Master Thesis

im Rahmen des
Universitätslehrganges „Geographical Information Science & Systems“

(UNIGIS MSc) am Zentrum für GeoInformatik (Z_GIS)
der Paris Lodron-Universität Salzburg

zum Thema

„The influence of cultural and institutional factors on cadastre-based GIS diffusion projects in emerging countries“

Two practical examples from Azerbaijan

vorgelegt von

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U1522, UNIGIS MSc Jahrgang 2010

Zur Erlangung des Grades

„Master of Science (Geographical Information Science & Systems) – MSc(GIS)”

Gutachter:

Ao. Univ. Prof. Dr. Josef Strobl

München, 14.04.2013

Acknowledgements

The author wishes to thank the GIZ staff in Sumgait for their support in organizing the field work and arranging all meetings. Special thanks to the head of the local GIZ representation Mrs. Schafiga Hadjiahmedova, the project coordinator Miss Katharina Lampe, the local office assistant Mr. Kamil Mamishov and the interpreter Mr. Seydi Kerimov who was a great help in separating essential from non-essential information. Thanks also to Mr. Mehdi Abdullayev for his invaluable advise on the legal issues surrounding communal tax collection and to Mr. Hartmut Junge for his ongoing support of AzArchitect in the Department for Architecture and Urban Development.

In addition I would like to extend my gratitude to my colleagues Mr. Ludger Sonntag who assisted me during my last visit to Sumgait, supporting me in conducting the trainings and various other activities. Mr. Sonntag further developed the FME template for future data transfers. My other colleague Mr. Michael Wagner is thanked for his contribution to the development of the PostgreSQL template database for the cadastral data of Sumgait.

Statutory declaration

I herewith declare that I have completed the present thesis independently making use only of the specified literature and aids. Sentences or parts of sentences quoted literally are marked as quotations; identification of other references with regard to the statement and scope of the work is quoted. The thesis in this form or in any other form has not been submitted to an examination body and has not been published.

Date: 14.04.2013 Signature: 

(Norman Kießlich)

Kurzbeschreibung

Die Verwaltung von Landressourcen ist eine der Kernaufgaben von nationalen und lokalen Verwaltungen. Moderne Landadministrationssysteme (LAS) integrieren eine Vielzahl von Regierungsbehörden um eine nachhaltige Landentwicklung gewöhnlich auf Basis eines einheitlichen, digitalen Liegenschaftskatasters sicherzustellen. In Entwicklungsländern werden solche Katasterdaten häufig gerade erst eingeführt und betroffene Verwaltungen werden in durch entsprechende Projekte bei der Einführung von GIS Technologie zur effizienten Nutzung digitaler Katasterdaten unterstützt. Solche Projekte führen allerdings häufig nicht zu nachhaltigen GIS Lösungen und als Grund dafür wurde unter anderem eine unzureichende Beachtung von kulturellen und institutionellen Faktoren im Projekt- und Softwaredesign genannt.

Diese Thesis evaluiert diesen Vorschlag im Zusammenhang mit einem Pilotprojekt in Sumgait, Aserbaidschan. Das politische, kulturelle und institutionelle Projektumfeld wird mit Blick auf den derzeitigen Stand der kürzlich durchgeführten Landreform, die institutionellen Gegebenheiten und den kulturell verankertem Fortbestehen hoher Korruptionsraten analysiert. Die Eignung von lokalen Behörden wird analysiert anhand der technischen und institutionellen Gegebenheiten sowie deren politischem Willen und Relevanz. Die Abteilung für Architektur der staatlichen Stadtverwaltung und die Steuerabteilung der kommunalen Selbstverwaltung wurden als Projektpartner ausgewählt. Ihre internen Arbeitsabläufe wurden eingehend untersucht. Zwei GIS Lösungen (AzArchitect & AzFinance) wurden basierend auf den Ergebnissen der institutionellen Anforderungsanalysen entwickelt. Diese Lösungen wurden so konzipiert, dass sie die digitalen Katasterdaten des Liegenschaftsamts zur Steigerung der Performanz der Abteilungen sowie zur Verbesserung des Datenaustauschs zwischen Verwaltungen nutzbar machen. Letzteres Problem behindert derzeit eine effiziente Verwaltung von Landressourcen in Sumgait.

Die Ergebnisse dieser Arbeit deuten darauf hin, dass die missionskritischen kulturellen und institutionellen Faktoren richtig erkannt und hinreichend in dem Softwaredesign umgesetzt wurden. Die Thesis folgert, dass solche Faktoren auch in ähnlichen Projekten eingehend untersucht werden müssen, da deren Nichtbeachtung mittel- bis langfristige zur Ablehnung der Lösung führen könnte.

Abstract

The management of land resources is amongst the core responsibilities of national and local governments. Modern land administration systems (LAS) integrate numerous government administrations to promote sustainable land development usually based on a common and accurate digital real estate cadastre. In developing economies such cadastral data is often only now being introduced and target administrations are subject to GIS diffusion projects to equip them with the necessary tools and expertise to make use of the generated cadastral data. Such project, however, often fail to introduce sustainable GIS solutions and it has been suggested that this may be due to a lack of consideration of cultural and institutional factors in the project and software design.

This thesis evaluates these suggestions in the context of a pilot project in Sumgait, Azerbaijan. The political, cultural and institutional project environment is analysed reviewing the current states of the recent land reform, the institutional setups and the culturally engrained prevalence of corruption. The suitability of target administrations in Sumgait is analysed in terms of their technical and institutional conditions as well as their political will and relevance. The state-controlled city department for architecture and the tax department of the self-governing municipality were chosen as project partners and had their internal work processes analysed in depth. Two GIS solutions (AzArchitect & AzFinance) were developed following the results of the institutional requirements analysis. These solutions are designed to utilize digital cadastral data of the state real estate office to improve the departments´ performances and address prevailing issues in the interdepartmental information exchange that is currently preventing efficient land management in Sumgait.

