WHY "WCS: A WORLD CADASTRE SUMMIT?"

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1. INTRODUCTION

Today as all of you aware of that Cadastre is a big challenge in all aspects of the land-related progression, from the basic property use to geo-data assembly, analysis and dissemination. It plays great roles in allowing people, governments, local communities, non-government organizations and the academicians to make progress in addressing many of the world's most pressing land-use and recording by land problems. The Cadastre has ability to support human lifetime in a better way, but failures are still existing. Is the cadastre really being used well and changed our social, economic and cultural creations and future of our world so far? So, we have to think globally about the cadastre for a better land use for our common future. Now it is the time to make a worldwide road map for the Cadastre itself… For the first time ever, this congress will bring together cadastral people, land administrators, politicians, scientists, investors, geo-data providers and GIS/LIS/SDI users dealing with cadastre from all over the world to share their ideas.

Key words: Cadastre, Land, Property, Land administration.

2. The Importance of Land

Land had represented wealth and power from the first settlement to the end of 1700s. As a result of the increase in the capital after the industrial revolution, land became a good that can be traded rather than a source of wealth. After 1945, effective environmental planning need emerged especially in Europe's urban areas and land was considered as a scarce source after the population growth as a result of the reconstruction works. In 1970s, due to the insufficient food production and scarcity in the sources, effective management of rural areas emerged as an increasing need.

Thus, land was seen as "socially" scarce source and the need to manage this source effectively was frequently mentioned in the international community. In this context, plenty of meetings and activities were organized by several global organizations, especially by the United Nations and the European Union.

Stated in the "Brundtland Report" by "The World Commission on Environment and Development" in 1987 and described as "Meeting today's needs by taking future generations into consideration", "Sustainable Development" was widely accepted throughout the world. Land can be used with a sustainable development approach only with good land administration and management. Healthy land policy is essential to ensure effective land administration and

management. One of the prerequisites of developing land policies is to have sufficient land knowledge.

This relation between land knowledge, policy, administration, management and use has a dynamic structure just as the relation between humanity and land does. Countries should regularly revise their land knowledge administration regimes, land policies, land administration and management systems and land use in order to keep up with this dynamism. They less frequently revise such field as land policies where change and development occur slowly; however, they more frequently revise such field as land administration, especially land management.

Some of the reasons that make Land Administration Systems – LAS dynamic are as follows; these systems are directly affected by rapid technological developments, they are the main source of land information, including land policy making, that all public institutions and private sector need, and government wants to provide more effective service by using these systems. "Cadastre" is one of the main components of LAS. In addition, as the main source of data concerning the land use, "topographical map producing" and "land valuation" activities fall within the field of cadastre.

A well-functioning cadastre guarantees property, reduces land conflict, supports real estate taxation, ensures loan security, protects land sources, monitors environment and ameliorates urban planning and infrastructural development. Today, the most important duty of cadastre is to support sustainable development.

Working towards international agreements that respect the interests of all and protect the integrity of the global environmental and developmental system on land, Recognizing the integral and interdependent nature of the Earth, our home, Proclaims that: As stated by the United Nations in 1996;

Land is the ultimate resource, for without it life on earth cannot be sustained. Land is both a physical commodity and an abstract concept in that the rights to own or use it are as much a part of the land as the objects rooted in its soil. Good stewardship of the land is essential for present and future generations.

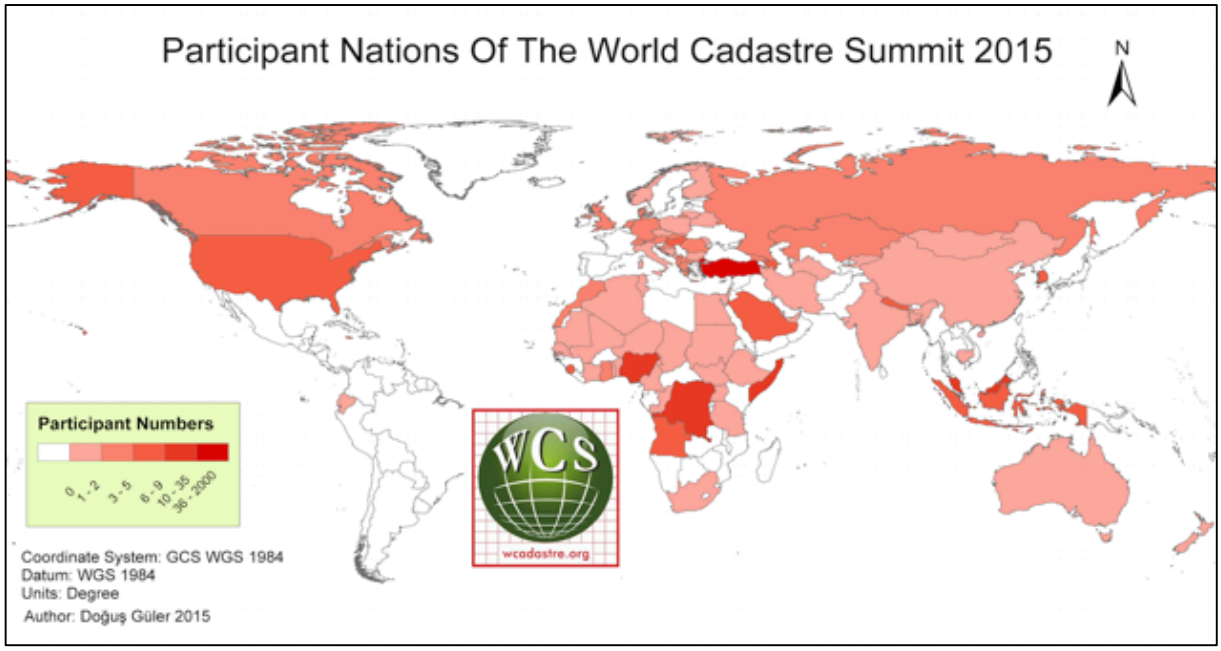
From a legal perspective, land extends from the centre of the Earth to the infinite in the sky. In the present discussion, however, the focus will be on that volume of space that encompasses the surface of the Earth, all things that are attached to it, and the rocks and minerals that are just below it. Land includes areas covered by water such as seas and lakes, all building and construction, and all natural vegetation.

3. The need for a WCS

Now it is the time to make a worldwide road map for the Cadastre itself. For the first time ever, a congress will bring together cadastral people, land administrators, politicians, scientists, investors, geo-data providers and GIS/LIS/SDI users dealing with cadastre from all over the world to share their ideas. Thoughts that related to any aspects of the cadastre proper for land-use people are came to the WCS-CE. Presentations focused on the national and international

policies, standards, methodologies, tools; and any developments involved with cadastral developments and new ideas and technologies. The call for contributions that cover land-related functions in any part, intersection of phases, and/or integration of phases of Surveying, Geomatics, Planning, Land Management, GIS, Geo-Spatial Information, Data Standards, Land Law and Policies, Cadastral Training and Developers etc..

The WCS-CE can cover all details in cadastral fields and aims to bring together cadastre specialists all over the World. Main aim is to discuss the latest issues and developments on the Cadastre in a scientific platform and to bring together researchers, experts in many countries. The WCS-CE is most timely and, in addition to hearing presentations from experts and interesting speakers, participants will be able to attend in a number of Panel Discussions, Tutorials, Workshops, Keynote Speakers, Technical Tours, Exhibitions, Social and Cultural Events particularly during the congress days. In addition, a special "Cadastre Summit" section can be held with the contribution of authority delegates of the world-nations to make a global declaration on the cadastre.



4. Conclusions

Many countries already recognize the need for a cadastral system. Agenda 21 and the HABITAT II Global Plan of Action provide additional justifications for establishing and maintaining appropriate cadastral systems to serve the different needs of nations and their citizens. Also, WCS recognize the statement of “FIG- International Federation of Surveyors Statement on the Cadastre”. As stated by the FIG;

This statement of the International Federation of Surveyors highlights, from an international perspective, the importance of the Cadastre as a land information system for social and economic development. It gives examples of legal, organisational, and technical issues that

need to be addressed in order to establish and maintain a Cadastre. The statement also describes some of the different roles that surveyors play in the management and operation of a Cadastre. This statement does not recommend a uniform cadastre for every country or jurisdiction.

A Cadastre is normally a parcel based, and up-to-date land information system containing a record of interests in land (e.g. rights, restrictions and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, the ownership or control of those interests, and often the value of the parcel and its improvements. It may be established for fiscal purposes (e.g. valuation and equitable taxation), legal purposes (conveyancing), to assist in the management of land and land use (e.g. for planning and other administrative purposes), and enable sustainable development and environmental protection.

TOWARDS A FOURTH WAVE OF PROPERTY REFORM

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"This was one of my prayers: for a parcel of land not so very large, which should have a garden and a spring of ever-flowing water near the house, and a bit of woodland as well as these."
Horace, 1st century B.C.

ABSTRACT

The first wave of property reform after the Second World War occurred largely in South-east Asia, was concentrated in Japan, Taiwan and South Korea, and was largely based on institutions and structures imported from the West. A second reform, with a strong ideological flavour, was a phenomenon of the land reform movements that peaked in the 1960s and early 1970s. Subsequently, a third wave of property reform emerged under different guises in a large number of jurisdictions including Russia and Eastern Europe, Thailand, Peru, South Africa and elsewhere. This was fuelled in part by a renewed interest in the importance of property institutions to development and by new technology and systems imperatives. In each wave lessons were learned and progress made, but as well limits were tested and failure was significant; currently only an estimated 30% of properties worldwide are covered by formal land administration solutions. Now a fourth wave of property reform is emerging. This presentation will include a retrospective look at property reform over the past six decades and an examination of some of the emerging challenges and trends.

Keywords: history of property reform, fourth wave of reform, emerging leadership

INTRODUCTION

These notes have been prepared as background material for a presentation scheduled for presentation to The World Cadastre Summit in Istanbul. They build on an earlier presentation given to the FIG International Congress in Sydney (McLaughlin, 2010).

The Sydney presentation provided a simple framework for reviewing the postwar history of property reform and the concomitant history of developments in the field of land management. That history was divided up into three overlapping chapters, or waves, and built upon a narrative of emerging interests in the importance of property to development, the subsequent investments in major initiatives, some early and important success stories, followed by a growing awareness of the challenges and limits to this aspect of development. Along the way, an unfortunate side effect has been that the rich elite have too often high jacked the administration services to secure land assets at the expense of the poor and the most vulnerable in society.

The framework was, and is, overly simplified and requires careful attention to the significant caveats and limits associated with such an overarching narrative. However, it was generally well received at the time and has provided a useful platform for discussing the impact of property reform on both economic and social development and for assessing lessons learned.

In this presentation, we'll briefly rehearse this history, with a focus primarily on the third chapter of reform (roughly from the late 1970s). The discussion will examine some of the key drivers (especially technology advances, systems developments in a number of Western countries, coupled with a renewed interest in the role of property and land reform within the international development community).

After a brief historical tutorial, the presentation will then review some of the major lessons learned over the past thirty years and the current consensus (to the extent that this is possible or indeed desirable) on the importance and direction of property reform. For example, the Western hasn't transplanted well into the dynamic environments of developing countries with high levels of urbanisation, leaving citizens exposed to eviction and land grabbing.

Next, and perhaps most importantly, we will attempt to make the case that we are now witnessing the movement towards a fourth wave of reform, based in part on lessons learned, new technologies, and new development priorities, but also with both the intellectual and professional leadership increasingly coming from a group of so-called middle income countries. Put simply, we in the West are now passing the torch!

Finally, and very briefly, we also want to discuss the role of the surveying profession throughout this history. In the past, both authors have periodically expressed our concerns about the profession, but (subject to plenty of caveats) in this presentation we will advance the argument that surveyors are actually rather well placed to make a significant contribution going forward.

FRAMING THE HISTORICAL NARRATIVE

The Sydney presentation provided a fairly detailed review of the postwar land and property reform story, primarily from an active practitioner perspective. It began (no surprise) with the reforms immediately after World War 2 and especially in South Asia, primarily Japan, Taiwan and South Korea. While these reforms, if remembered at all, are often seen as part of a policy to contain communism and weaken local elites, rather than as one of the most important measures taken for market economies to flourish.

Indeed, over the years the Asian examples have featured in the core narrative about the importance of fundamental land reform to the economic development agenda. And with good reason. But we have also come to appreciate the flaws in these reform programs, programs imposed from without (a la Douglas MacArthur in Japan) with limited sensitivity to the social and cultural norms within which they were implemented, and embedded with institutional flaws that in some cases only emerged decades later. These early success stories largely failed to be replicated elsewhere, the Swynnerton Plan in Kenya often cited as a cautionary example, and this first wave of reform gradually grew to a close.

The second wave of land reform, which featured prominently in the 1960s and 1970s, had a very strong Latin American dimension (McLaughlin, for example, was a graduate student at the University of Wisconsin during the time when the Land Tenure Centre was actively involved with Allende's government in Chile) and was very much ideologically driven. As one would imagine, this chapter has proven to be very complicated and controversial. Although dated, a great introduction to that period for anyone interested is Russell King's *Land Reform: A World Survey* (1977). For a detailed critique of this period, see Dasgupta (2010).

