calculation on the map.

b. *Field Book:* This contains the details of measurement of each field e.g. its length, breadth, diagonal detail, and worked out total area.

c. *Shajra Kishtwar:* All the Mussavis of a village are drawn up conjointly on a cloth (Lattha) for day-to-day use by the Patwari which is called Shajra Kishtwar.

d. *Register Haqdaran-e-Zamin (Jammabandi):* This is the most important register containing necessary particulars about ownership, tenancy, khasra number and its classification, source of irrigation, land revenue, and Rent (Lagan).

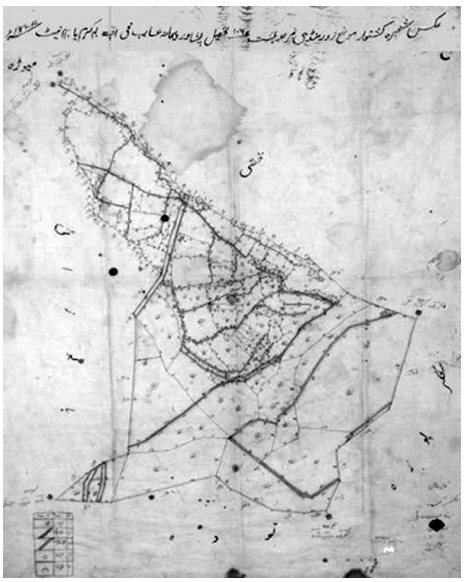

Figure 4. *A sample village map (Mussavi) in Mozah Zor Mandi, Peshawar.*

e. *Register of Mutations:* It contains particulars of all transactions which are entered by the Patwari and decided by the Revenue Officer.

f. *Register Khasra Girdawari:* This register contains details of the inspection of crop grown in each field in each harvest and all changes of ownership and tenancy. It is a track record of the possession of a particular patch of land which helps to resolve issues relating to ownership of that patch.

g. *Lal Kitab (Village Note Book):* This book has details about statistics of a village lands e.g. total area, area sown, assessment of land revenue, number of entered and attested mutations, notes about changes in cultivation, and ownership for the last four years. It also shows the population of a village and the approximate number of livestock. It is a statistical book of a village.

h. *Fard Bach:* It contains the details of the demand of land revenue and cesses thereon recoverable from each land owner in a village.

i. *Roznamcha Waqiati:* All the happenings about land affairs are recorded in this diary. For instance, hailstorm, severe rains, the reports of all transactions of land, encroachments on State Land, tours conducted by various revenue officers, and all other matters connected with land are entered in it.

In addition, there are nineteen forms of registers which are maintained by a Patwari but are not of much significance.

4.2 Stakeholders perception about LAS

Although the LAS in Pakistan is time tested and has remained functional for more than two hundred years, presently there are several concerns due to changes in societal needs particularly the LAS users views (Gauhar, 2004; Qazi, 2006; Raza et al., 2005; World Bank, 2005). Since this study is exploratory in nature, only a limited field questionnaire was used at this stage. Having studies on present organisational mandates, supporting laws, and processes and record (see section 4.1), field visits are conducted. During the fieldwork, many issues are raised verbally and a number of responses were also collected in writing. Major findings are organised below under the institutional and technical pictures of present LAS situation.

4.2.1 The institutional picture

Open interviews from six officers of BOR at headquarters and three at district offices show that the present LAS is fiscal in nature. It is mainly used for tax collection and is used as a means of generating revenue. The land records show information on who the tax payer is, how much the tax value is, how much the land (cost and size) is and where the location is. It does not clearly define the nature of rights in land for land owners. This means that legal security on land rights is not guaranteed.

Responses from the clients, including fifteen law professionals and land owners, show that they are not satisfied with the performance of the present LAS. As 93% of the clients indicate that there is room for corruption and unofficial changes in the land records due to heavy dependence on Patwaris for land transaction and other processes which affect the efficiency and effectiveness of the present LAS. 87% of the clients are not satisfied with the procedures and processes in the present LAS such as mutation. These results are in agreement with the literature and reports accessed in this fieldwork (Qazi, 2006; Qazi, 2005; World Bank, 2005).