The results suggest that the critical cultural and institutional factors were correctly identified and found adequate consideration in the software design. The thesis consequently concludes that such factors ought to be examined closely in similar projects as their dismissal may lead to rejection of the solutions in the mid to long term.

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Acronyms

CPI	Corruption Perception Index
EU	European Union
EXCOM	District Executive Committee
GCI	Dr. Schindler Geo Consult International Gmbh & Co KG
GFA	GFA Consulting Group
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit
IAP	Istanbul Anti-Corruption Action Plan
IDE	Interactive Development Environment
IMF	International Monetary Fund
KfW	Kreditanstalt für Wiederaufbau
LAS	Land Administration System
LCS	Land Commission Secretariat
MoU	Memorandum of Understanding
OECD	Organization for Economic Co-operation and Development
PPP	Private-Public Partnership
SCPI	State Committee for Property Issues
SLC	State Land and Cartography Committee
SPC	State Property Committee
TIN	Tax Identification Number
WB	Worldbank

1 Introduction

Modern land administration systems

The management of land resources is amongst the core responsibilities of national and local governments and forms a fundamental basis for political and social stability, economic growth and a sustainable environment (Enemark, Willamson et al. 2005). The term management here relates to the practise of using available land to pursue the goals set by the respective national or regional land policy and strategy. Land resources are commonly managed within a national or regional Land Administration System (LAS) which provides a theoretical framework for the implementation of the associated land policies. Such frameworks are complicated by their cultural, political and jurisdictional background and thus vary between nations and regions across the globe (Enemark, Wallace et al. 2010). The basic functions of a LAS include the regulation of land and property development and associated disputes, control on land use and taxation (Dale and McLaughlin 1999). Recent shifts in the land management paradigm, however, trend away from their focus on simple land management and towards holistic management systems integrating ever more aspects related to, and extending beyond, the traditional functions of land resource management (Enemark, Willamson et al. 2005). The land management paradigm, as illustrated in Figure 1, is a theoretical and universal construct that can be used to guide the establishment of reformation of a national or regional LAS with the intention to improve ownership security, promote good governance, tackle poverty and ensure effective land markets (Willamson, Enemark et al. 2008).

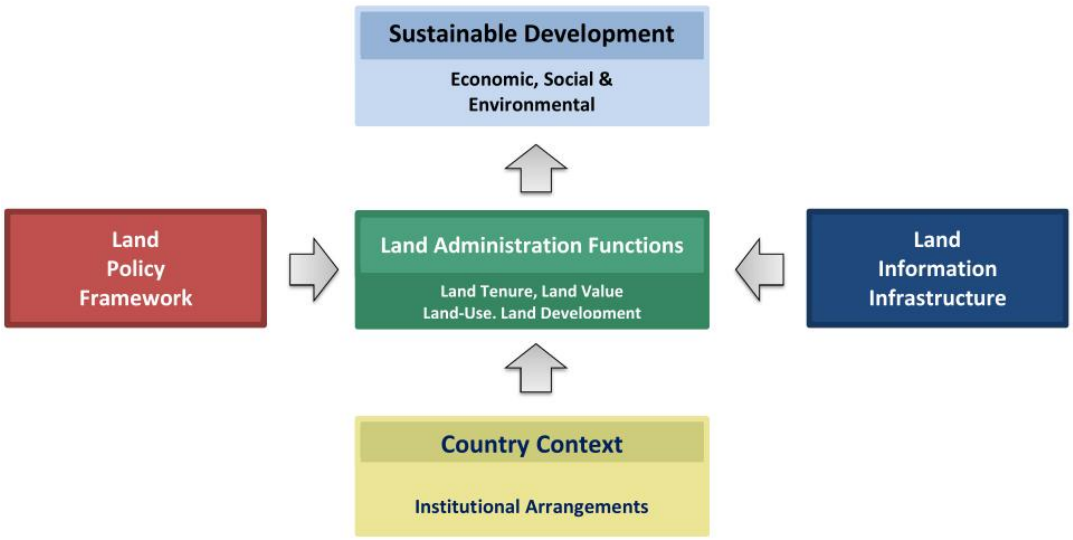

Figure 1: Land management paradigm, adopted from Enemark *et al.* (2005).

The paradigm shift reflects an ever increasing interdependence of individual actors from private and public sectors and their need for shared data and information regarding land resources (Ting and Willamson 1999). In its pursuit of sustainable development, a modern LAS thus incorporates a multitude of land related activities such as taxation, land use planning, emergency planning, waste management and the real estate market, to name just a few. Such a unified, holistic approach is primarily intended for developed economies, however, it is also applicable as a guideline for transitional economies and consequently ought to find consideration in the planning and implementation of cadastre related development work. Information exchange between different state agencies or administration is consequently a key prerequisite for effective land administration (Enemark and Sevatdal 1999) and presents one of the primary challenges in current development work.

Creation and utilization of digital cadastral data

Another aspect to be considered is the need for accurate and topical real estate cadastral data as the building blocks for modern LAS, the recognition of which has prompted a substantial amount of development work directed at the establishment of modern and accurate digital cadastres in emerging economies (Williamson 1997). Often times the establishment of a modern digital cadastre constitutes the first attempt to create a nationwide digital spatial dataset spanning administrative boundaries. Such projects entail a high degree of customization as each national cadastre must be tailored to address the requirements posed by the unique social and economic demands of that

nation (Williamson 1982; Hawerk 1997). In addition, complications that were previously unforeseen or only impacted land owners at a local level become evident when boundaries are determined for entire cities, regions and nations. Such complications are particularly evident in emerging economies that have recently undergone land reforms (Schmidt 2011) such as privatisation in the wake of the collapse of a communist government system. The establishment of cadastres thus goes beyond the technical realization of surveying works, which, in and by themselves are already very cost intensive. International donors invest much effort and monetary resources into solving these issues, however, the various legal and practical issues surrounding the full distribution and use of the generated cadastral data is often beyond the scope of the individual project or program. The targeted user base is usually limited to those administrations immediately concerned with the registration and titling of land.
The inclusion of all relevant agencies and administrations, however, is a requirement if the above mentioned holistic approach to a modern LAS is to become reality in the mid to long term. Realizing the full potential of cadastral data thus depends on whether a lack of access to, or underutilization of, surveying results in those government bodies, that would benefit from access to the information, is addressed and tackled following a successful establishment of a cadastre.