Whatever successes may be attributed to this era, the overall impact was to sow doubt on the motives and concerns of property reform as part of the development agenda, and there was a wholesale retreat from the field by the funding agencies.

But not for long. By the late 1970s a new generation of technocrats and development specialists were rediscovering the fundamental importance of land and property (and more often than not were trained by a distinguished cadre of pragmatic specialists who came of age in the immediate postwar era). Thus began a third wave of reform which we discuss in somewhat more detail in this paper.

THE THIRD WAVE

This most recent chapter in the property reform narrative has a large number of strands, from the major World Bank investment in property projects such as Thailand, to the East European reforms in the post-Soviet era, to Latin American jurisdictions such as Peru (with its language of formalization), to South Africa and elsewhere.

Early drivers in this chapter included:

- a renewed interest in the importance of property in Western countries (and especially its relationship to the emerging environmental agenda);
- the importance of land and property reform to the international economic agenda (beginning with the focus on economic liberalization and the so-called Washington consensus through to the Millennium Development Goals);
- the need for social stability following the collapse of communism (which led to fast, innovative programs for the restitution of land and compensation to the former owners).

The World Bank in particular played an especially important role in shaping this agenda, arguing for example in its 2003 Annual Report, that "increasing land rights for poor people is the key to reducing poverty and stimulating economic growth". This has been reflected through the World Bank funding loans of over US$1 billion to 40 land projects in 23 Europe and Central Asia countries in support of the land and property sector (Satana et al, 2014). This is the largest program of land reform the world has ever seen and has included: land privatization, especially farm restructuring; business, housing and enterprise privatization; restitution; systematic registration and improved services. New programs include land consolidation, NSDI, state land management, planning, property taxes and e-government.

Another important dimension in this third wave was the re-emergence of land administration as a significant field of endeavour. Early attempts at automation, especially in the field of land

registration, were followed by the introduction of modern systems engineering concepts and the evolution of new models for the integration of the various components of land administration (including surveying, registration, valuation and so-forth). Beyond all of this, the concept of the land parcel as a fundamental window into the information world (introduced, for example, by McLaughlin et al in his work from the multi-purpose cadastre through to the spatial data infrastructure concept and published in a series of seminal US National Academy of Sciences publications.) Out of all of this came a series of major programme initiatives in Canada, Australia, Scandinavia, and elsewhere, led by such iconic programs as the Land Registration and Information Service (LRIS) in the Maritime Provinces of Canada. These influential initiatives provided the framework and thinking for citizen services and citizen engagement in land management under the emerging e-government agenda, and were forged with increasing partnerships with the private sector.

Building on this brave new world, and with the emergence of a new generation of creative and motivated land administration officials, focus shifted to the developing world. The Thailand Land Titling Project (an initiative of the Royal Thai Government, the World Bank and the Australian Agency for International Development) can serve as perhaps the iconic initiative of this chapter, receiving the World Bank Award for Excellence in 1997. The project stood out for its ambitions goals (including both institutional strengthening of the Thai Department of Lands and its commitment to delivering approximately 13 million titles to Thai landowners); it also became a major international reference site due to the extensive assessment of its progress by Gershon Feder and his colleagues (see, for example, Feder et al. 1998.)

The intellectual foundations for this chapter built on a significant post-war literature, especially the richly documented case studies of organization such as FAO and the incredibly useful depositories provided by some very special libraries (the Office International du Cadastre et du Régime Foncier in the Netherlands and the library of the Land Tenure Center at the University of Wisconsin come immediately to mind). As well, there was a small, but immensely influential professional practice literature represented (in the English-language) by such works as S.R. Simpson's *Land Law and Registration* (1976), a seminal work at the time which contained such memorable pearls of wisdom at "land registration is only a means to an end. It is not an end in itself. Much time, money, and effort can be wasted if that elementary truth be forgotten." Indeed!

The third wave of property reform has subsequently benefited from a series of extensive program reviews, which have explored (from a variety of perspectives) its significance to economic and social development under many difference circumstances. For example, Feder et Nishio (1999) undertook a rigorous examination of the benefits of land registration and titling, concluding that "there is convincing evidence from around the world that land registration has led to better access to formal credit, higher land values, higher investments in land, and higher output/income." They went on to note, however, that "there are prerequisites for land registration to be economically viable, and social aspects which need to be considered when designing a land registration system."

Following the significant investments in countries in transition in Central and Eastern Europe through the early 1990's, the UN Economic Commission for Europe collated the experiences in a set of land administration guidelines (UN ECE, 1997). This provided an important

framework to guide investments in land administration in the region and influenced the significant reforms implemented in the Baltic countries, especially Lithuania.

Further east in Central Asia, the World Bank provided significant loans to countries of the former USSR for land administration and management programs. The World Bank had learned that speed, innovation and Fit-For-Purpose were key characteristics of a new generation of land administration programs. The World Bank has enabled the implementation of some very successful programs in Kyrgyzstan, Russia and Georgia, for example. In Kyrgyzstan over 5 million parcels were registered in 3 years using para-surveyors and this resulted in the annual number of mortgages doubling between 2002 and 2007 and value increasing from US$85 million to $1billion; this represented about 30% of GDP in 2007. Georgia is now the number one in the World Bank's 'doing-business' league table for registering a property. The experience from these projects is influencing approaches in the developing world. The best example is Rwanda where a nationwide systematic land registration started after piloting in 2009 and was completed in 2013 using para-surveyors. 10.4 million parcels were registered and 8.8 millions of printed land lease certificates were issued. The unit costs were about 6 US$ per parcel. This is an example of a Fit-For-Purpose approach (FIG / World Bank, 2014) that is significantly influencing the fourth wave.

Closer to home, the Cadastre Modernization Project for Turkey, with major funding from the World Bank, provides a significant case study of the potential role of land administration reform to the broader e-government agenda (World Bank, 2015).

More recently, a systematic review of the quantitative literature on the effects of tenure formalisation in developing countries funded by the U.K. Department for International Development (Lawry and Samili, 2014) concluded that formal registration of individual land rights increases investment, productivity, and household consumption (although this review also included the important caveat that productivity had not risen as much in Africa as in Asia and Latin America).

These findings, coupled with a review of the literature on best practices and policy direction (the *Voluntary Guidelines on the Responsible Governance of Tenure* (FAO, 2012) providing an especially interesting and important example) will be briefly addressed in our talk.

The Committee on World Food Security has formally endorsed these guidelines, which resulted from an unprecedented negotiation process chaired by the United States, and which featured broad consultation and participation by 96 national governments, more than 25 civil society organizations, the private sector, non-profits and farmers' associations over the course of almost three years. The new guidelines provide a set of principles and practices that can assist countries in establishing laws and policies that better govern land, fisheries and forests tenure rights, ultimately supporting food security and sustainable development.

TOWARDS A FOURTH WAVE

The property reform story, and the crucial contributions being made by the land administration community, continues to evolve and feature prominently in the international development agenda.

And while much of the professional practice literature continues to be based on paradigms developed in the West, there is a significant and growing contribution by academics and practitioners based elsewhere (the recent paper by Demir et al (2015) et al being a good example).

But at a deeper level, we are also witnessing the evolution of a new narrative: about the nature and importance of property, the institutional and administrative underpinnings required and the role of citizens and civic society for the successful and sustainable implementation of reform

The beginnings of this new narrative date back decades. One is reminded, for example of the pioneering work done by Solon Barraclough and his colleagues at FAO a half a century ago on the need to recognize the importance of communal land tenures, and the overarching commitment to providing more equitable access to agricultural land. These themes were often marginalized in the heady days of the neo-liberal agenda, but are very much back on the table today.

Similiary, Hernando de Soto, a prominent Peruvian development economist has made a huge contribution to the way we think about property and its role in civil society through his framing of the narrative through the formal/informal lens. His work, from *The Other Path* (1989), through *The Mystery of Capital*, to his most recent documentary for Public Broadcasting in the US (*Unlikely Heroes of the Arab Spring)* have been especially successful in connecting with the most senior leaders in the political and business worlds.

Another major strand in advancing a fourth wave narrative relates to Deng Xiaoping and his rise to power following the Third Plenum of the Central Committee Congress of the Communist Party of China in December 1978. The household-responsibilty system and the famous experiments in Xiaogang village, Anhui, and subsequently in Sichuan and Anhui provinces, which led to dramatic increases in agricultural productivity and nationwide adoption since 1981 have fundamentally changed the world!

Furthermore, while there seemed to be a widespread perception in the West that China somehow created capitalism out of thin air, without the initial imperative of securing private-property rights and imposing limits on state power, in fact this view is wrong. As the economist Yasheng Huang from MIT has argued, institution in fact have mattered as much in China as elsewhere. While China doesn't have well-specified property rights security, in the early 1980s it moved very far and very fast toward establishing security of the proprietor. "One should never underestimate the incentive effect of not getting arrested" (Huang, 2008). See also Caryl (2013) for an excellent review of this remarkable story.

Social-media is also reshaping how land administration services are being provided and how citizens and communities are engaging in the process. A movement of democratisation of land rights is emerging that will allow citizens to directly record their evidence of land rights and post it on a global platform. This is outside the formal land administration domain and is based on trust and information transparency. This has inherent risks that have to be managed effectively, but has the promise to be inclusive and scalable – something that hasn't been achieved in the past.

Future land administration services must also increasingly support solutions to the 21st century global challenges of climate change, critical food and fuels shortages, environmental degradation and natural disaster as today's world population of 6.8 billion continues to grow to an estimated 9 billion by 2040 when over 60% will be urbanised. This is placing excessive pressure on the world's natural resources. This support will be reflected through the inclusion of global land indictors in the post-2015 Sustainable Development Goals currently being negotiated by the United Nations to replace the Millennium Development Goals. There will be no hiding for land sector community!

As well, we are beginning to witness the development of new administrative and professional practice models which (although they still embed much of the thinking and experience from the West) reflect a very different set of priorities and realities. In this regard, the increasing importance of the urban agenda will inevitably lead to new land administration priorities and practices in local government (such as can be seen in the emergence of new land taxation strategies in China, where local government carry out over eighty percent of the country's public spending but receive less than half of the taxes). From a surveyor's perspective, the FIG / World Bank statement on Fit-For-Purpose is expected to be especially influential in shaping the professional practice model (Enemark et al, 2014).

We will conclude our paper with a few thoughts on this theme, arguing that increasingly the leadership in our profession is going to come from a new generation of land administration specialists largely based in the developing world. An excellent example is provided by an outstanding property specialist, Dr. Clarissa Augustinus (Chief of the Land and Tenure Section at UN-Habitat), and her colleagues in fashioning the Social Tenure Domain Model (Lemmen, 2010) and coordinating the Global Land Tool Network that is delivering pro-poor solutions. This transition in leadership will be dependent on the how effectively capacity is built in developing countries, especially at the management level, and how successfully new innovative approaches, driven by Fit-For-Purpose, are accepted and implemented. If successful, Africa in particular has the potential to become a land administration powerhouse.

To provide context for that discussion, we rather arbitrarily divide the property world into three components.

DIFFERENT WORLDS, DIFFERENT AGENDAS

At one end of the spectrum lie those traditional economies ranked as low on the human development scale by the UNDP (including Nepal, Kenya, Nigeria, Yemen, Haiti, Sierra Leone, Congo). These societies are largely outside the formal economy, confounded by the issues of deep poverty, food security, lack of institutional integrity, and so forth.

The importance of property reform to the economic and social development agenda in these societies is vitally important - as recognized for example in emerging concerns about land grabbing (Pearce, 2012). In this regard, the importance attached to property reform in the Sustainable Development Goals (the successor to the Millennium Development Goals scheduled to be agreed to by world leaders at the UN General Assembly in September) will be of special significance. However, any success in tackling the subject will continue to be

frustrated by the severe limitations of the institutional foundation. As Deininger and Feder (2009) have put it, the realization of the benefits from land administration reforms (they focus on registration) depend "on the broader socio-economic and governance environment and the nature of interventions. Bad governance and an ineffective or predatory state will hinder benefits from such interventions, or even cause negative outcomes."

Deep, sustainable reform is unlikely to come from government any time soon; rather we anticipate real change coming much more from bottom-up initiatives. Some of this new direction is reflected in the current interest in the potential role of behavioural economics by the development community (the most recent World Development Report providing an instructive example). Ultimately far more important, however, are the emerging voices in the market and in civil society captured in the new social media world (through platforms such as http://timbuktuchronicles.blogspot.ca/ and http://africanarguments.org/).

At the other end of the spectrum are those post-modern economies (the EU 15, the US, Canada, Japan, etc.) In these countries the role of property and its supporting administrative infrastructure is moving beyond its traditional role of supporting the real estate market to being viewed as an important component in re-imagining the role of civil society (including a new dialogue with indigenous peoples) and the increasing importance of the environmental agenda – see, for example Grinlinton and Taylor (2011). In our talk we will very briefly discuss this theme from an institutional geography perspective. But it is a third group of nations that are mostly likely to provide the leadership for the next chapter.