All clients said that inaccuracy and complex nature of the present LAS exacerbates land-related disputes. This creates doubts about tenure security in land owners' minds due to which they can not use their property for any mortgage and loan from banks. Moreover, land transactions are relatively expensive and disputes about the correctness of land rights are caused among others by an inefficient and dispersed land record system (Qazi, 2005). The 46% of the BOR officials (thirteen officials including Patwaris and Naib Tehsildars) pointed out that the government does not provide any sufficient funding to Patwaris for stationary as the fund provided is very less which is provided according to the old rules and regulations followed from the British period. For this purpose then they are seeking to get money from stakeholders through different means which affects their performance.

87% of the clients accepted that official procedures in the present LAS are so complicated that this always leads to delays in court decisions that affects the land market directly or indirectly both at local and national level. 87% of the clients also admitted that the lack of credible information and insufficient cooperation of

land administration officials during land disputes generate considerable delays in resolving pending cases in courts. Mumtaz and Nosherwani (2006) also mentioned that the legal procedures in land cases are complex and the duration of a land case may go beyond the litigant's lifetime. 62% of the clients are not in agreement with the court procedures in the present LAS.

Although a Patwari is obligated to appear in court in all land-related inquiries as responded by 92% of the thirteen land administration officials during the fieldwork study, 87% of the clients pointed out that the land administration officials do not provide in-time cooperation during land related disputes. However, as pointed out by 92% of the land administration officials, the workload on a Patwari makes it impossible for him to perform his duties in a better way. Moreover, 61% of stakeholders said that BOR does not have sufficient infrastructure and manpower to deliver all their services in an efficient manner.

Moreover, land record maintenance takes place through an intricate system which involves several levels of administration as mentioned by 46% of the land administration officials. For example, all changes of ownership, use or other dealing with land is recorded by the Patwari but the records have to be checked and forwarded by the Kanungo and approved by the Naib Tehsildar or Tehsildar. These make the process time consuming and always lead to delays at the user end.

4.2.2 The technical picture

It is evident from responses of 100% of the land administration officials that the present land records are in paper format. These land records are quite outdated and there is a lack of updated geographical information data. 92% of the BOR respondents said that there is no latitude/ longitude information on the cadastral maps which creates a gap between the map and the register to present the reality on the ground as pointed out by 67% of the clients.

Information about the record-of-rights is originally established on the basis of a detailed field survey and includes a map of each village showing the position and boundary of each parcel. All these graphical information is intended to be updated every 25–35 years which is not in accordance with the rapid changes in developmental works in the society. The agricultural land in many areas is still recorded in the name of a person who passed away long ago and whose legal successors are the owners but whose names are not entered in the land records (Khalid, 2002). It is said by 100% of the BOR officials that record-of-rights are to be updated once every four years which affects the efficiency of the LAS and slows down the land transaction business in the land market. In fact, land records should be maintained at every instant of a land transaction.

67% of the clients responded that delays in most of the land disputes were due to insufficient knowledge and information about the land. Moreover, 87% of the clients argued that a Patwari does not provide correct and timely information in all land related disputes. 93% of the clients said that land related disputes can be solved easily in-time if the information on land is provided correctly by the BOR officials in a timely fashion.

100% of the clients responded that most of people were not aware of the land related procedures and fees defined by the BOR. 92% of the BOR officials agreed that no effort is carried out by the BOR to publish any printed information for public awareness about land related procedures, basic steps, and rules for land transactions. Thus the public is not aware of who has to be approached for an appeal or who is responsible for what at different levels of the land administration agency.

The MBR said that less education & training facilities are presently available for training BOR staff and officials. He said that there is only one training school for the whole Board of Revenue to train their staff. He also said that educational and training programs do not have sufficient capacity.

According to 93% of the clients, land registers and cadastral maps are not in good condition which restricts their use for producing an efficient land market. 73% of the clients accepted that ownership information in land registers is not correct, which creates doubt in people's mind about their tenure security.

Moreover, the temporal archives (land record rooms) are only stored at district level as mentioned by all of the BOR officials. There are still occasions when the entire record was wiped out due to fire or flood in the past. During a field visit in the Chitral district, it was observed that the methods used for land surveying were quite old and time consuming even impossible sometimes when there were harsh weather conditions. Due to this reason, no land records are prepared by the BOR in some remote areas and no settlement surveys have been carried out in those areas for the last sixty years.

100% of the clients and 92% of the BOR officials agreed that by introducing newer technologies into the present LAS, an improvement in its quality and performance will result.