While cadastre projects require national coordination and support, in most cases, they must ultimately be designed to enable local and regional government bodies to operate with the cadastre (Williamson 2000). Williamson uses the terms decentralization and deconcentration to describe the need for local administration of national cadastres and emphasizes its importance in implementing local land policies within a national framework.
In the context of development work, regional government representations are rarely adequately equipped to integrate the generated cadastral data into their work processes. They require assistance with the necessary amendments to their IT infrastructure, their work processes as well as training and knowledge transfer concerning the operational use of digital spatial data. Numerous follow on projects consequently focus on the introduction of GIS technology to relevant local actors in order to facilitate the management and creation of new information products based on the cadastral data (e.g. LandManager presented by Gläsel, Schindler *et al*. 2013) and an overall contribution to national land policies.

Critical factors in GIS diffusion projects

The budgets for such projects, however, do not usually allow comprehensive requirements analyses as part of the development of software applications adequate for the task at hand, resulting in solutions that are often times too rigid in their design or insufficiently customized to reflect the local circumstances (Dooley 2001). Another significant factor limiting the success of such projects is the common disregard or at least insufficient consideration of local political, sociological and institutional factors in the project and software design, potentially resulting in rejection by the intended users (Karikari, Stillwell et al. 2002; Wise and Craglia 2008). This aspect, in particular, needs to be addressed in order to achieve sustainable developments beyond the lifetime of the respective project. Failure to diffuse GIS technology effectively and sustainably on a local level will ultimately compromise any attempt at implementing modern land administration systems on a larger scale and jeopardize considerable investments in international economic development.

The need for a systematic analysis of the latter factors is highlighted by Karikari *et al.* (2002) in their paper presenting the findings of a pilot study on the factors and processes underpinning successful GIS diffusion into the Land Commission Secretariat (LCS) in Ghana, Africa. The study emphasizes the importance of a systematic evaluation of the socioeconomic and institutional settings and the involvement of local experts in the attempt to introduce GIS technology in African government agencies. The authors caution against the introduction of preconceived technical concepts and ideas by the implementing consultants.
The results are presented in the context of the development of a prototype GIS software solution that was developed following their human based approach with a critical factor analysis conducted through interviews. The results and findings cannot readily be extrapolated to all comparable GIS diffusion projects in other nations, leave alone other continents, and require validation under different socioeconomic conditions.

There is consequently a need for further empirical evidence from other sociological contexts to support or relativise the findings of Karikari *et al.* (2002).

1.1 Motivation

Since the Republic of Azerbaijan has gained independence on August 30, 1991 the Azerbaijan government has sought to strengthen the economic relationship with the EU, its primary trade partner. This effort has resulted in a series of international development projects aimed at consolidating Azerbaijan´s economy and promoting political stability. The absence of a functioning, modern cadastre has been identified as a principal obstacle to economic growth as well as a source of significant land conflicts. The government of the Republic of Azerbaijan has recognized the need for a thorough reformation of the real estate registration and cadaster on all scales throughout the nation and is cooperating with international donors such as The World Bank (WB) and KfW and subject experts to develop and implement a modern nationwide real estate registration and cadastral system. The World Bank (2013), SCPI (2011).

Consequently, priority was given to the establishment of a national digital cadastre that will guarantee security of investments in the future and assist in the implementation and enforcement of national and regional land development policies. The national State Committee for Property Issues (SCPI) is responsible for all practical implementations concerning the establishment of a real estate cadaster and coordinated a WB funded pilot project aimed at the creation of a comprehensive digital cadastral dataset for two pilot areas (Sheki and Ganja), that was successfully implemented in 2011 with the assistance of the international consultancy consortium GFA/GCI. The author of this thesis was involved in that project and bore responsibility for the management and quality assurance of all spatial and non-spatial data. As a result of the positive outcome of these pilot projects, the SCPI decided to conduct similar, self-financed projects for part of the Azeri capital Baku and the whole of Sumgait, the third-largest city in Azerbaijan. Beside the establishment of the cadaster in form of digital geometries of all buildings and land parcels, ownership information and other relevant data were collected through personal interviews with the rights holders and stored together with the geometrical data in a GIS. The pilot projects were completed and the data handed over to SCPI by the end of October 2011. The author was personally involved in the project and assumed responsibility for the management and quality assurance of all generated spatial and non-spatial data.

The encouraging results of the successfully completed pilot projects have prompted more efforts to establish such data sets for other parts of Azerbaijan and, if possible, all of Azerbaijan at some point in the future. The Azeri government initiated and fully self-financed another real estate cadaster project for Azerbaijan´s second largest city Sumgait. All surveying work and quality assurance activities were completed by the end of January 2013. The intended use of the Sumgait cadaster was limited, however, to supporting land related activities by SCPI in the field of registration and titling.