THE NEW LEADERSHIP AGENDA

The heart of this next chapter of property reform will be based in a group of modernizing nations, which may be thought of as primarily (albeit not exclusively) the approximately 50 nations ranked in UNDP Human Development Index as "High Development Nations". This will include such countries as Uruguay, the Russian Federation, Malaysia, Turkey, Mexico, Peru, Thailand, Tunisia, China and Ecuador.

It is in these countries where we can expect the next generation of academic and professional leadership to evolve. For example, we anticipate that prominent academic departments within these countries (such as the hosts of our conference – Geomatics Engineering at ITU – and others such as the Department of Cadastre at Warsaw University of Technology) and at the intersection of the advanced and developing worlds (such as the Department of Land Surveying and Geo-Informatics at Hong Kong Polytechnic University) will play an increasingly important role in fashioning the new intellectual and professional narrative. Similarly, we are already witnessing the professional centre of gravity moving to practitioners in these countries.

The International Federation of Surveyors, especially during the tenure of its President, Professor Stig Enemark, has been especially pro-active in nurturing this new agenda. See, for example, Enemark et al (2009).

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A PERFORMANCE ASSESSMENT MODEL FOR CADASTRAL SURVEY SYSTEM EVALUATION

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ABSTRACT

As an indispensable land administrative function, a cadastral survey system operates to provide spatial related cadastral dataset to the society. A sound cadastral survey system should fit for the purpose of the land administration system in fulfilling its societal requirements. Few studies have assessed the efficiency and effectiveness of a cadastral survey system. This paper describes an on-going research project on building a multi-criteria performance assessment model for cadastral survey systems evaluation. A set of criteria and performance indicators are defined. These model parameters are applied to compare different stakeholders' opinions under a common framework and measuring the performance of individual system by normalized yardsticks. The model builds a platform to show different understandings of the cadastral survey systems. It evaluates each system performance based on land stakeholders' judgements and the achieved performance datasets. With sufficient feedbacks, a robust framework can be established to share ideas on how well the current cadastral survey system fits for the "purpose" from the society. This paper emphasizes the introduction of the established model and its assessment strategy. Some preliminary results of implementing this assessment model in Hong Kong cadastral survey industry are also discussed.

Key words: cadastral surveying, performance assessment, fit-for-purpose, multiple criteria decision analysis

INTRODUCTION

The most essential function of a cadastral survey system is to provide reliable information and descriptions of land parcels. Land parcels are the basic spatial unit in the operation of a land administration system. A cadastral survey system targets societal requirements by implementing cadastral survey and mapping activities and then supplies spatial related information to users. Together with land registration, these core cadastral components (FIG, 1995) become an important infrastructure to facilitate the implementation of land use policies (UN-FIG, 1999).

As indicated by Dale (1979), the cadastral survey and mapping activities are regulated by its own legal and institutional arrangements. Nowadays, as land becomes scarce community resource (Ting and Williamson, 1999), social and environmental interests are more seriously considered by land stakeholders for sustainable development (Bennett et al., 2008). Ruled by each jurisdiction's own background, no unique model can effectively fulfil its societal

requirements world-wide. This notion cannot be regarded as a brand-new concept in the field of cadastre (see Dale, 1976 and Williamson, 1985). Still, unsatisfied land administration projects are continuously being reported during international conferences or in the publications. Merely complying with top-end technological solutions and rigid regulations for accuracy are summarized as the reason for most unsuccessful land administration projects (FIG, 2014). In addition, Enemark (2013) and Enemark et al. (2014) highlight the influence of unfit-for-purpose solution in building spatial framework for a land administration system.

A cadastral survey system produces spatial related datasets in building and maintaining the spatial framework of a cadastral system or land administration system. The appropriateness of a cadastral surveying system-design directly influences the performance of land registration in each jurisdiction. However, as an indispensable land administrative function, the end results of a cadastral survey system have rarely been evaluated. Most assessment projects in the field of cadastre and land administration are either focusing on a broad aspect of land matters (see Steudler et al., 1997; Williamson, 2001 and Mitchell et al., 2008) or using a specific cadastral activity to evaluate the cadastral survey system (see Chimhamiwa, 2011). Furthermore, there are very few projects with special focus on cadastral survey system performance in developed land markets nowadays.

This on-going research project aims to build a self-assessment framework for any cadastral survey systems in both developed and developing land markets. The general successfulness or fitness of a cadastral survey system will be examined through a structured multi-criteria assessment model. With a specific focus on the technical, economic, legal and institutional arrangements, we propose four criteria termed: *Capability*, *Cost*, *Security* and *Service*. Under each criterion, performance indicators are selected and evaluated by assessors for gap analysis. Land stakeholders, especially cadastral surveyors who are the key operators of the system are expected to give their judgements on what the "purpose" (optimum societal requirements) is and how well the system "fits for" it.

This paper is structured as follows. First, an explanation on the structure of the established assessment model is introduced. Second, the assessment methodology and strategy are discussed with highlights of utilization of the adopted multi-criteria decision analysis methodology: Analytic Hierarchy Process (AHP). The initial results of a pilot study on the performance assessment of Hong Kong cadastral survey system will be followed. Finally, the paper discusses the initial findings of the case study of Hong Kong and suggests the directions for further development of the proposed assessment model.

ASSESSMENT FRAMEWORK

A Performance Assessment Model

In general, each cadastral survey system has its unique characteristics. To thoroughly assess a cadastral survey system, the assessor needs to have extensive resources of the system design and deep understandings of its jurisdictional background. In addition, system users' satisfaction level should be considered, which is also resource demanding. Neely et al. (2005) commented that the performance of a system is more practicable to be assessed and it is easier to quantify

the efficiency and effectiveness of the system. Indeed, the strategy of conducting performance assessment is widely applied in land administration systems evaluation projects.

In this project, we built an assessment model to measure the efficiency of each individual cadastral survey system by its performance. Furthermore, the established assessment model will be applied to evaluate how well an individual cadastral survey system fulfils its society's requirements. Therefore, the performance gaps between the optimum societal requirements and the achieved performance can be identified and evaluated.

From an overall aspect, Williamson (2000) concludes a desired cadastral or land administration system performance should be decided by two key performance indicators: 1) whether the system was trusted by the general populace; and 2) whether it was extensively used by land stakeholders. Following these two key principles, for the assessment of cadastral survey system, we defined four key system performance aspects as the assessment criteria termed: *Capability*, *Cost*, *Security* and *Service*. The logic connections are represented in Figure 1.

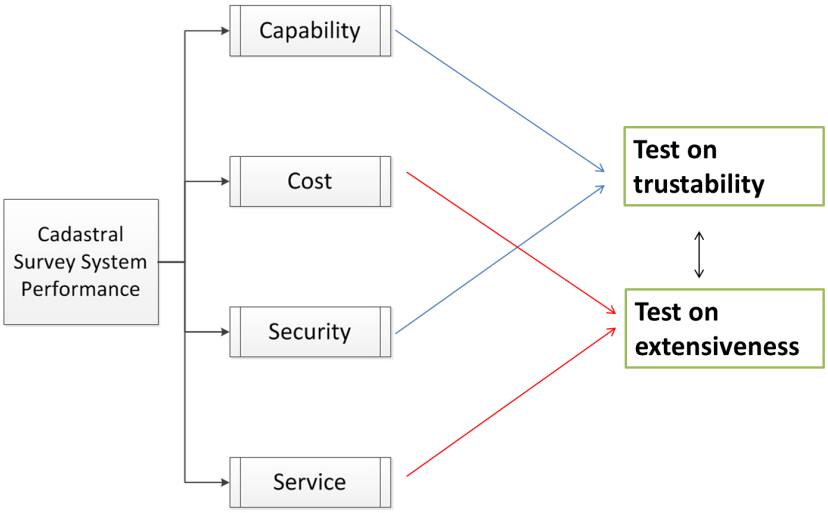

Fig. 1. Logic connections of the criteria set

A Multi-Criteria Assessment Model

To the best of our knowledge, very few assessment projects in the field of cadastre or land administration adopted single criterion to perform whole system evaluation process. In general, the term "multi-criteria" represents the utilization of Multiple Criteria Decision Analysis (MCDA) methodology. In this project, we selected Analytic Hierarchy Process (AHP) as the applied MCDA methodology for structured evaluation of the system performance. The detailed introduction of AHP will be addressed later. In this section, the selected assessment content is focused.

The structure of the adopted criteria and their sub-criteria are illustrated in Figure 2. The overall performance of a cadastral survey system is divided by four criteria: *Capability*, *Cost*, *Security* and *Service*. These criteria set covers the technical, economic, legal and institutional aspects of a system. Under each criterion, three sub-criteria are selected to measure the performance specifically.

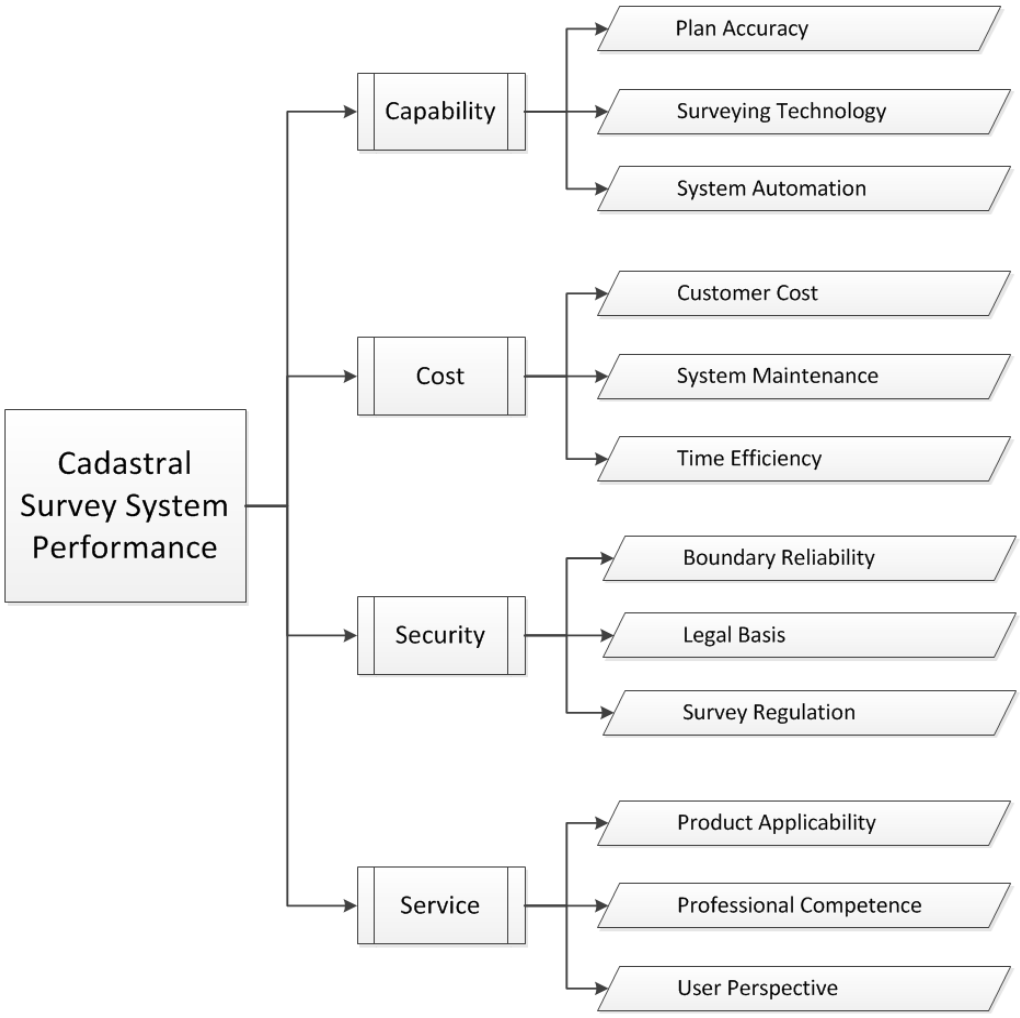

Fig. 2. The structure of adopted criteria set

Capability

Capability aims to evaluate the system performance with highlights on its technical dimension. In short, it asks the question "what can be done" by the current system. The sub-criteria set includes: 1) *Plan Accuracy*; 2) *Surveying Technology*; and 3) *System Automation*.

Plan Accuracy targets the horizontal accuracy of the currently produced land boundary plan. *Surveying Technology* exams the current adapted level of surveying technology to producing cadastral survey datasets. *System Automation* measures the level of system automation process with a focus on the database and data model approach.

Cost

Cost measures the performance of the system from the economic aspect. In short, it asks the question: "what is the cost" in providing cadastral survey and mapping activities to the society. Three sub-criteria are applied: 1) *Customer Cost*; 2) S*ystem Maintenance*; and 3) *Time Efficiency*.

Customer Cost indicates the individual cost of using cadastral survey service. *System Maintenance* focuses on the system cost of maintaining the cadastral survey services. *Time Efficiency* considers the cost in the time dimension by measuring the time spent on using cadastral survey services.

Security

Security evaluates system performance from the legal aspect. It asks the question: how reliable is the service? Three sub-criteria are selected: 1) *Boundary Reliability*; 2) *Legal Basis*; and 3) *Survey Regulation*.