5 Lessons learned and developing a framework for improving the quality

From the fieldwork study in exploratory nature, the following elements on the LAS in Pakistan are seen as vital and are thus presented briefly below. These are considered as the elements that need to be tackled for improving the quality of LAS in general, although national particularities might lead to adding one or more elements.

5.1 Institutional elements

5.1.1 Tenure security

Tenure security is assured by a multitude of factors, not only by the revenue record. In addition to the official documents, the social capital, community relations and one's position of power in the local context add to the authenticity of one's claim to land, leading to tenure security (Qazi, 2005). The land ownership concepts are clearly defined in Islam (Nuzhat, 2000) but still there is very little information on land tenure rights in the present LAS in Pakistan. Basically, the present LAS is fiscal in nature which is developed only for tax collection purpose. It does not clearly define the nature and extents of rights in land for the land owners and

tenants. In the present LAS the tenure security is based on interaction of various social, administrative and legal factors. This has affected the quality of the LAS for market demands as per users' needs and economy of the country.

5.1.2 Land policy

Land policy is a part of the national policy of a country. Such policy generally relates to economic development, social justice and equity, and political stability (UN-FIG, 1996). It also deals with the land use planning which exists neither at national, provincial, district, tehsil or local levels in Pakistan (SLMP, 2008). The coherency of national land policy with policies in other sectors reflects the quality of LAS that supports customers' needs and society's requirements. Hence, land policy needs to be updated as per society/users needs and technological demands with rapid changes in Geo-ICT to introduce these new tools in the LAS.

5.1.3 Legal framework

Legal framework of the BOR is very old. An analysis of legal and policy framework governing the land records show that land related matters are governed under several pieces of legislation and two parallel systems of adjudication under revenue courts and civil courts (Qazi, 2005). Although an independent judiciary exists in the country but still the land related disputes (such as boundary, land revenue, partition) are adjudicated by revenue courts while other matters relating to land title and ownership are adjudicated upon by civil courts in the present system. The land adjudication is undertaken under the mentioned laws as presented in section 4 under legislative framework. These regulations are set out in the *Land Record Manual*, specifying the functions of different categories of the land revenue officials. Moreover, some of the issues and entities mentioned in these laws have become outdated. This legal framework needs to be modified as per societal changes and user demands to make the processes more effectively and rapidly.

5.1.4 Land dispute resolution

Main types of land disputes include: the conflicts between various persons with a joint ownership of the same piece of land (because of inheritance), conflicts between smallholders on determining the boundaries of the fields, efforts to encroach upon one another's or communal or government land (often with the connivance of revenue officials), and rarely conflicts between land owners and tenants on the division of earnings from land or when the landowners want to evict the tenants. In all these conflicts a reference always needs to be made to the land records (Qazi, 2005). The land dispute resolution mechanism is very complicated and it takes very long time to resolve these land disputes. These mechanisms are high cost and time consuming that needs to be improved for better performance of the present LAS. These improved mechanisms can help in rapid resolution of land conflicts.

5.1.5 Organisation & mandates

The BOR is the only organisation in the country at provincial level with a mandate to manage land related data for tax collection and disputes resolution. There is no any other organisation in the country to deal with such land related activities. The land records are created and maintained at local level (village level) in the present LAS where most of the work is carried out by a Patwari and all the land records are in his custody. The expansion of Patwari's jurisdiction due to increasing subdivision of holdings and population growth make the land records unmanageable. There is a need to re-define land organisation's mandates and duties of each official to improve the quality of the LAS as per society/users needs.

5.1.6 Human resource development

Since LAS has the ability to influence societal and institutional behaviour (including that of individuals), professional competence and human resource development are an important component of LAS (Enemark and van der Molen, 2008). The existing number of BOR officials and staff is insufficient as compared to the increasing number of users' demand in the province. All the existing appointment procedures and criterion are followed from the British period that needs to be changed with changing environment as said by the SMBR.

5.1.7 Land administration processes

The complex system of maintenance of land records, cumbersome business process, hard-to-decipher language of land records, and general apathy towards the rights of the citizens has added to the mystification of land records. This creates fear in the minds of people about the potential manipulation of these land records (Qazi, 2005). The land administration processes in the present LAS are too old and time consuming e.g. a chain of six steps is followed in mutation process and requires 4–10 weeks for processing a single mutation. These processes need to be improved to provide quick services to users for fulfilling the demands of a society and land market.