When the project was announced in early 2012, the lack of integration of other administrations encouraged the author and his colleagues to approach the GIZ for a potential development cooperation regarding the widening of the users´ circle for the newly generated cadaster to other local administrations in Sumgait. The GIZ is actively promoting efficient and sustainable governance in Sumgayit and other cities in the Caucasus and the local GIZ representatives were interested in the potential of the expected cadastral data to increase administrative efficiency and transparency for the citizens. The author recommended a series of missions to identify one or more suitable local administrations and evaluate their needs and potentials for a cadaster based GIS diffusion project. Following the findings of Kirikiri *et al.* (2002), the author proposed a human based approach, paying particular attention to the given socioeconomic, political and institutional circumstances. The development of a customized GIS application was envisaged upon the successful identification and conclusion of a cooperation agreement between GCI (represented by the author), GIZ and the local administration in question.

1.2 Hypothesis

The introduction of cadastre-based GIS technology has the potential to substantially increase the efficiency and productivity of the chosen public administrations but will not achieve sustainable success unless local political, institutional and social aspects are taken into consideration and integrated into the project design and software products.

1.3 Aims & Objectives

It is the overall aim of this work to gather empirical evidence on the general applicability of the findings by Karikari *et al.* (2002) for cadastre-based GIS diffusion projects in Azerbaijan and evaluate which non-technical factors are critical and need to be integrated into the design of software solutions. This aim is pursued through a pilot

project involving selected local administrations in Sumgait that profit from access to digital cadastral information and its integration into their work processes. This in turn, is intended to result in an increase in efficiency and is anticipated to contribute to interdepartmental synergies in the wider local land sector.

The individual objectives are as follows:

- Analyse public departments within the city administration and the municipality of Sumgait for their potential to benefit from access to the cadastral dataset and their suitability for a cooperation (including the political environment)
- Perform a technical requirement analysis for selected candidates with particular attention to the institutional setup
- Develop custom GIS solutions based on technical and non-technical requirements identified in the previous two objectives
- Introduce the developed solutions to the selected administrations, provide training and gather feedback to evaluate the acceptance

1.4 Expected Results

The empirical evidence on the influence and importance of non-technical factors in the introduction of GIS technology in local administrations in Azerbaijan is expected to add to the understanding of why similar endeavours omitting such considerations often fail to introduce permanent, sustainable solutions.

The chosen approach of this thesis will result in a set of practically applicable software solutions that are aimed at improving the chosen departments´ workflows and services rendered to the public. The success of these solutions heavily depends on the correct identification and consideration of all relevant political and social factors in the development of sustainable software solutions. It is therefore expected, that the outcomes of this work will contribute to the understanding of relevant factors in the utilization of digital cadastral data in local governments of developing nations. In the mid to long term, the introduction of modern digital data management and GIS technology in Sumgait is further intended to promote computer literacy and to pave the way for future improvements and extensions to the software solutions.

1.5 Issues not covered

The stated aim and objectives of this thesis do not imply a comprehensive implementation of the herein discussed good governance project by the GIZ and will, as such, not cover every aspect of it. That is to say the completion of the mentioned project is not an envisaged outcome of this thesis. Rather it focuses entirely on the potential of accurate cadastral data for local government administration other than the cadastral office itself and the identification of critical non-technical factors and obstacles posed by the local social, political and institutional environment.

This thesis does not present a generally applicable guideline to the preparation, leave alone introduction, of land administration systems on a local government level, it presents empirical evidence of relevant factors to such implementations and attempts to add to previous research in that field.

1.6 Target audience

The results of this thesis are directly relevant to the involved administrations and international experts in Sumgait as well as future beneficiaries of the developed solutions, should these be introduced in other regional offices in Azerbaijan in the future. The conclusions further add to the understanding of relevant factors in the preparation of a holistic LAS in transitional economies and are thus valuable empirical findings that may be applicable to similar efforts undertaken by the international economic development community.

1.7 Structure

The thesis is divided into six chapters. This **chapter** (1) introduces the reader to the subject of LAS and their preparation in terms of the creation and utilization of accurate cadastres and emphasizes the importance of introducing cadastre-based GIS technology to target administrations at a local level with adequate consideration for their specific institutional and social requirements in the context of a developing economy.

Chapter 2 provides the reader with essential background information on the environment that this thesis was conducted in. It sets the scene by discussing the three primary variables affecting land administration in Azerbaijan, namely the recent land

reform, the structural setup of relevant administrations and the state of corruption, highlighting their relevance to the conducted work.

Chapter 3 covers the analyses performed by the author prior to project implementation. It presents the results of the suitability analyses, followed by the selection of suitable candidates and finally reports on the software requirements analyses. Relevant technical, political, cultural and institutional factors evaluated through interviews with department staff and post-interview discussions with local experts are highlighted.

Chapter 4 delves into the implementation process and offers a detailed overview of the two developed solutions, presenting the reader with a reasoned approach to the development of practical solutions based on the findings of the preceding analyses. The reasoning behind the decisions for certain tools and features is highlighted where applicable and commented in the light of the given institutional or social environment.

Chapter 5 presents the reader with the last chronological step, the delivery procedure. The solutions are presented and installed, trainings are provided and feedback is gathered from users and decision makers. The acceptance of the developed solution is evaluated based on the given feedback and observable operation of the solutions.

Chapter 6 summarizes the findings, states the limitations, discusses the results of this work and offers an outlook on necessary future steps to build on this work and carry it through to fruition. The author draws relevant conclusions from his work and critically evaluates the limitations of this thesis in an attempt to extract those lessons learned that will be applicable to similar future endeavours and the continuation of this development.

2 Background Information

The current state of the LAS of the Republic of Azerbaijan must be evaluated in a historical context in order to identify and understand current issues, their origin and consequently their relevance to an attempt at a successful implementation of cadastre related development projects. An evaluation of risks and potentials to such implementations would therefore be incomplete without, and must in fact start with, a review of the Azerbaijan´s land reform following the transition from a member of the Soviet Union to an independent state as well as the structural changes and administrative settings that directly or indirectly affect the management of land resources.