Boundary Reliability measures the potential boundary disputes of surveyed parcels and the efficiency of the surveyed boundary (e.g. would it be overridden easily by newly discovered evidence or other rights, such as adverse possession?). *Legal Basis* intends to exam the performance of the updated legislation for the operation of cadastral survey system and the authorization of legal boundary for surveying. *Survey Regulation* assesses the technical and administrative guidance for the cadastral survey industry.

Service

Service measures the development of a cadastral survey system as a service provider. It contains three sub-criteria: 1) *Product Applicability*; 2) *Professional Competence*; and 3) *User Perspective*.

Product Applicability measures the level of adopting cadastral survey products by land related professions and the involvement of current cadastral survey products for further system development (e.g. Spatial Data Infrastructures and Building Information Modeling). *Professional Competence* assesses the efficiency of professional service to fulfill client's requirements and the appropriateness of the licensing or practicing system. *User Perspective* checks the quality of the data and the overall satisfaction of general public.

ASSESSMENT METHODOLOGY

General Procedures

The established criteria set is closely connected to the fundamental functions of a cadastral survey system. It defines the assessment content in a flexible way. The assessor are required to give their judgements on what constitutes (which criterion contributes more to) a desired performance for his (including assessors of both genders) specific system. In this research project, the AHP pairwise comparisons are applied to determine the weight of each criterion. Figure 3 gives an example of AHP derived criteria weight distribution.

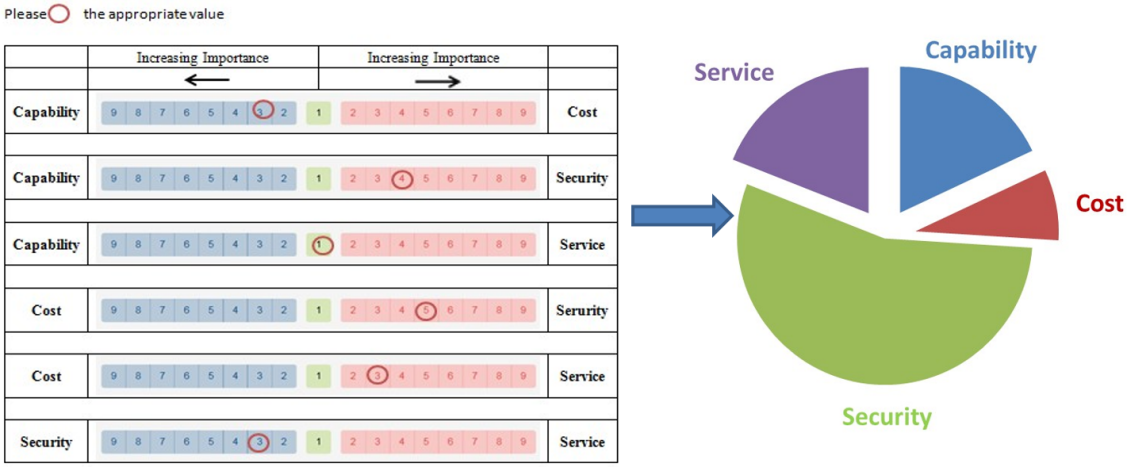

Fig. 3. A sample of AHP pairwise comparison methodology

Theoretically, the criteria weight distribution reflects the constitution of a desired system performance. Further, it aims to give hints on what the "purpose" is for the cadastral survey system based on a summarization of different AHP evaluation results from relevant stakeholders.

The next fundamental question in the assessment model is how well the current system fits for the "purpose". Benchmarking the current optimum societal required performance (should-be performance), stakeholders as the assessors are required to rate on the currently achieved performance. Gap analysis will then be conducted to evaluate the relative strengths and weaknesses of the current system (Figure 4). Furthermore, the overall weighted scores of current system rated by each individual assessor can be calculated based on his criteria weight distribution results. Thus, the normalized satisfaction level of the current system from different stakeholders can be assessed and compared.

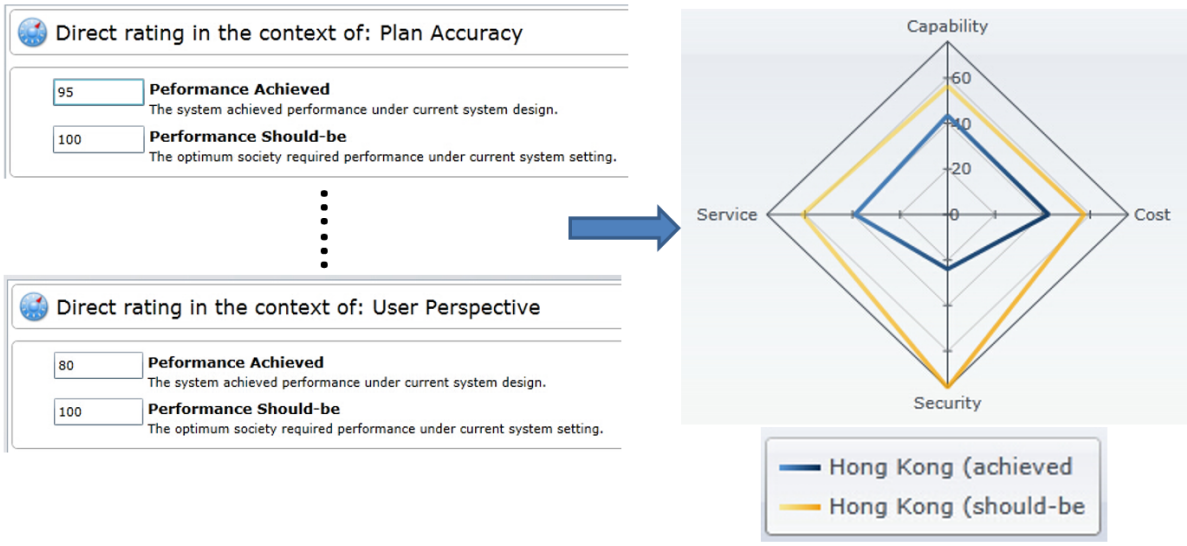

Fig. 4. Gap analysis of current system

It should be noted that the previously mentioned two types of judgements are both subjective individual opinions. It fits for the purpose of this assessment which is to provide a platform to show different understandings on the cadastral survey system performance. Sufficient feedbacks are needed to reflect the performance level of a cadastral survey system. There are two strategies adopted in the assessment to increase its reliability: one is to categorize different stakeholder types based on the assessors' professional backgrounds; the other is to invite informative answers from assessors on the specific performance datasets of the system. Correlation may be conducted between the given performance datasets and the previously defined performance satisfaction level. Therefore, with sufficient feedbacks, a robust multi-stakeholder assessment model contains actual performance of each cadastral survey system can be established.

Analytic Hierarchy Process

AHP served as the weight determination methodology in this assessment framework. The AHP method is a decision method for organizing and analyzing complex solutions. It was first introduced by Saaty in 1970s and widely used by researchers in different fields to transform qualitative and quantitative issues to the judgments about the data (Vaiday and Kumar, 2006). As indicated by Macharis et al. (2004), the fundamental principles that AHP concerned are: hierarchy construction, priority setting and logical consistency.

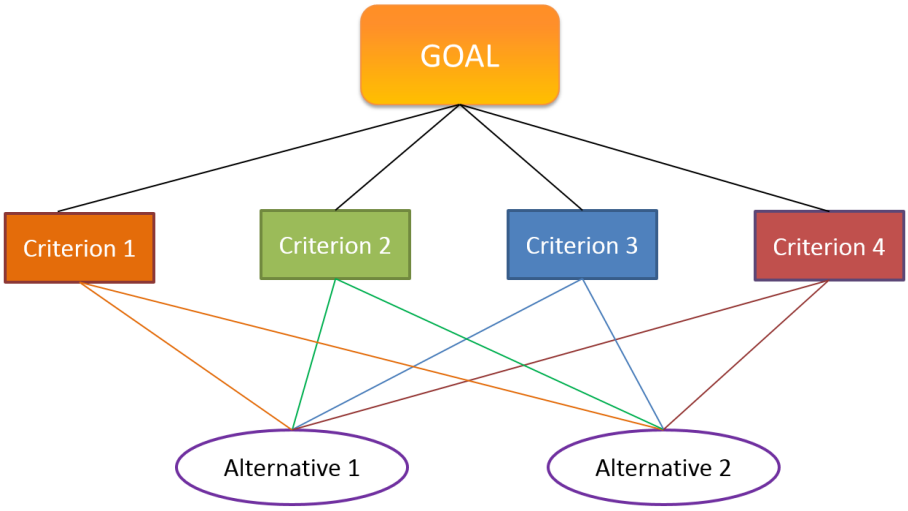

Fig. 5. Basic AHP structure

In general, an AHP solution contains three layers: goal, criteria and alternatives (Figure 5). In this project, the "goal" of the assessment project is an ideal/sound cadastral survey system performance that fits for the current optimum societal requirements. The detailed criteria set is introduced in section 2.2. *Capability*, *Cost*, *Security* and *Service* are the four selected criteria. Under each criterion, three representative and measurable sub-criteria are defined. In this project, we aimed to build a self-assessment model to evaluate how well a system fit for the optimum societal requirements. Thus, only two alternatives for each system, which termed as *Achieved Performance* and *Should-be Performance,* will be adopted.

In this model, priority settings of each criterion are derived from AHP pairwise comparisons. A matrix is used to calculate the priority values of those criteria with reference to the comparison attributes. Pairwise comparisons are provided to assessors to decide the relative importance of each pair of criteria in contributing to the goal. Here, the fundamental algorithm with the most common Saaty's 9-point pairwise comparison scale is applied. Table 1 lists the definition and explanations of each scale value.

Table 1. Satty's 9-point pairwise comparison scale (Satty, 1980)

Intensity of Importance	Definition	Explanation
1	Equal importance	Two elements (criteria/alternatives) contribute equally to the goal
3	Moderate importance	Judgment is slightly in favor of one element over another
5	Strong importance	Judgment is strongly in favor of one element over another
7	Very strong importance	One element is to favored very strongly over another
9	Extreme importance	There is evidence affirming that one element is extremely over another
2,4,6,8	Intermediate values between above scale values	Should be the intermediate value adopted by the assessor

The common steps to derive criteria weight can be generally illustrated by Figure 6. In step 1, assessor is needed to pairwise compare the criteria set in the same layer. Step 2 shows the established comparison matrix based on assessor's judgements. In step 3, the weight of each criterion that is calculated by the AHP algorithm is listed. Also, inconsistency ratio of the assessor's judgment is presented. A thorough explanation of AHP algorithms will not be discussed in this paper, but can be found at Satty (1980).

The inconsistency ratio reflects the logical stability of assessors' judgements, and further this value can be applied to weight the influence of each assessor's judgements in summarizing stakeholders overall opinions.

ASSESSMENT STRATEGY

The established model intends to establish a platform to represent the development of cadastral survey systems world-wide. It does not aim to evaluate which system is better than the other. Under each jurisdiction, land stakeholders can express their ideas on the relative importance of different performance aspects of current system and their satisfaction level on each performance aspect. Correlating with achieved performance datasets, different stakeholders' opinions will show us a comprehensive performance level of the cadastral survey system in fulfilling its societal requirements.

The core task of implementing this model is to collect judgments and performance datasets from stakeholders. On one hand, international cooperation is sought. On the other hand, a pilot study of local cadastral survey system performance is currently conducted in Hong Kong under the coordination of the Land Surveying Division (LSD) of The Hong Kong Institute of Surveyors (HKIS). The strategy of implementing the established model in Hong Kong cadastral survey system assessment can be divided into three stages.

Fig.6 . Steps in AHP weight determination

At stage 1, a consultancy panel is established. We supposed land surveyors are the type of stakeholders who know the system most. At this stage, as the key players of the system, thirteen land surveyors or surveying backgrounds members (4 from public sector, 3 from private sector, 3 young surveyors and other 3 from academia) are formed this consultancy panel under the coordination of HKIS. Through interview and questionnaire, opinions and comments are collected to calibrate the established assessment criteria and structured model.

At stage 2, an online questionnaire will be sent to all HKIS LSD members to collect their judgements on the performance level of our local cadastral survey system. In general, their professional backgrounds will be categorized into four types: public sector, private sector, academic and young surveyor.

At stage 3, this assessment model will be introduced to other relevant stakeholders through interviews or online questionnaire. Thus, comprehensive opinions can be collected to evaluate the actual performance of local cadastral survey system in fulfilling the requirements of the society.

With sufficient feedbacks, a robust platform can be established. To facilitate the process of opinions collection, a concise questionnaire was designed and utilized to collect assessors' judgements. Figure 7 shows the flowchart of the questionnaire. In general, an assessor can finish the questionnaire within 10 minutes by filling in all required questions. Information questions on the achieved performance datasets are optional.