5.1.8 Data organisation

Land record data include maps, field sketches, and registers that need to be kept up to date for getting land information. There are areas where no proper land records are prepared due to absence of the consolidation, settlement operations, and absence of new technologies. Moreover, improper maintenance of land record and interpolation in the record-of-rights lead to a lot of difficult land disputes. The land record data in the present LAS needs to be organised in a better way to provide full coverage of the province. There should be easy ways for sorting, accessing, and disseminating this data at local level for the users to produce efficient land market.

5.1.9 Co-ordination & data sharing

Data sharing and co-ordination among different organisation for accessing land related data are the important elements of LAS quality. The civil courts are not properly trained in revenue laws especially in handling of maps and revenue/land

records which are very complicated in nature. In this case information sharing can play an important role to resolve land disputes in civil courts timely. Furthermore, sharing of land record data with other organisations such as agriculture, forestry, irrigation, and urban planning would remove tasks duplication in many cases to improve the quality of the LAS.

5.1.10 Financing & data cost

Availability of funds is a limiting factor in addressing land administration and land management issues as observed in this study while interviewing the BOR officials. Financing is an important factor that affects the quality of LAS to provide a sufficient push to run the system properly. These elements should be brought into consideration while improving the quality of the present LAS.

5.2 Technical elements

5.2.1 Strategic plans

The strategic level requires exclusive links with changing views of Geo-ICT. The relation between technology and strategic plan is very important as this affect the quality of LAS. The quality of LAS largely depends on two strategic elements. The first element is about the analysis of users' requirements including their roles. The second element is the adoption of latest technologies in land administration processes/services to achieve high quality of products that are easily accessible and reliable for land data supply. Strategic plans should be kept in mind while making the necessary changes in LAS and adopting new technologies.

5.2.2 Users' needs

With the passage of time always there is a change in users' needs and demands. The present LAS is quite old and new technologies should be adopted as per new requirements and demands at users end. While adopting the latest technologies in LAS, it is necessary to understand the users' needs and requirement so that the cost of the technology adoption must be reduced as much as possible.

5.2.3 Technology adoption

The adoption of latest technology plays a key role in improving the quality of LAS. Recent advances in the space based data capturing techniques (imaging) have revolutionized the field of cartography and mapping. The high resolution images acquired by satellites have augmented the pace of mapping and its updation by manifolds (Ajai, 2002). This technology adoption makes the system process quick and provides fast services at the users end to fulfil land market needs for enhanced economy generation and user satisfaction. Moreover, the use of historical images can also help in resolving some land disputes.

5.2.4 Education and training

The existing training facilities are not sufficient to fulfil the demands of adopting new technology in the system. Less education and training facilities are presently

available for training the BOR officials. There is only one training school for the whole Board of Revenue to train their officials. Furthermore, no research and development is carried out in the field of cadastre and LAS in any university or institute at provincial level.

5.2.5 Land information system design

Information system design concepts for LAS in data/process modelling are the most prevailing elements in term of organisational structure. They relate how the quality data are gathered, processed, stored and disseminated at affordable cost with many data access points such as a front desk or the internet. System design concepts should be brought into consideration while improving the quality of LAS.

5.2.6 Workflows for land administration processes

Workflow management and secured databases are the basic components of functional LASs. Standard operating instructions for each step of workflow should be developed and implemented as a part of total quality in the framework. Workflows should be considered while improving the quality of LAS as it will provide a line of action for land agency staff to carry out their tasks.

5.2.7 Quality standards

The traditional/existing land information system is entirely based on maps and land records that are in paper formats. These records have no surveying standards and often have quite outdated information which restricts their operational usefulness in extracting precise information on land parcels and ownership. Quality standards should be defined for these products and processes so that less effort would be required while the data is accessed, shared and transferred.

5.2.8 Services & products

The services and products of LAS should be in time so that users' needs should be fulfilled within time. Services can also be improved to use the new techniques e.g. photogrammetric (or remote sensing) techniques using the aerial photographs or high resolution satellite images can be used as an alternative to the traditional land surveying approach for spatial data acquisition. In this case most measurements can be done in the office (Tuladhar, 2005c). The front disk services can also improve the quality of services at users end to get their desired products in an easier way.