2.1 Privatisation and land reform

The privatisation of state land and property has been a key issue in the establishment of a competitive market economy in most former Soviet member states such as Azerbaijan. In Azerbaijan, the Constitutional Act "On State Independence" (dated October 18th, 1991) laid the foundation for all following reforms, of which the land reform was one. The privatization of both property and land has had a significant impact on the current state of land and property ownership in Sumgait and Azerbaijan as a whole.

The privatisation of state property in general proceeded slowly and did not begin before 1996 despite an early establishment of the State Property Committee (SPC) in 1992 that was responsible for the implementation of the privatisation programs and the adoption of the Law on Privatization passed in January 1993 (Bairamov 2001). The delays were due to political instability during the early years as Azerbaijan had four different governments between 1991 and 1993 and two coup attempts were made against President Aliyev after he seized power in 1993 and before he achieved political stability through the parliamentary elections in November 1995 (The World Bank Group 2000). While these and following elections were marred by serious irregularities, the resulting stability allowed the privatisation funded by the International Monetary Fund (IMF) to go forward. Since then Azerbaijan´s political structure with a strong president and weak parliament has meant that reforms could swiftly be implemented without much debate or opposition as was occasionally the case in privatisation efforts in other former Soviet nations that have stronger parliaments. On the other hand, the concentration of political

power on the president and his associates has led to serious irregularities and occasional conflicts between international investors and the Azeri government. The Government Accountability Project (2008) discusses the role of corruption as a significant factor in Azerbaijan´s privatization efforts.

The land reform, that is the distribution of land to private or commercial owners, was given a good deal of attention due to the importance of agriculture to the national economy and it manifested in a large number of associated laws, decrees and legal acts such as the law "On Land Reform" (adopted on July 16th, 1996), "On Land Tenure", "On Land Market", "On State Land Cadastre, Land Monitoring and Land Creation", "On Land Fertility", "On Municipal Land", "On Management of Municipal Land", the Land Code (adopted on June 25th, 1999) and approximately 50 others (Khanalibayli 2008). After the initial delay described above, the land reform was swiftly implemented and progressed at a fast pace primarily due to the strong political backing and foreign expertise provided by the WB (Csaki, Kray et al. 2006). The various decrees specified the procedures for the redistribution of land and the dissolution of state owned and collective farms. The SLC was tasked with all land surveys and titling associated with the division of land. The land reform produced a predominantly privately owned and well distributed land market with more than 96% of land in private ownership (Dudwick, Fock et al. 2005) and noticeable increases in agricultural productivity (Figure 2).

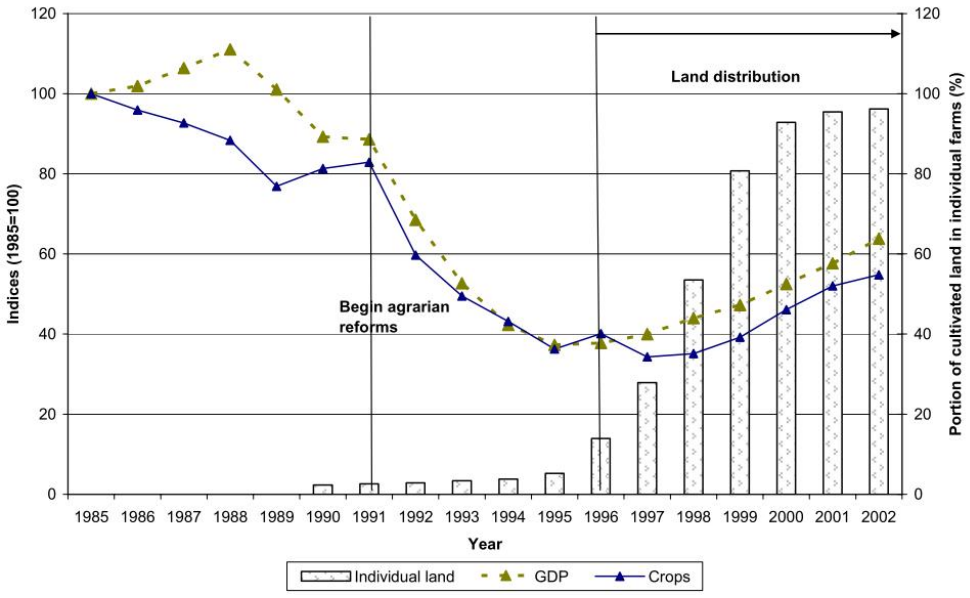

Figure 2: Agricultural land allocation and productivity in Azerbaijan before and during the land reform. Source: Dudwick *et al.* (2005).

While the land reform was successfully implemented in terms of land distribution, the low level of governance and strong centralization of political power in Azerbaijan have

adversely impacted progress in the institutional development necessary for maintenance of the local land markets through public services and regulation. Figure 3 illustrates how the institutional factor in the land reform stagnates (reform factor = 5 in 2003) while other aspects of the reform made positive progress during the first seven years of the reform implementation phase. As of 2006, 99% of the land reform had been completed, yet the index has for the institutional framework necessary for a sustainable development and management of land has stagnated at a factor of 5 out of 10 (Csaki, Kray et al. 2006).