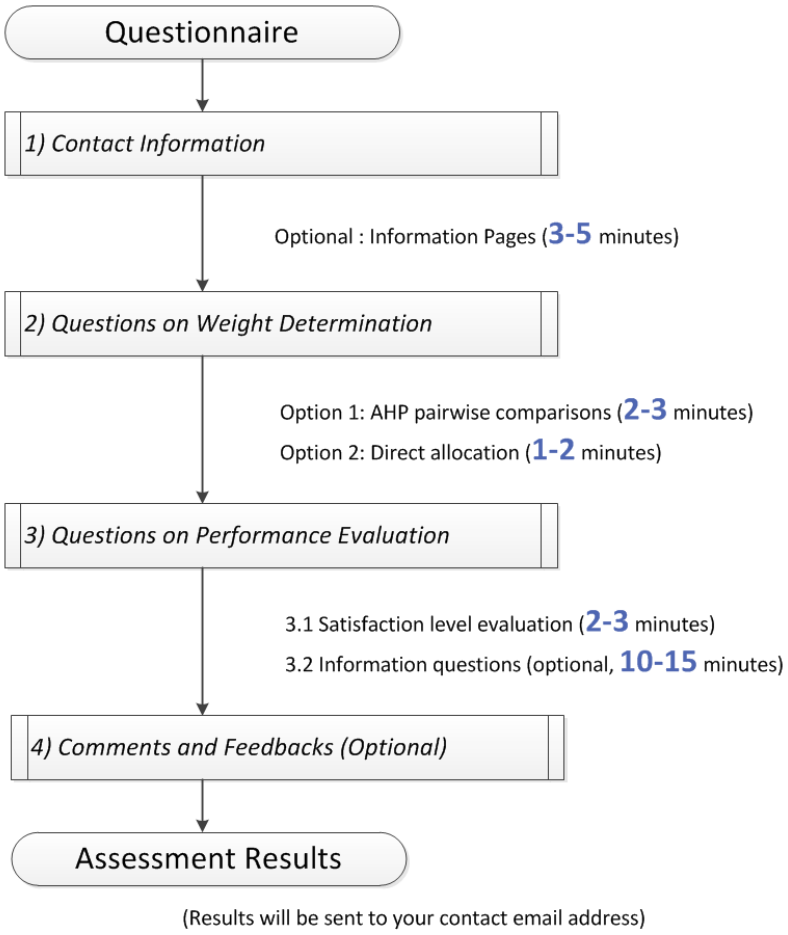

Fig.7 . Flowchart of the questionnaire

PILOT STUDY IN HONG KONG

The implementation of this assessment model is currently being conducted in Hong Kong cadastral survey industry. The formed consultancy panel has already been interviewed by our research team. Their opinions and judgements on the system performance are collected. Using the weight distribution of different assessment criteria as an example, summarized charts are listed in Figure 8.

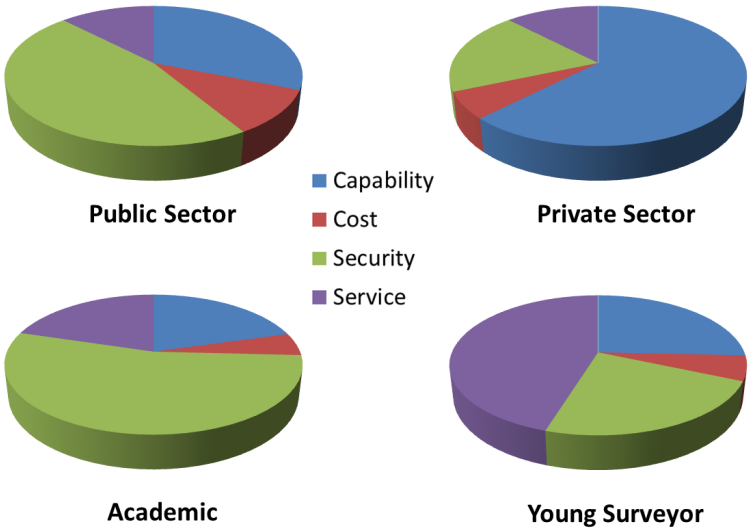

Fig.8 . Initial weight determination results in Hong Kong

Characteristic weight distribution scheme can be found from these four summarized weight distribution results. Both of the group "Public Sector" and "Academic" have more concerns on the criterion "Security", and a reliable system is mostly expected by them. Comparatively, "Private Sector" prefers "Capability" and "Young Surveyor" considers the "Service" most. At this stage, we cannot conclude that the presented four charts can reflect the local cadastral survey industry opinions. But this initial results do provide us some clues on the requirements from different professions or stakeholders for the system.

Currently, an online platform has been established for relevant stakeholders. A concise online questionnaire will be sent to all HKIS LSD members soon. A set of more representative and comprehensive judgements on the system performance is expected.

CONCLUSIONS

This paper describes an on-going research project that aims to use an established model to answer questions on the cadastral survey system performance in fulfilling societal requirements. The established structural model settles the question of what to measure and how to measure through a set of criteria and performance indicators. Those model parameters intend to bring different understandings of a cadastral survey system performance into a common framework and measuring its performance by normalized yardsticks. Certainly this assessment framework cannot be well established without the involvement of relevant stakeholders. With sufficient feedbacks, a robust assessment results can be achieved and handily applied to measure the effectiveness and efficiency of a cadastral survey system. This research provides a scientific means to express the general successfulness or fitness of any cadastral survey systems in fulfilling the requirements of its society, and shed lights on areas for improvement.

ACKNOWLEDGMENT

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GNSS AND THE INTERSECTION OF GEODESY AND THE CADASTRE IN KINGDOM OF SAUDI ARABIA

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ABSTRACT

In The Kingdom of Saudi Arabia (KSA), the geodetic network has evolved from the 1966s with the introduction of the National Geodetic Datum (Ain Al Abd) and followed by the Global Positioning System (GPS) compatible Geocentric Datum of the Kingdom (MGD2000) in 2004. With the advent of space based measuring techniques in particular GPS, The Kingdom of Saudi Arabia established a new geodetic network in 2004 based on the International Terrestrial Frame (ITRF) datum using Geodetic Reference System 80 (GRS80) ellipsoid. This new geodetic network allowed cadastral connections to the geodetic framework. The fundamental obligation of cadastral surveying in The Kingdom is to mark out the boundary of buildings as its current status and redefining the boundary of an empty land with surrounding properties based on all the available evidence. Cadastral surveying therefore works from the part to the whole in contrast to the fundamental role of geodesy: working from the whole to the part. GPS techniques, and more recently, with the addition of modernized GPS, reinvigorated The Russian GLONASS, the European GALILEO, the Chinese BeiDou, the Japan QZSS, and the Indian IRNSS system and the rollout of Continuously Operating Reference System (CORS) infrastructure, Global Navigation Satellite System (GNSS) techniques have challenged the user community to change their thinking. Cadastral surveying has traditionally relied on angles and distances whereas GPS techniques produce coordinates. The implications of this intersection are profound. The cadastre can act as a significant layer of a Spatial Data Infrastructure for The Kingdom improving efficiencies and advancing new and innovative spatial applications. This paper will give an overview of the evolution of this intersection with particular emphasis on the situation of a case study in Huraymila region near Riyadh and the application of CORS networks in The Kingdom of Saudi Arabia.

Key words: Geodetic Network, Cadastre, GNSS, CORS Networks

INTRODUCTION

Land is the most important natural resource, upon which all human activity is based since time immemorial. The expansion of human settlements and infrastructure, and the expansion of urban canters emphasize the need for integrated planning and management of land resources. Land is a critical resource for any country; it forms the basis of its cultural, social and economic progress [1].

Techniques of land measurement in old times were rudimentary. Directions were defined by magnetic compass and distances by chain and tapes. Often, an extra link was placed in the chain

to deliberately give more land than was actually granted. Consequently, the dimensions and geographic locations between the boundary marks where often inaccurate and making it hard to relocate using the correct measurements. Land was sometimes transacted before it was marked on the ground. often, when surveyor visited a district to survey and mark a property, the owner was not there. In some cases, the land was sold to another party before the original land was surveyed [2].

The fundamental obligation of cadastral surveying in The Kingdom is to mark out the boundary of buildings as its current status and redefining the boundary of an empty land with surrounding properties based on all the available evidence. Cadastral surveying therefore works from the part to the whole in contrast to the fundamental role of geodesy: working from the whole to the part.

The land system in The Kingdom was unorganized and incomprehensive; many individual departments were involved in the collection and maintenance of land records. The absence of a unified and complete land registration system had resulted in numerous conflicts over access rights and ownership rights; the whole system was prone to errors.

The incentive was to develop and implement a sustainable and productive land registration system that would provide a basis of conflict resolution and participatory decision-making process, as well as providing an enabling political, social and economic environment.

EVOLUTION OF GEODETIC NETWORK

The first order horizontal control network of The KSA, called The National Geodetic Network (NGN), was the fundamental reference frame from 1966 till 2004 for all geodetic activities (surveying, mapping and cadastral etc.) in The Kingdom based on local datum, called AIN AL ABD (Figure 2.1). This initial network, covering about sixty percent of the country, was later densified and extended further to include remaining south-eastern part.

The NGN was observed using different instruments at different stages and its extensions were adjusted by holding the earlier control as fixed [3].

The KSA has enacted new legislation and acquired new technology to modernize its land registration system. The new Cadastral Registration Act [4] has been moving the KSA from an archaic system to a system that secures and guarantees land ownership rights [1].

Ministry of Municipal and Rural Affairs (MOMRA) and the Ministry of Justice (MOJ) have been given the exclusive mandate for implementing the new cadastral registration system throughout the country; the MOJ looks into the legal aspects of the system while the MOMRA is responsible of the acquisition and production of all the necessary geospatial data for the system [5].

The new cadastral registration system necessitates high levels of accuracy both at data acquisition and production as well as at data verification phases. The MOMRA with its state-of-the-art mapping infrastructure and technology designed the entire processes and procedures of cadastral surveying and mapping [6]. The new cadastral registration system has been

constructed upon a new horizontal geodetic reference frame of the KSA that the MOMRA established in 2004.

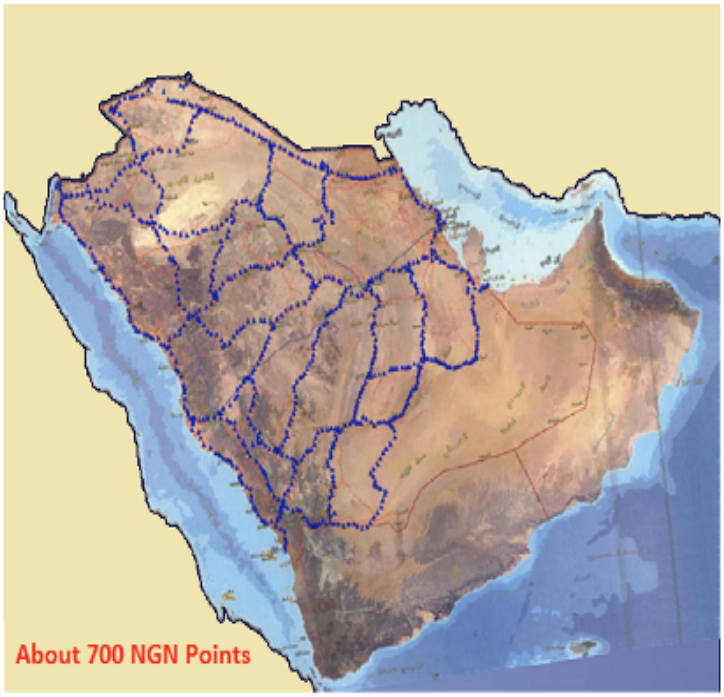

Figure 2.1 National Geodetic Network (NGN)of Saudi Arabia

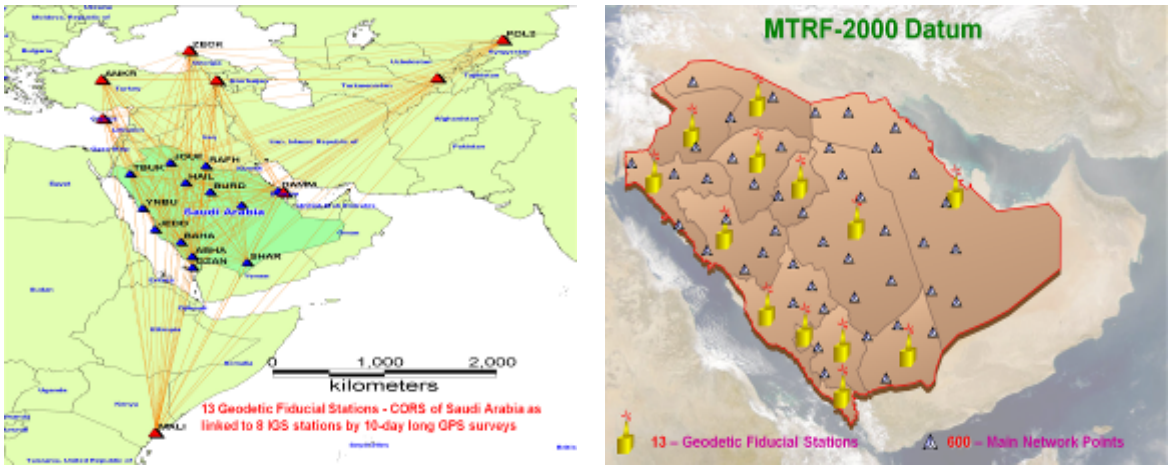

Figure 2.2: MTRF-2000. Left) 8 IGS Stations and Primary network of 13 CORS. Right) Primary network of 13 CORS and Secondary network of 600 stations.