5.3 Framework for analysing aspects of LAS

Studying the above lessons learned on the elements, a framework for analysing the aspects of LAS is presented in Figure 5. The concerned elements are listed under either institutional or technical aspects that play key role for analysing and then improving the quality of LAS. This framework defines the relationship between different parts of the institutional and technical elements. It includes all the elements relating to the institutional as well as the technical part that must

be brought into consideration to improve the quality of LAS. While improving the quality of LAS, it is further necessary to understand these elements of the institutional and technical aspects in more detail as per users' needs and society requirements.

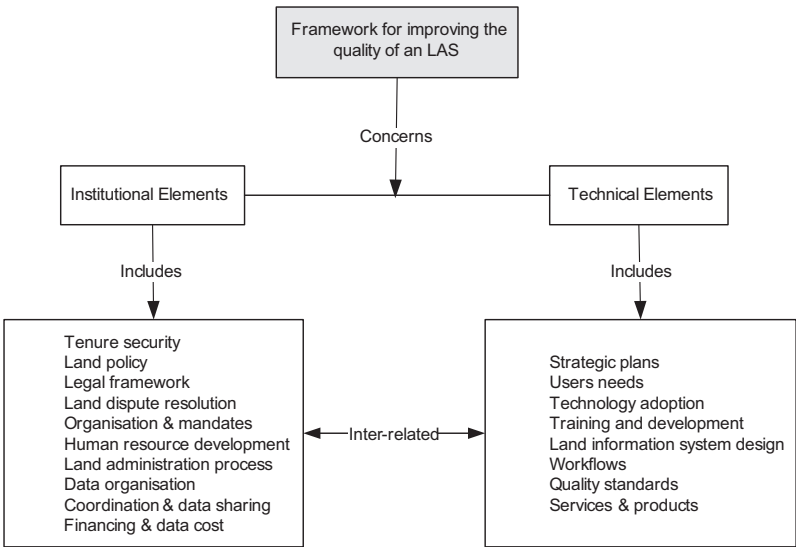

Figure 5. *Framework for analysing aspects of LAS .*

6 Conclusions

There is always a demand for improving the quality of LAS due to rapid changes in technology and users needs with changing societal demands. This holds especially in countries where the present LAS is based on traditional approaches, and can be seen as deteriorated, as in Pakistan. The quality of LAS depends on the institutional as well as the technical aspects. A selection of elements on the institutional as well as on the technical sides is made to contribute to improving the quality of the present cadastral data and LAS. Through considering these elements for improving the quality of LAS, the institutional and technical aspects and their relationships, can be analysed. The quality framework made up of these elements further helps to model the dynamics of the cadastral information infrastructure and LAS within country's social and cultural norms and values as per the users' needs.

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References

Ajai. (2002) *"Mapping for Micro-Level Planning: The Issues & Challenges"*. Indian Cartographer 22 (Convergence of Imagery, Information & Maps).

Aleksic, I., Lemmen, C.H.J. and Dabass, S. (2005) *"Technological aspects of land administration systems in the West Balkans"*. FIG Working Week and GSDI 8 : From Pharaohs to Geinformatics, 16–21 April, Cairo. International Federation of Surveyors (FIG). p. 17.

Auzins, A. (2003) *"Institutional Arrangements: A Gate Towards Sustainable Land Use"*. The Commons in Transition: property on natural resources in CEEC, Prague.

Auzins, A. (2004) *"Institutional Arrangements: A Gate Towards Sustainable Land Use"*. Nordic Journal of Surveying and Real Estate Research 1, pp. 57–71.

Barnes, Grenville. (2003) *"Lessons learned: an evaluation of land administration initiatives in Latin America over the past two decades"*. Land Use Policy 20(4), pp. 367–374.

Dale, P. (1985) *"Evolution and development in cadastral studies"*. The Canadian Surveyor 39(4), pp. 353–362.

Dale, P. (1990) *"Strategies for Cadastral Reform"*. National Conference on Cadastral Reform '90, 10–12 July, Melbourne, Australia. pp. 292–299.

Enemark, S. and van der Molen, P. (2008) *"Capacity assessment in land administration"*, FIG publication 41, International Federation of Surveyors (FIG), Frederiksberg. p. 35.