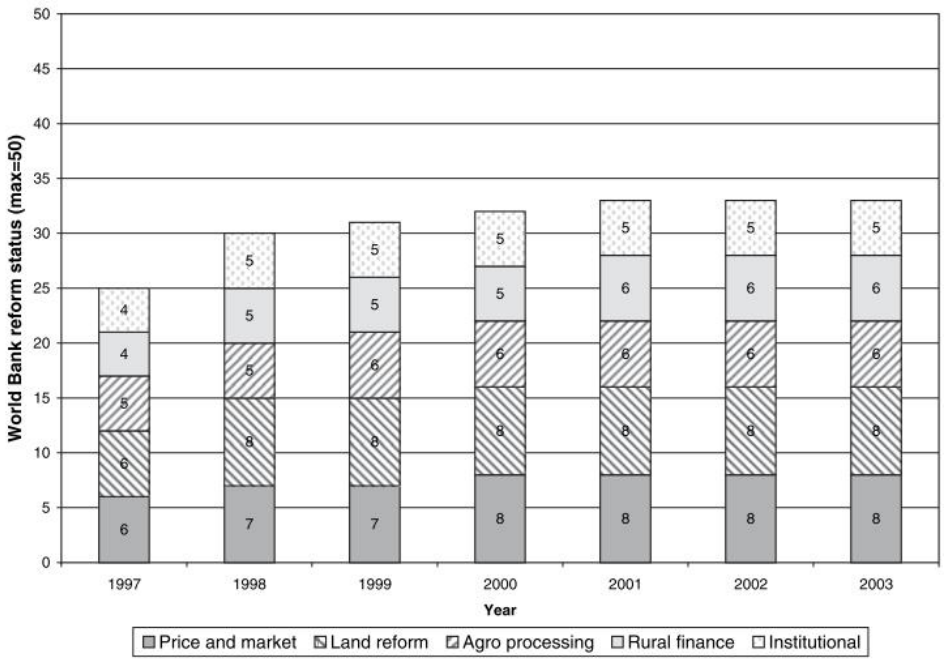

Figure 3: Progress of the land reform in Azerbaijan in 5 key areas between 1997 and 2003. The index values range from 1 (centrally planned economy) to 10 (completed market reforms). Source: Dudwick *et al.* (2005) based on data from Csaki *et al.* (2005).

2.2 Institutional setup

The lack of adequate local governance in the land market is a symptom of a general problem plaguing the nation. The constitution of Azerbaijan outlines the establishment of local self-governance in compliance with the European Charter of Local Self-government. These local self-governing bodies assume responsibility primarily for locally implemented social programs, budgeting and taxation amongst other activities while a local representation of the state, the district executive committee or EXCOM (a term adopted from soviet times, hereafter referred to simply as City administration) governs in state related matters. The concept of local self-governance in general is a

recent development in Azerbaijan and has only been factually introduced in 2000 after the “Law on Municipal Elections” and the “Law on the Status of Municipalities” had been enacted (Dudwick, Fock et al. 2005). Citizens are thus given the rights to participate in local governance and indirectly elect, through the council, a chairperson acting as the head of the executive apparatus (Munteanu, Popa et al. 2001).

The municipalities are supposedly autonomous institutions and ought to act independently and on equal terms with the local state executive commission. The relationship between the two actors are, however, not defined in legislation and have resulted in ambiguity concerning their mandates that, at least in the case of the Sumgait, currently prevent municipalities from fulfilling their tasks as locally elected government bodies (Mamedova, Bashir et al. 2001). The financial independence of municipality is in theory assured through local taxation and revenue generated through municipal land. In practise, however, the strong opposition by many local state representatives who fear loss of power and influence has prevented the legally outlined allocation of land to the municipalities to be completed. Municipal boundaries thus remain unclear and in most cases both the city administration and the municipality have prepared and keep their own conflicting records that divert ever more from another with every sale of land plots in part or in whole.

The situation in Sumgait is such that significant tensions exists between the locally elected and state appointed governing bodies, municipality and city, respectively, and that the representatives of the city administration wield significantly more political power than their elected counterpart. The local self-governing municipalities possess little influence and are often disregarded by decision makers. Their establishment prescribed by no lesser document than the nation´s constitution itself has resulted in their de-facto institutional introduction but not in their full integration in local political activities. Considering the strict adherence to political hierarchies and an incisive top-down governing approach evident in all institution, Azerbaijan has the institutional setup in place for local self-government coupled with a mentality for strictly central decision making. The described issues are therefore only partly due to insufficient legislative clarification and also root from the cultural heritage of governing history. In the context of local land administration, the parallel management of municipal and state owned lands with unclear boundaries poses one of the greatest challenges in implementing and enforcing sustainable land management.

2.3 Prevailing corruption

As already demonstrated in the context of privatisation, corruption remains prevalent in Azerbaijan and poses a significant risk to any reformation process. Corruption in Azerbaijan affects all levels of government and has long since been recognized by the wider development community as a high priority problem that needs to receive immediate attention (Council of Europe 2007). The participation in the Istanbul Anti-Corruption Action Plan (IAP) set up by the Organisation for Economic Co-operation and Development (OECD) in 2003, the founding of the Azeri Commission on Combating Corruption in 2004 and several other initiatives launched since then are indicative of the political pressure exerted on the Azeri government by the international community to combat the high prevalence of corruption in Azerbaijan. While the OECD Monitoring Report for Azerbaijan (2010) states that the government has made significant progress in implementing the recommendations made in the IAP, it also notes that corruption "*remains an issue*" and refers to the results of the annual Corruption Perception Index (CPI) published by Transparency International. Figure 4 and Figure 5 show the ranking and CPI scores for Azerbaijan between 2001 and 2012. A slightly positive trend is visible in the both figures though the one in the ranking statistics in Figure 4 is more pronounced than that of the CPI actual scores in Figure 5, indicating a slow but noticeable progress.