MOMRA Terrestrial Reference Frame 2000 (MTRF-2000) was based on the International Terrestrial Reference Frame 2000 (ITRF-2000), Epoch 2004.0, while MOMRA Vertical Geodetic Control (MVGC) maintained Jeddah 1969 mean sea level as its reference [7]. MTRF-2000 has a primary network of 13 CORS and a secondary network of around 600 permanent pillar stations distributed throughout the country (Figure 2.2).

The MTRF-2000 datum is based on the GRS80 ellipsoid. This is identical to the World Geodetic System 84 (WGS84) ellipsoid, except for minor difference with regard to the gravity model, which meant that GPS could be used directly in The Kingdom without need for transformations.

The MTRF network is densified with a network of stations with approximately 50 km spacing called the MOMRA Real Time Network (MRTN), (Figure 2.3) to provide real-time kinematic positioning and post-processing positioning throughout the KSA using this system together with rover GNSS measurements, to have full GNSS-CORS coverage over the entire Saudi Arabia in general and over the major urban & semi-urban areas in particular, providing real time GNSS corrections to rovers/surveyors, post processing services, and static data for scientific geodetic applications, and to fulfil all accuracy requirements of geodesy and navigation in centimetre and even millimetre-levels of accuracy in the post-processing mode; and centimetre and decimetre levels of accuracy in the real-time mode.

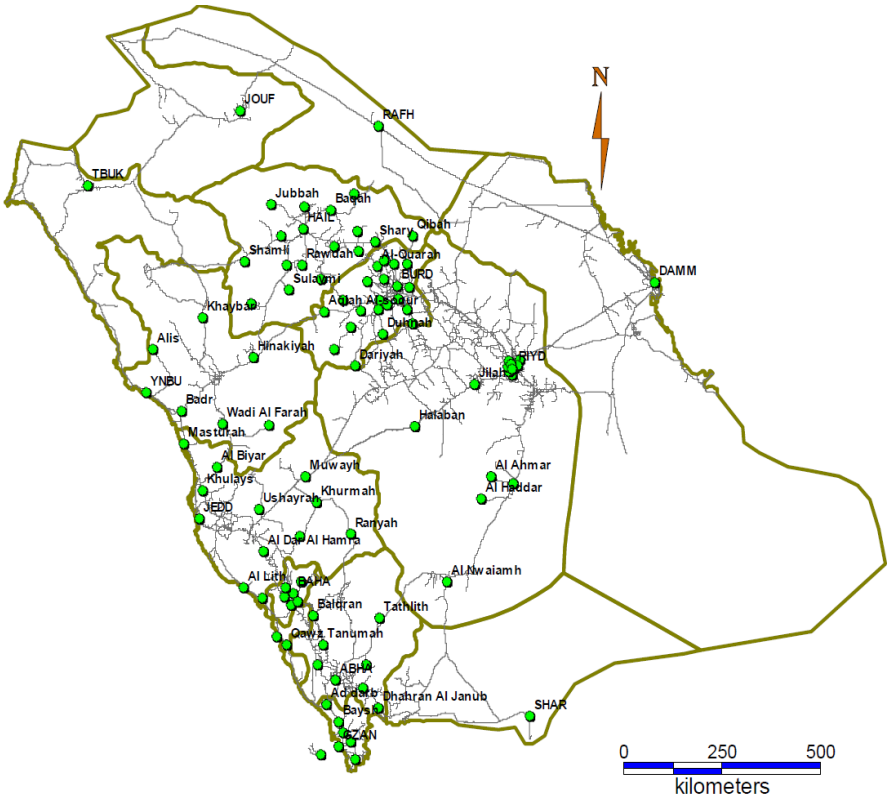

Figure 2.3 MOMRA RTN stations

These MRTN stations with MTRF stations are used to orthorectify aerial photographs and to control the delineation operations needed for the cadastral registration system. Using such geodetic referencing foundation, aerial photography at 10 cm Ground Sample Distance (GSD) ensures satisfactory Digital Elevation Model (DEM) generation. Aerial photographs are rectified using the 3-dimensional (3D) control points and DEM is generated from them. The output orthophotos have the geometric reliability needed for cadastral mapping. The orthorectified aerial photographs provide a base for cadastral base map generation with subdivision planning maps as reference.

INTERSECTION OF GEODESY AND THE CADASTRE

GPS techniques, and more recently, with the addition of modernized GPS, reinvigorated The Russian GLONASS, the European GALILEO, the Chinese BeiDou, the Japan QZSS, and the Indian IRNSS system and the rollout of CORS infrastructure, GNSS techniques have challenged the user community to change their thinking. Cadastral surveying has traditionally relied on angles and distances whereas GPS techniques produce coordinates. The implications of this intersection are profound. The cadastre can act as a significant layer of a Spatial Data Infrastructure for The Kingdom improving efficiencies and advancing new and innovative spatial applications.

Traditionally, cadastral survey work involving all aspects of field and office duties and surveyors are performing surveys on public lands from the part to the whole. With the advent of space based measuring techniques, in particular GNSS, is gently nudging surveyors toward a coordinates based approach and agencies see the long term benefit of combining the cadastral and geodetic information as a fundamental layer in a Land Information System. This was never possible before GNSS.

At present MRTN provides RINEX data and provides real-time positioning to cm level accuracy without the need for a base station for users. It is anticipated that many other applications with follow on from this infrastructure.

IMPLICATION FOR CADASTRAL SURVEYING

The KSA has been divided into units of cadastral areas in the new system. The new land registration system has been rolled out in Huraymila's first cadastral area in Riyadh region (Figure 4.1). The cadastral area of interest is approximately 3.0 km^2 and encapsulates around 1700 land parcels.

The MOMRA and the MOJ are working together in this new system to secure and guarantee land ownership rights. A new cadastral identification system has been developed based on MTRF-2000 such that each cadastral unit would be identifiable using its unique 14-digit Cadastral Unit (parcel) Pin Number (CUPN) which represents the latitude and longitude of the parcel centriod (Figure 4.2).

The CUPN is to give each cadastral parcel a unique number so it will be the new deed number and it was used as a primary key for the spatial geodatabase of the cadastral system, which was designed so as to incorporate and enable both way data transactions and also to support a web-enabled interface.

Information and Computers Technology have revolutionized conventional cadastral surveying, mapping and land registration processes and are increasingly becoming significant components of any agency where automation plays part in improving production. The fundamental change envisioned in the new cadastral registration system will be manifested in unification of the methodologies for data capturing, storing, checking, and analysing.

In this point of view, an online cadastral registration module has been developed using the capability of the Geographic Information System (GIS) and the web to disseminate information and provide services to its users and at the same time record of all the processes and procedures is been automatically generated and archived. The user has to initiate the process online by registering himself and submitting the necessary documents, wherein the user is given a unique identification number and his case is processed; the user is constantly updated of the progress.

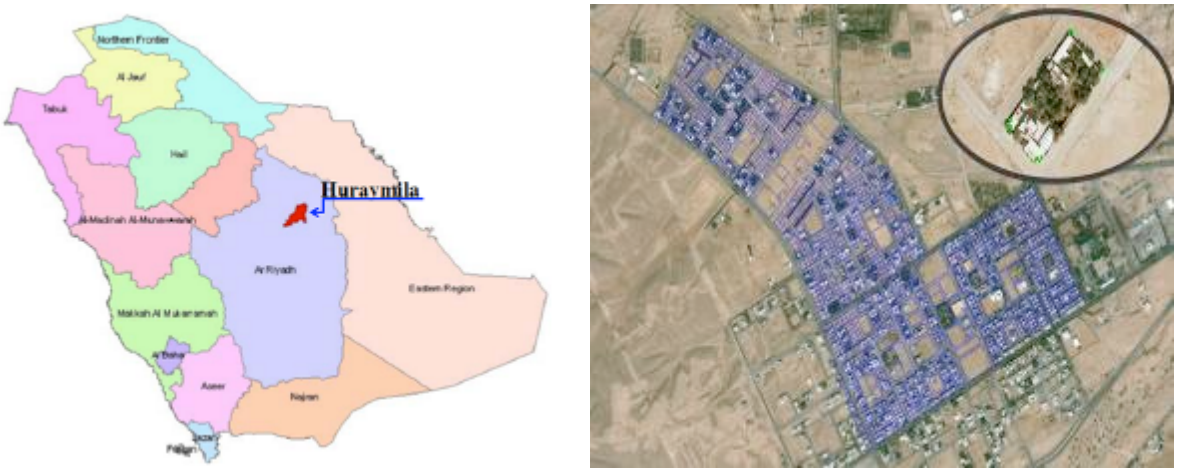

Figure 4.1 Huraymila. Left) Shown on KSA map. Right) Parcels of first cadastral area.

Figure 4.2 Cadastral unit PIN numbering system

Surveyors in The Kingdom are willing to use GPS/GNSS surveying technique for land survey. With the growth of CORS network in The Kingdom wide, it is anticipated that GPS/GNSS surveying technique utilization will grow considerably. In fact, MOMRA teams carry out field operations using GNSS/RTK in the presence of the owner and the MOJ representative by following the predefined process.

The process is initiated by the owner itself, submitting his pre-determined documents and credentials to the cadastral registration office of MOJ for registration of his cadastral unit. The cadastral registration office processes the information, then forwards it to the cadastral surveying department of local municipality, which has the responsibility of performing all field and office technical tasks. The cadastral surveying department teams carry out field operations using GNSS/RTK in the presence of the owner and the cadastral registration office

representative. After that, final cadastral unit document is produced with final CUPN, and all data in incorporated into the spatial geodatabase. The cadastral surveying department forwards the final cadastral unit document and CUPN to the cadastral registration office, which carries out the adjudication process and issues final ownership certificate.

CONCLUSIONS

This paper has given an overview of the evolution of the geodetic network and implementing GPS/GNSS techniques in cadastral surveying in The Kingdom. The authorities are working hard to modernize regulations and implementations of new Cadastral Registration Act to accommodate GPS/GNSS technology for land and cadastral surveyors. The KSA has modernized the way of cadastral registration system that provides a complete peace of mind to the owner. A digital system has been developed in order to provide accessibility to the country's cadastre records from any online location.

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FOUNDATION IMMOVABLE PROPERTIES IN TURKEY

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ABSTRACT

The General Directorate of Foundations (GDF) is a governmental institution that performs intensive land management implementations and controls them in the name of foundations coming especially from Ottomans and Seljuks. In fact, it is known that GDF represents nearly 40.000 fused foundations and administers nearly 80.000 properties-parcel based. Foundation properties may be exposed to some land management implementations both in rural areas and also urban areas based on different laws. In addition to these, information technology is also used in GDF's projects, based on land management implementations, in the concept of e-Turkey. It is aimed to determine with this study what the land management implementations of foundation properties and e-government applications of foundations in concept of e-Turkey are. This study explains mainly how many tenants there are as third parties in foundation properties in Turkey, how much money GDF earns from these tenants for properties, what the tender process of foundation properties is and related issues on foundation properties.

Key words: Registered-fused foundation, immovable property, e-government.

ÖZET

Vakıflar Genel Müdürlüğü, özellikle Osmanlı ve de Selçuklu dönemlerinden günümüze intikal eden vakıfların ve taşınmazlarının bulunduğu yoğun arazi yönetimi uygulamalarını yürüten, doğrudan Başbakanlığa bağlı bir kurumdur. Ülkemizde, 40000'in üzerinde mazbut vakıf ve bunlara ait 80000'in üzerinde parsel bazında vakıf taşınmaz olduğu bilinmektedir. Vakıf taşınamazlar hem kırsal hem de kentsel alanlarda, farklı kanunlara tabi olarak çeşitli arazi yönetimi uygulamaları için yer alabilmektedirler. Bunlara ilaveten, E-Türkiye projesi kapsamında, arazi yönetimi uygulamaları temelinde VGM tarafından yürütülen projelerde bilgi teknolojileri de kullanılmaktadır. Bu çalışma ile E-Türkiye kapsamında, vakıfların e-devlet uygulamaları ve vakıf taşınmazlarının arazi yönetimi uygulamalarının ne durumda olduğunun belirlenmesi amaçlanmaktadır. Bu çalışma temelinde, Türkiye'de vakıflar tarafından üçüncü kişilere kiralanmış taşınmazlardaki kiracı sayısını ve bu kiracılardan VGM'nün elde ettiği kira bedelinin ne kadar olduğunu, vakıf taşınmazların ihale süreçlerini ve vakıf taşınmazlarla ilgili benzer durumlar açıklanacaktır.

Anahtar kelimeler: Mazbut vakıf, taşınmaz mal, arazi yönetimi uygulamaları, e-devlet.