Feagin, J., Orum, A. and Sjoberg, G. (1991) *"A case for case study"*, Chapel Hill, NC, University of North Carolina Press.

Feder, G. and Feeny, D. (1991) *"Land tenure and property rights : theory and implications for development policy"*. World Bank Development Review 5(1), pp. 135–153.

FGDC. (1994) *"Content Standards for Digital Geospatial Metadata"*(FGDC-STD-001-1998), Federal Geographic Data Committee, Washington, D.C. http://geology.usgs.gov/tools/metadata/standard/metadata.html.

FIG. (1995) *"FIG statement on the cadastre"*, FIG publication;11, the International Federation of Surveyors (FIG), Belconnen. p. 22.

Gauhar, S. (2004) *"Mapping Pakistan – Taking a Leaf Out of Sher Shah's Book"*. Blue Chip, Islamabad 1(3).

Gulaid, M. A. (1990) *"Effects of Islamic Laws and Institutions On Land Tenure with Special Reference to Some Muslim Countries"*, Islamic Research and Training Institute, Jeddah, Saudi Arabia.

Gulaid, M. A. (1991) *"Land Ownership in Islam"*, Islamic Research and Training Institute, Jeddah, Saudi Arabia.

Henderson, J. C., Thomas, J. B. and Venkatraman, N. (1992) *"Making sense of IT: Strategic Alignment and Organizational Context"*. Cambridge Massachusetts, Centre for Information Systems Research, MIT.

Khalid, A. K. (2002) *"Guaranteeing Title to Land"*. DAWN.

Mumtaz, K. and Nosherwani, M. M. (2006) *"Women's Access and Rights to Land and*

Property in Pakistan", Shirkat Gah – Women's Resource Centre, Karachi. http://www.shirkatgah.org/Women_access-rights-to_land_property_in_Pakistan.pdf.

North, D. C. (1990) *"Institutions, institutional change and economic performance"*, Cambridge University Press, New York.

Nuzhat, I. (2000) *"The Concept of Land Ownership in Islam and Poverty Alleviation in Pakistan"*. The Pakistan Development Review 39(4), pp. 649–662.

Onsrud, H. J., Jeffrey, K. P. and Azad, B. (1992) *"Case Study Research methods for Geographic Information Systems"*. Urban and Regional Information Systems Association (URISA) 1(Spring(Part 4)), pp. 32–43.

Paré, G. (2001) *"Using A Positivist Case Study Methodology to Build and Test Theories in Information Systems: Illustrations from Four Exemplary Studies"*, Groupe de recherche en systèmes d'information (GReSI).

Qazi, M. U. (2006) *"Computerization of Land Records in Pakistan"*, LEAD International, Islamabad.

Qazi, Mohammad Usman. (2005) *"Social Assessment of Land Record Management Information System Programme"*. Background Paper, The World Bank Pakistan Country Office, Islamabad, Pakistan.

Radwan, M. Mostafa, Onchaga, Richard and Morales, Javier. (2001) *"A structural approach to the management and optimization of geo-information processes"* 41, European Organization for Experimental Photogrammetric Research (OEEPE), Frankfurt am Main. Bundesamt für Kartographie und Geodäsie.

Raza, Fawad, Almas, Muhammad and Ahmed, Kamran. (2005) *"Land Records Information Management System"*. 25th Annual ESRI International User Conference, San Diego, California.

Scott, W. R. (1995) *"Institutions and Organizations"*, SAGE Publications, Thousand Oaks, California.

Sevatdal, Hans. (2002) *"Land Administration and Land Management: An Institutional Approach"*. Land Administration for the New Millennium, FIG XXII International Congress, Washington, D.C. USA.

Silva, Maria Augusta and Stubkjær, Erik. (2002) *"A review of methodologies used in research on cadastral development"*. Computers, Environment and Urban Systems 26(5), pp. 403–423.

SLMP. (2008) *"Barriers to Sustainable Land Management in Pakistan"*, http://www.slmp.org.pk/slm_barriers.asp.

Stanek, H. and Frank, A. U. (1993) *"Data Quality – Necessary Complement for GIS Based Decision Making"*. 25th International Symposium: Remote Sensing and Global Environment Change, Graz, Austria.