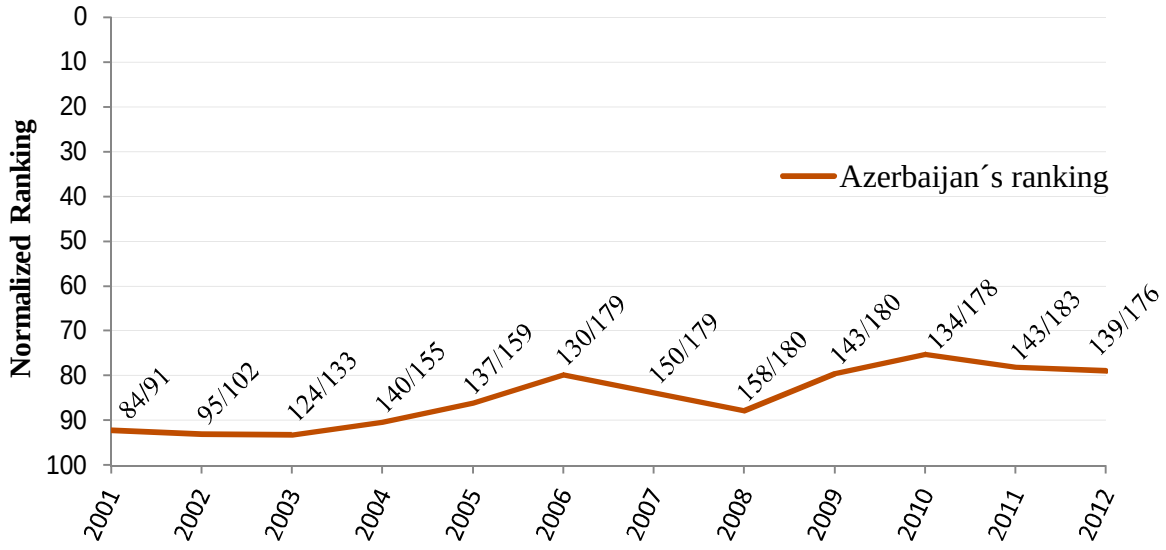

Figure 4: Perceived corruption in Azerbaijan between 2001 and 2012 by international ranking based on data from the annual Transparency International Perceived Corruption Indexes. The Ranking was normalized to a scale of 1-100 (y axis). The actual ranking and the total of analysed countries for each year is given as x-axis labels (e.g. in 2001, Azerbaijan ranked 84th out of 91 nations).

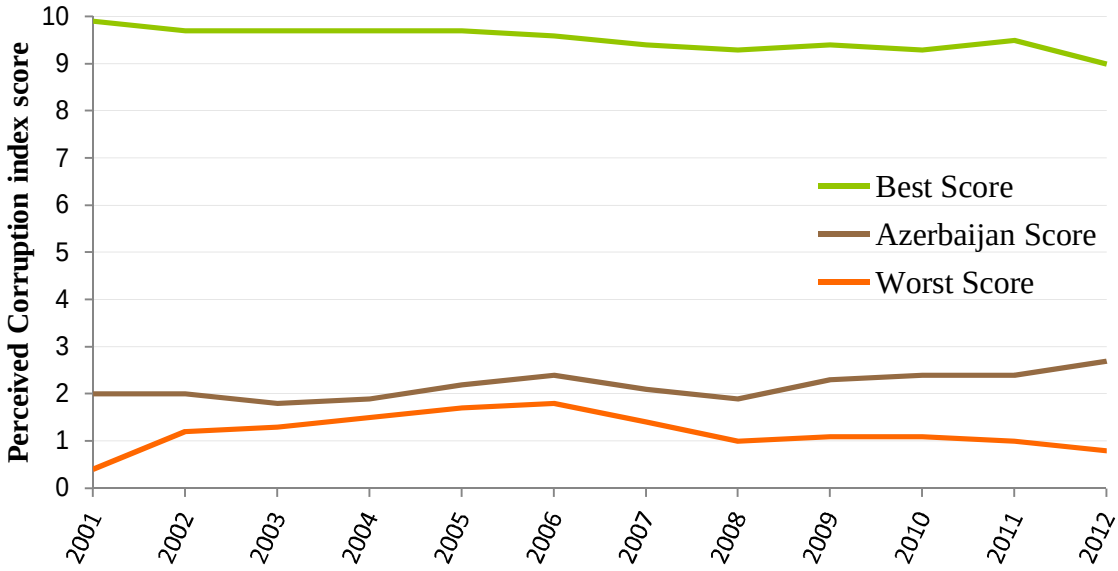

Figure 5: Perceived corruption score for Azerbaijan between 2001 and 2012 based on data from the annual Transparency International Perceived Corruption Indexes. The score for 2012 was ranked on a new 1-100 scale and was adapted to the scale of all previous years of 1-10 for the purpose of this graph.

The difficulties in combating corruption in Azerbaijan are mainly due to the institutionalized nature of corruption according to Tural Abbasov, who describes the distribution of bribes through the of chain of superiors in his article on good governance (Abbasov 2012). Given that such circumstances are to be expected to prevail in Sumgait´s public administrations as well, the knowledge thereof must find consideration in the approach to introduce GIS in these institutions and must influence the design of the developed software solutions.

The recent case of the demolishing of summer houses near Baku, reported by Çingizoğlu (2012) and Abdullayev (2012), is an illustrative example of how corruption undermines effective land management and administration in Azerbaijan. In March 2012 Azersu began demolishing summer houses called dachas at the coast near the capital Baku that have pipelines of Azersu running underneath them (Figure 6). Some of the dachas were constructed as long as 20 years ago and many of their owners were able to provide all proper documents related to the purchase of the land and the construction permit. Such permits should never have been granted for these restricted areas, rendering the dachas effectively illegal structures that Azersu has legal permission to demolish in order to maintain their pipelines. The reason why they were granted, in part by individuals not authorized to issue such permissions, is personal enrichment through bribery. A spokesperson for Azersu confirmed that the affected owners will not receive any compensation for their losses.

Figure 6: Azersu demolishes dachas (bottom) that were illegally constructed on or within the restricted zone around their pipelines (top).