INTRODUCTION

Foundation (“Vakıf” in Turkish) is an Arabic word and defined as "property, money formally allocated under certain terms and conditions and handed down by a community or a person so that a service is also provided in the future" (URL-1, 2014). Foundation became very important, especially in the Ottoman Time. It is known that there were about 200,000 foundations in the Ottoman Empire, known as a civilization of foundations, and that almost all services, excluding the state's internal affairs, security and palace affairs, were conducted through foundations (GDF, 2000). Foundation is one of the institutions which played an extremely important role within the Turkish cultural system particularly during the Ottoman period. Foundations lived in the golden age during the Ottoman Empire period and also became widespread with the growth of the Ottoman Empire (Coruhlu, 2013; Coruhlu and Demir, 2014a). Upon transition from the Ottoman Empire to the Republic of Turkey, all business and operations of the foundations were delivered to the General Directorate of Foundations (GDF), under the authority of the Prime Ministry of Turkey, management and control by Foundations Law numbered 5737. Today, all transactions of properties owned by fused foundations and the GDF are carried out by the GDF under Law 5737 (Official Gazette, 2008). Fulfillment of charities and requirements of Foundations is performed using the income derived from foundation properties. These properties are included in various land management practices according to the region in which they are located, and those which can be utilized are utilized by property development methods.

In addition to provisions of the legislation to which foundation properties are subject to in terms of their qualities, there are issues of land management practices in cadastral works, zoning practices, property development works, property registration processes, and expropriation processes, applications regarding properties with foundation entry thereon, information system applications and legal processes. It is possible to classify these issues into technical issues, legal issues and institutional issues. These issues should be absolutely resolved for targets represented in the GDF's Strategic Objectives for 2010-2014 (Coruhlu, 2013). In this context, the aim of this study was to identify foundations and immovable properties of these, the General Directorate of Foundations, the number of fused foundations in Turkey, income from immovable properties of fused foundations via leasing, evaluation of foundation properties, the importance of foundation properties on the Turkish Land System, and the other subject related to foundation properties. Some information in this article will be given from the PhD thesis of the first author completed in July 2013 and other information from both the 2013 GDF Strategic Plan published in May 2014 and from the authors’ experiences gained from working on foundations and also foundation properties between 2007 and 2014.

MATERIALS AND METHODS

There are, in general, two types of foundations in Turkey as foundations founded before the proclamation of the Turkish Republic and founded after the proclamation of the Turkish Republic. The main subject of this article is foundations founded before the proclamation of the Turkish Republic especially in Ottoman Times. These foundations are divided into four parts in terms of characterization, ownership, administration and usage. The study will focus on administrative foundations, these are fused foundations, annexed foundations and community foundations. All of details are given in figure 1.

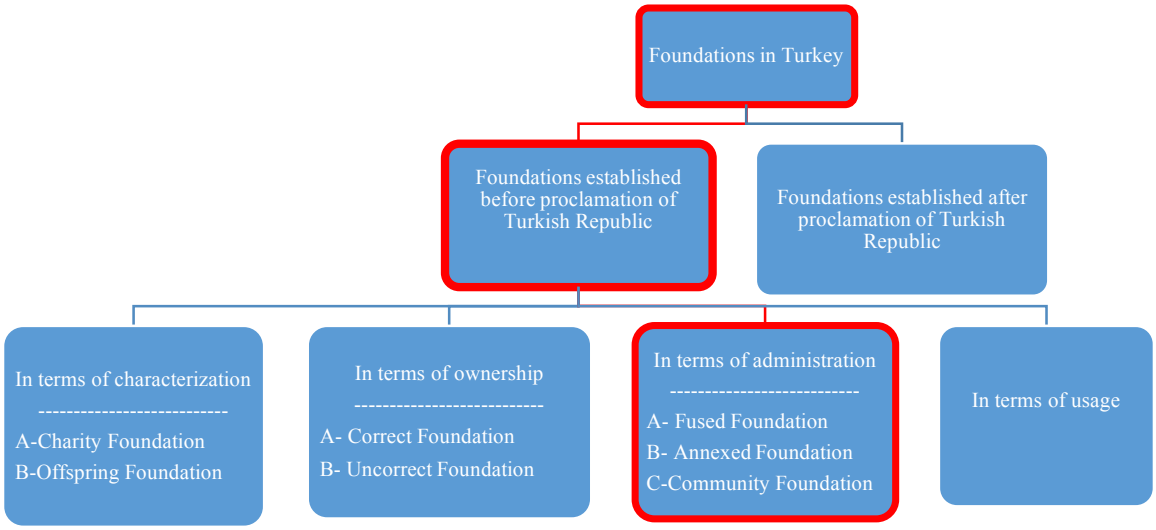

Fig.1. Foundations in Turkey

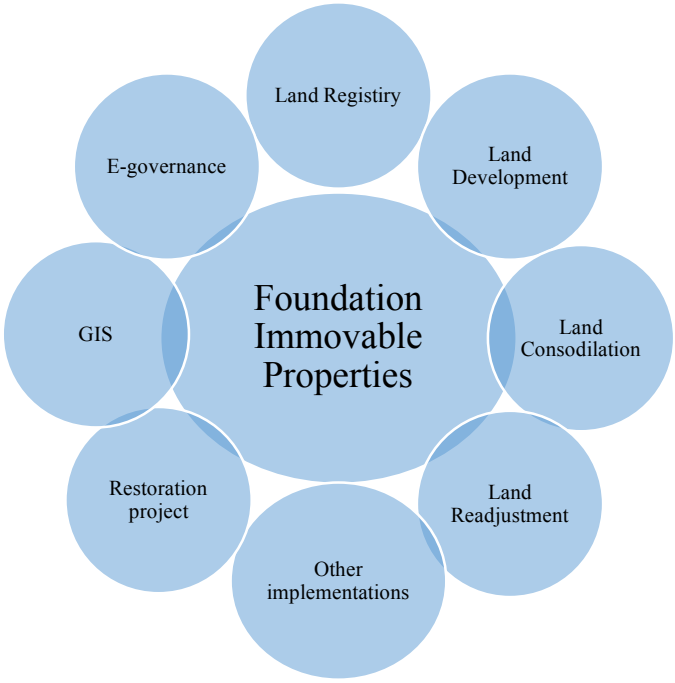

Fig. 2. Foundation immovable properties in various land management implementations in Turkey

According to Foundations Law 5737, all foundations and foundation immovable properties especially from the Ottoman time have been administered and represented by the GDF. As known there are 41.720 fused foundations (URL-2, 2014) in Turkey. In addition, there are about

80.000 parcel based foundational immovable properties in Turkey conducted by the GDF (Coruhlu, 2013; Coruhlu and Demir, 2015). These properties are managed and represented by the GDF but it must be stated that these properties and foundations do not belong to the state. Each foundation has got a special legal entity itself. Foundation immovable properties have been implemented by various land management issues via different ways such as land registry, land development, land consolidation, land readjustment, geographical information system, e-governance and so on. These all can be seen as in the below figure cantered on foundation immovable properties.

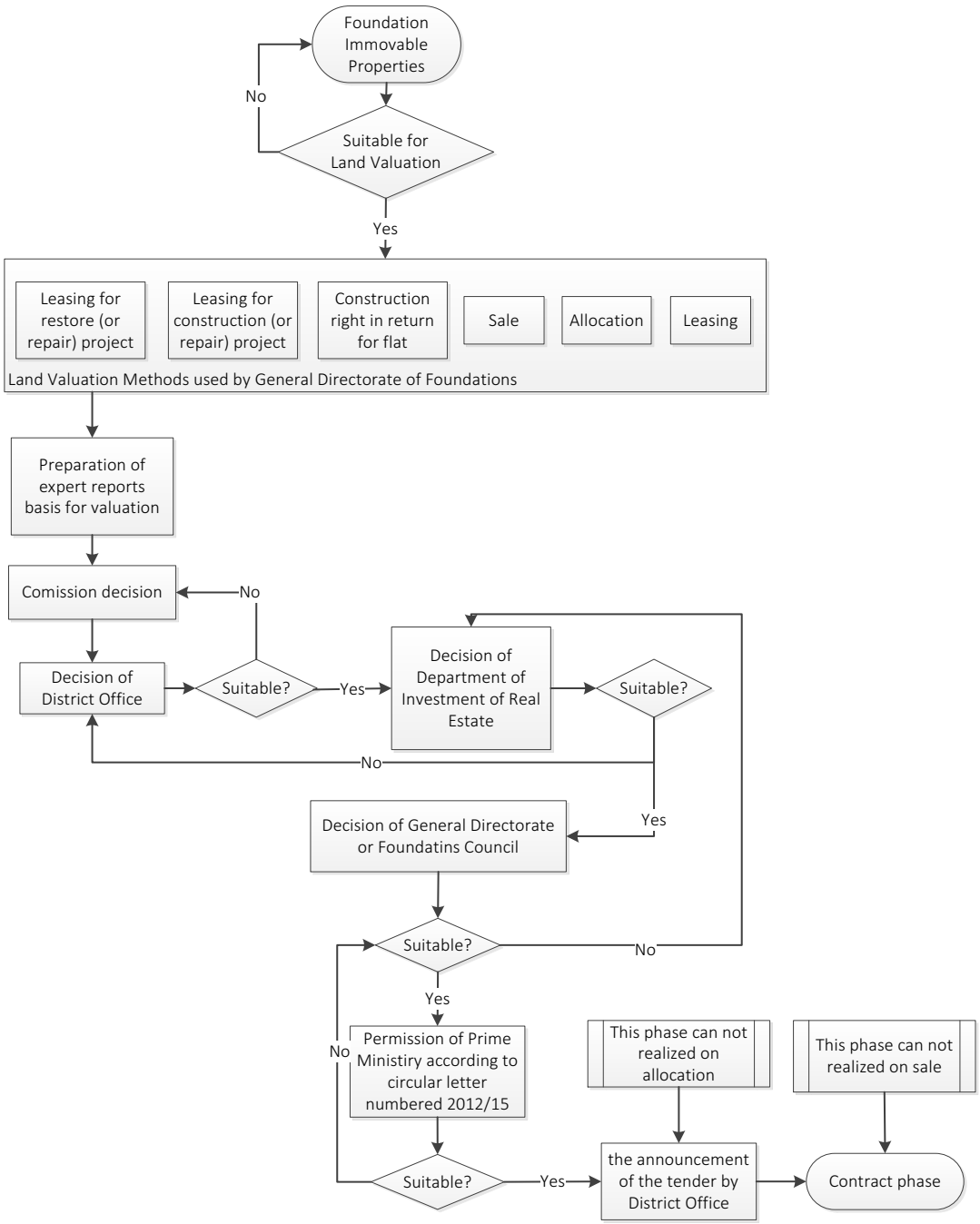

Fig. 3. Land Valuation methods used by GDF

The Development/ valuation of in the discipline of land management is to be investigated in this section. According to the current Foundations Law numbered 5737, like the abolished Foundations Law numbered 2762, all duties, powers and responsibilities of foundation properties have been assigned to the GDF. Based on the Foundations Law, foundation properties have been evaluated via various land valuation methods. The Foundations Law and the Strategic Plan of GDF's (Official Gazette, 2008; URL-3, 2014) aim at increasing the income derived from foundation properties via good management of foundations and their properties. In this section, land valuation methods used by the GDF, will be presented in figure 3.

The annual report of the GDF from 2005 to 2013 is given in table1 year by year showing that income from leasing on foundation immovable properties was 331.163.700 Turkish Liras in 2013 all over the country Turkey (URL-4). However, the other income operations were not shown in the below table, because the study aim is based on income through land valuation methods seen in figure 3.

Table 1. The income of Leasing from foundational properties in Turkey

Income type	**2005**	**2007**	**2009**	**2011**	**2013 (TL)**
Leasing	94.192.923	129.263.470	180.491.251	252.189.800	331.163.700
Interest	10.707.352	45.266.584	18.728.960	98.478.387	15.294.944
Others	-	-	-	-	-
Total	*172.109.057*	*400.368.063*	*305.269.513*	*485.012.196*	*554.398.306*

Income type	**2006**	**2008**	**2010**	**2012 (TL)**	**2014 (TL)**
Leasing	106.389.579	146.157.508	203.412.866	273.195.718	Not yet
Interest	32.050.921	32.407.622	14.894.191	16.808.820	published by
Others	-	-	-	-	GDF
Total	*362.650.417*	*424.288.857*	*400.434.188*	*416.966.022*	

As seen from table 1 leasing income from foundational properties in Turkey has been increasing for each year. The reason of this can be given as two main principles. One of them is that each leasing contract between the GDF and third parties is lasts until 31 December for each year, normally. If the GDF and its' tenants intend to continue the contract for one more year, they can signa rental commitment. As seen from the below table the tenants, who were eager to be tenant for the fallowing year, accepted the rent increase rate in order to be tenants the fallowing as well by signature.

The approximate income from leasing/hiring from foundation immovable properties is 49% of total income. This situation shows that land valuation methods, hiring methods and also rent increase rate for next year are so important to GDF that these must be done with full concentration on the idea of increasing income.

What is the reason for the column of differences? The answer can be given with the contribution of new foundational immovable properties via different land valuation tools each year. Thanks to the Construction Right in return for flat, 105 independent units namely 95 flats and 10 shops; thanks to the Leasing for the construction (or repair) project, 22 centers namely 8 trade centers, 4 tourism centers, 2 educational centers, 4 dormitories, 1 gas station and car park, 1 health care

service, 1 sport center; thanks to the Leasing for restoration (or repair) project,4 centers namely 3 public baths, 1 cultural center, 4 trade centers, 1 house; were completed and delivered to the GDF units in 2013 so that these can be hired to third parties from the past to now and the future.