Steudler, Daniel. (2006) *"Swiss cadastral core data model – experiences of the last 15 years"*. Computers, Environment and Urban Systems 30(5), pp. 600–613.

Steudler, Daniel, Rajabifard, Abbas and Williamson, Ian P. (2004) *"Evaluation of land administration systems"*. Land Use Policy 21(4), pp. 371–380.

Tan, W. (1999) *"The development of cadastral systems: an alternative view"*. The Australian Surveyor 44(2), pp. 159–164.

Ting, Lisa and Williamson, Ian P. (1999) *"Cadastral Trends: A Synthesis"*. The Australian Surveyor 44(1), pp. 46–54.

Tuladhar, A. M. (2005a) *"Innovative Land Tools, Surveying and Geo-information Technologies"*. Global Network for Pro-poor Land Tool Developers, Stockholm, Sweden, Sida and UN-HABITAT.

Tuladhar, A. M. (2005b) *"Institutional and Technical Aspects of Cadastral Systems: Experiences and Reflections"*. Map India 2005, New Delhi, India.

Tuladhar, A.M. (2002) *"Developing a framework for cadastre and land registration systems in land administration organizations"*. XXII FIG International Congress, April 19–26, Washington, D.C., USA. pp. 19–26.

Tuladhar, A.M. (2004) *"Parcel Based Geo-information System: Concepts and Guidelines"*. ITC Dissertation;115, PhD Thesis, p. 252, ITC, Enschede.

Tuladhar, A.M. (2005c) *"Innovative use of remote sensing images for pro poor land management"*. Secure land tenure : new legal frameworks and tools in Asia and the Pacific, Bangkok, Thailand, International Federation of Surveyors (FIG).

UN-ECE. (1996) *"Land administration guidelines: with special reference to countries in transition"*, United Nations (UN), Geneva. p. 94.

UN-ECE. (2005) *"Land Administration in the UNECE Region: Development trends and main principles"*(ECE/HBP/140), United Nations Economic Commission for Europe, New York and Geneva.

UN-FIG. (1996) *"The Bogor Declaration on Cadastral Reform"*. United Nations Interregional Meeting of Experts on the Cadastre, Bogor, Indonesia, A joint initiative of the International Federation of Surveyors (FIG) and the United Nations.

van der Molen, Paul. (2003) *"Institutional aspects of 3D cadastres"*. Computers, Environment and Urban Systems 27(4), pp. 383–394.

van der Molen, Paul. (2006a) *"The Importance of Enhancing Land Registration and Cadastre: Some General Considerations"*. Map India 2006, New Delhi, India.

van der Molen, Paul. (2006b) *"Unconventional approaches to land administration : the need for an international research agenda"*. 5th FIG regional conference for Africa : promoting land administration and good governance, 8–11 March, Accra, Ghana.

van Oosterom, Peter, Lemmen, Christiaan, Ingvarsson, Tryggvi, van der Molen, Paul, Ploeger, Hendrik, Quak, Wilko, Stoter, Jantien and Zevenbergen, Jaap. (2006) *"The core cadastral domain model"*. Computers, Environment and Urban Systems 30(5), pp. 627–660.

Williamson, Ian P. and Fourie, Clarissa. (1998) *"Using the Case Study Methodology for Cadastral Reform"*. Geomatica 52(3), pp. 283–295.

World Bank. (1998) *"World Development Report 1998–1999"*, World Bank, Washington DC.

World Bank. (2001) *"Land policy and administration: lessons learned and new challenges for the bank's development agenda"*, World Bank, Washington, DC.

World Bank. (2005) *"Land Records Management and Information Systems Program (LRMIS-P) Province of Punjab"* (No. AB1469), World Bank.

Zevenbergen, J. A. (1998) *"The Interrelated Influence of the Technical, Legal and Organisation Aspects on the Functioning of Land Registration (Cadastre)"*. FIG XXI International Congress: Commission 7, Cadastre and Land Management,, July 19–25, Brighton, England.

Zevenbergen, J. A. (2002) *"Systems of land registration : Aspects and Effects"*. Netherlands Geodetic Commission NCG: Publications on Geodesy : New Series;51, PhD Thesis, p. 223, TU Delft, Delft.

Zevenbergen, J. A. (2004) *"A Systems Approach to Land Registry and Cadastre"*. Nordic Journal of Surveying and Real Estate Research 1, pp. 11–24.