Table 2. Impact of leasing on total income in per year and average in total income

Year	Impact of leasing (%) on total income in per year
2005	55%
2006	29%
2007	32%
2008	34%
2009	59%
2010	51%
2011	52%
2012	66%
2013	60%
2014	Not yet published
Average	%49

Table 3. The Rent increase rate for the fallowing year from 2006 to 2014 with realization and expectations

Year	Rent increase rate for next year (%)	Expectation: Total income from hiring (TL)	Realization: Total income from hiring (TL)	Differences (TL)
2006	8	101.728.356	106.389.579	4.661.223
2007	11	112.918.476	129.263.470	16.344.994
2008	8	121.951.954	146.157.508	24.205.554
2009	15	140.244.747	180.491.251	40.246.504
2010	8	151.464.327	203.412.866	51.948.539
2011	10	166.610.759	252.189.800	85.579.041
2012	13	188.270.158	273.195.718	84.925.560
2013	6	199.566.368	331.163.700	131.597.332
2014	5,5	210.542.518	Not yet published	

The Importance of Optimum Income from Immovable Foundation Properties

The GDF have administered and represented foundations and foundational properties in order to perform foundation charters written on foundation founders' wishes. Foundation charters known as Vakfiye in Turkish are defined as "A document which includes the founder's statement and judge's oral hearing and decision regarding the foundation". Foundations certificate charters many include these:

1) Sections of surahs and hadiths regarding thanks God and and good deeds of foundation.
2) Dedicated real estates
3) How the dedicated foundation will be used.
4) Usage place of the income.
5) Who will manage the foundation
6) The Judge's decisions related the foundation's correctness and necessity.
7) The deadline and judge's seal on certificate (URL-11, 2014)

In this perspective the mission for the GDF is defined as "to keep the foundations alive in accordance with their purpose, to carry the foundation consciousness to the future with a contemporary perception" and the vision for GDF is defined as, on the GDF website (URL-12, 2014). So, foundational purposes can be carried out by good management on foundational properties via appropriate land development methods.

Land Management Issues via E-Governance in GDF

Land management applications and implementations have been carried out by the GDF via web-the based service named EVOS. EVOS include all land management issues both performed by the GDF and the other governmental institutions related to foundational works. Some information will be beneficial in the name of explaining these subjects in detail.

EVOS (Entegre Vakıf Otomasyon Sistemi-EVOS in Turkish, Integrated Automation System of Foundations): An e-government application by the GDF seen in figure 3, by which web-based verbal data is currently managed as a result of efforts to establish a foundation information system, started in 2006. In this application, it is possible to work in conjunction with MERNİS and TAKBİS, which are other e -government applications (Çoruhlu, 2013).

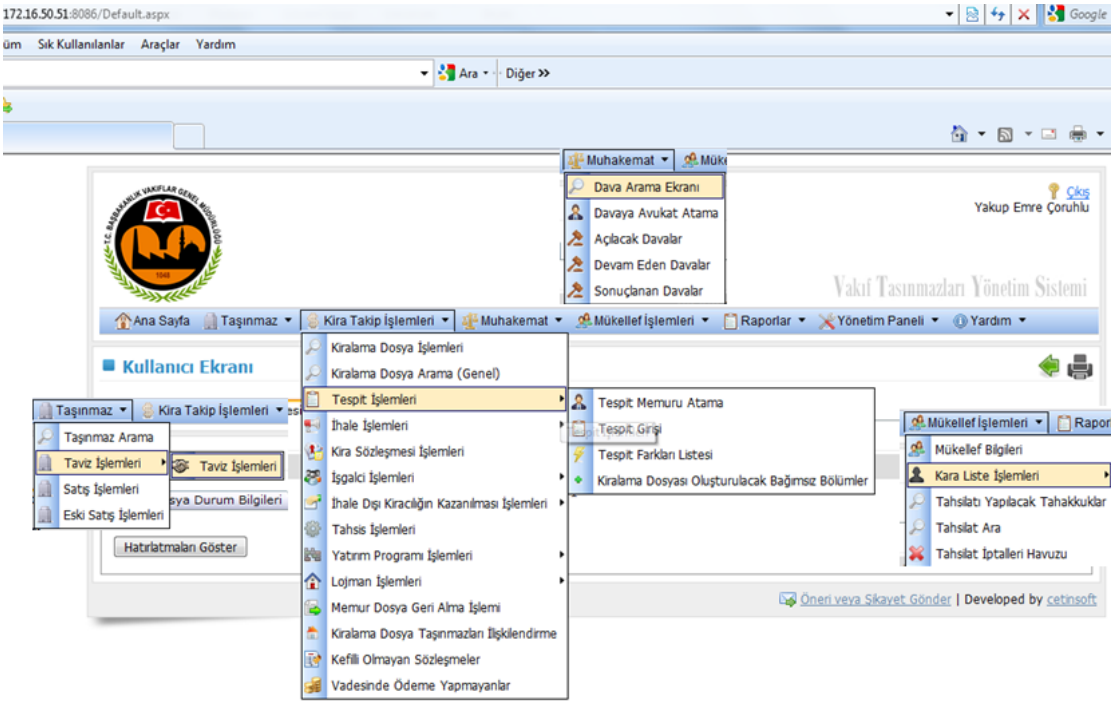

Fig. 3. The screen of EVOS

VTYS (Vakıf Taşınmaz Yönetim Sistemi-VTYS in Turkish): A piece of software under the name of Management System of Foundation Properties was developed and began to be used (Çoruhlu, 2013; Çoruhlu and Demir, 2014b; Çoruhlu and Demir, 2015).

VAKBİS (Vakıf Kütük Bilgi Sistemi-VAKBİS in Turkish): An e-government application module by which foundation registry information of foundation properties registered in EVOS are blended with title deed details retrieved from LRCIS (Çoruhlu, 2013).

MERNİS (Merkezi Nüfus İdaresi Sistemi MERNIS in Turkish):The MERNİS project is a project that transfers all civil status details into electronic medium and enables instant updating and sharing through a safe network of any change in civil status details from 957 centers scattered across Turkey (URL-5, 2014).

MERSİS (Merkezi Sicil Kayıt Sistemi-MERSİS in Turkish, Central Registration System CGS in English) Central Registration System is a central information system. Thanks to this system, commercial registration procedures are carried out electronically together with trade register records, registration and content. All this information is stored regularly and served to third parties if it is needed via internet (URL-6, 2014).

KVK (Konumsal Veri Konsolidasyonu-KVK in Turkish, Cadastral Data Consolidation (KVK) is available as an open source WEB GIS application that provides collection, query and management in a single system of all cadastral parcels in Turkey. Date of about 58 million parcels is presented via the web interface and used in activities within TKGM. Through the software, cadastral data in various formats in scattered locations are combined in a single system (URL-7, 2014).

MEGSİS (Mekânsal Gayrimenkul Sistemi-MEGSİS in Turkish) It is an open-source application developed by the General Directorate of Land Registry and Cadastre (GDLRC), where cadaster data are collected by the center system from local users in the cadaster offices in digital .cad format and are harmonized with land registry data in order to be submitted to stakeholder institutions, organizations, municipalities and citizens via the e-government link. (URL-8, 2014).

VAKIFBANK: The bank with which GDF works with on monetary issues. Business and transactions of all foundation lessees covered by EVOS are carried out with this bank.

NOTARY PUBLIC: A person authorized by the state to issue and certify contracts, instruments and other documentation directly in accordance with law, and retain their true copies (URL-9, 2014). Notaries are people who ensure that any contract executed between the GDF and third parties are prepared, signed and recorded.

LİHKAB (Lisanslı Harita Kadastro Mühendisleri ve Büroları-LİHKAB in Turkish): The Licensed Surveying Engineers and Bureaus (LSEB): Some technical cadastre works, which were conducted by the Cadastre Office of GDLRC and private surveying engineering bureau under the control of the cadastre offices, have been passed to LSEB based on the law numbered

5368 put into practice in 2005. Passed technical works have been implemented by LSEB under the control of the Cadastre Office of GDLRC (Demir et al., 2015).

TAKBİS (Tapu Kadastro Bilgi Sistemi-TAKBİS in Turkish, Land Registry and Cadastre Information System-LRCIS in English), which is the most important pillar of location-based information systems, is a major project, which began in the 1990s (URL-7, 2014; URL-10, 2014). LRCIS was completed in all units on the basis of Title Deed Registry Offices and is run in certain provinces and regions based on Cadastre Offices. In cadastre pillar of the system, problems stemming from cadastre bases leads to a delay in operability of the system literally across Turkey. LRCIS will be the basis of all spatial-based information systems (Çete et al., 2010). All web based interfaces and their relation to EVOS can be seen in figure 4

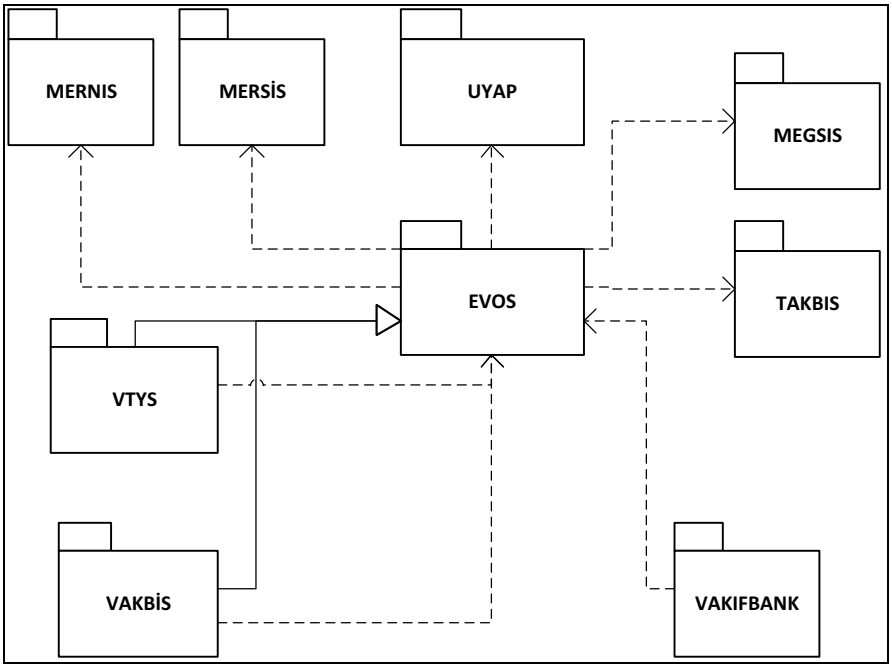

Fig. 4. EVOS with the other e-government interfaces in terms of interoperability

CONCLUSIONS

During the Ottoman Empire time, each foundation had been managed by board members of the foundation itself. But now, there is no one in order to manage to foundational works from the board members of foundation in Turkey because of some reasons such as the death of board members or foundation employees, migration, escaping etc., so these foundations had to be managed by the Turkish Governmental Institution, the General Directorate of Foundations since the first Foundations Law 2762 was abolished in 2008. Now these foundational duties have been represented and managed by the same institution according to new law numbered 5737 put into practice in 2008. All practices and land management implementations for foundational duties are mentioned by the law 5737 so that there will not be difficulties in practices.

As stated at the beginning of article, nearly 40.000 foundations and their 80.000 parcel based immovable properties have been administered and represented by the GDF since 1935.When the first Foundation Law 2762 has put into practice. It can be said that foundational immovable properties are very important for Turkey, these properties originated from especially the Seljuk's and Ottomans times, and these are used for different aims such as religious facilities, cultural centers, trade centers, health care centers, shops, houses, public baths etc. in Turkey.

The GDF carries out social welfare and food aid, medical care, scholarships, and the restoration of cultural heritages-cultural assets be protected so that these heritages such as mosques, bridges, houses, public baths, church, and so on., can be handed down to future generations.

The GDF aims to increase foundational income so as to increase social aids increase other foundational aims. So the rental income from foundational properties is an important point for the GDF. To accomplish these aims with in the control of the GDF, land management, land development, land acquisition, land purchase and sale, rent increase rate etc. have to be managed carefully. Moreover; all these duties can be carried out by the strict control of the GDF. Is it possible now? The answer of this question is simply all of them are possible thanks to the usage of web based information systems.

The GDF web based information system, given above in detail, EVOS is a part of e-governance. Day by day the system is being accelerated with the contribution of the GDF employees. However, the system has some deficiencies in the name of becoming a part of e-Turkey.

The failure to access spatial data of foundation properties by e-government is a problem. The GDF's system does not include spatial data for foundational parcels. Therefore, it is also necessary to immediately provide access to spatial data on the basis of foundational parcels conducted by GDLRC. As a result, EVOS, an e-government application in GDF, was developed to a large extent in accordance with the e-government perspective just for foundational work only by GDF, but EVOS must be proceeded and integrated with the all of the e-government applications in e-Turkey in the name of interoperability.

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