3 Suitability & Requirements Analyses

Having reviewed the political and institutional environment that affects the current land context on a local scale in Sumgait, the logical next step in the proposed work is to inform all relevant parties about the envisaged development, secure their cooperation, visit the administrations and their individual departments and perform a suitability analysis in order to identify suitable partner administrations. Individual interviews with the heads of department and their staff members were chosen as the most suitable method of determining the exact purpose of the department, the political relevance, the daily work processes, data requirements and information products, as well as, of course, their preparedness to cooperate in the proposed introduction of GIS technology in their departments. The purpose of these initial interviews is not the compilation of comprehensive summaries of all work processes in minute detail but rather a set of information that will allow the author and the GIZ representatives involved to evaluate if and what kind of cadaster based GIS development is feasible and which department(s) would be able to improve its/their services to the citizen quantitatively and qualitatively the most.

3.1 Information and Preparation Activities

Prior to the interviews and in their preparation, a seminar was organized by the host organization GIZ and held in Sumgait on March 13th 2012 with representatives of all relevant government bodies such as the SCPI, the local administrations (City and Municipality), the involved surveying companies and other decision makers in attendance. The author informed the audience about the progress of past and ongoing cadastral survey projects in Azerbaijan and the opportunities that the anticipated cadastral data for Sumgait present for the local administrations. The author further introduced the next steps in a presentation on the envisaged methodology for GIS introductions in governmental organizations based on the excellent guidelines prepared by Wise and Craglia (2008). The necessary commitment of financial, temporal and personnel resources by both the developers and the recipients were highlighted.

The presentation was followed up with a Questions & Answers session during which the audience had the chance to clarify open issues or address their concerns and voice their expectations. The active participation of the audience and their keen interest were

an encouraging sign that there is a willingness to introduce modern technology and tackle land related issues affecting both local administrations. The main concerns voiced were related to data safety and security and the author addressed these concerns with comparisons to other common applications of GIS, particularly in military agencies, where data confidentiality ranks amongst the highest in the world. However, the consultant understands that security concerns are deeply rooted in the minds of Azerbaijani decision makers, mostly due to the historic conflict with Armenia but also due to mistrust and a lack of openness towards other, sometimes rivaling, departments or administrations. It was evident that most listeners held a proprietary notion of their department´s information and there was a general reluctance to share data amongst another. The overall outcome of the seminar was thus an informed although slightly sceptical audience and the understanding that the critically viewed, proposed interdepartmental information exchange needs further encouragement. The seminar ended with a discussion between the author and all heads of department in which appointments were made for the ensuing interviews.

Seven departments agreed to participate in the suitability analysis:

- Architecture and Urban Planning Department (City)
- City Management Section for Economy (City)
- Housing Department (City)
- Housing, Communal Economy & Production Union (City)
- Tax Department (Municipality)
- Architecture Department (Municipality)
- Department for Property Management (Municipality)

The outcomes of the initial interviews are outlined below.

3.2 City administration departments

3.2.1 Department for Architecture and Urban Planning

The author visited the Department for Architecture and Urban Planning on Wednesday, March 14th 2012 and conducted interviews with employees following an initial presentation of the purpose of his visit to the entire staff. The department is subdivided into five divisions and one project group:

- Administration
  Book keeping and handling of all incoming and outgoing correspondence
- Design & Urban Planning
  Design and approval of building plans
- Land Allocation & Alignment
  Processing applications concerning land purchases and leases
- Accounting
  Accounting and billing
- Supervision
  Supervision of constructions and detection of building code violations
- Contaminated Sites Cadastre Project Group
  GIZ supported project to map contaminated sites in Sumgait

The author interviewed staff members from the subdivisions Design & Urban Planning, Land Allocation & Alignment and Supervision.

The Design & Urban Planning subdivision is responsible for the assessment of building designs and their approval. The approval procedure involves field visits to assess the location of the proposed building and ascertain that no utility lines intersect the construction site or the mandatory safety buffer around it. Records of the field visits are kept in a log book but these records are limited to the date and time of the visits; no findings are recorded. The application for design approval must be forwarded to no less than six and apparently up to thirteen external organizations, companies or departments that have not been specified explicitly but are said to also assess the location of the proposed construction in regards to utility lines (that they are presumably responsible for). The work process also includes other external decision makers such as, for example, the Ministry of Emergency Situations that needs to approve building designs of a certain construction type.

The Land Allocation and Alignment subdivision conducts initial surveys of a land parcel that is subject to an application for registration launched at the municipality. The initial survey of the parcel is conducted with tapes rather than sophisticated surveying equipment and this methodology is considered adequate by at least the staff member that was being interviewed. An architectural sketch with local coordinates (based on a local reference point chosen during the survey) is then forwarded to the municipality for further processing. The author understood that, at a later stage in the registration process, an exact cadastral extract for that parcel is requested from the responsible authority (the local SCPI representation) which would render the initial sketch produced by this subdivision unnecessary. Irrespective of this issue, the author noticed an acute overall lack of computerized management of the division´s activities and considers this division the least modern and possibly superfluous though the latter would need to be determined in a more thorough analysis of the division´s purpose.

Finally, the last interview was conducted with an employee involved in the GIZ project to map contaminated site in Sumgait. The employee uses a proprietary GIS software solution to maintain a cadaster like dataset of buildings and various land use areas for internal purposes. The software package has minimal capabilities since no license for any additional module is available so that the capability extends little beyond data entry and maintenance. The level of experience of the staff member is minimal and what little knowledge she has acquired is self-taught. The data sources are mostly, if not completely, scanned paper maps that she geo-referenced as best as she could using Google Earth. The attribute data kept with the geometric data is minimal and of greatly varying completeness. While the author was encouraged to find a GIS in active use, the lack of accuracy, the incompleteness and the absence of any clear purpose for the so called “Master Plan” other than the production of pleasant looking maps of questionable topicality confirms the author´s impression that the department would greatly benefit from a technical modernization. The employee talked about the lack of internal communication as a significant problem in the department particularly in the context keeping her Master Plan updated. This would need to be addressed in case a GIS system should be developed and implemented.

3.2.2 City Management Section for Economy

The City Management Section was visited by the author on Wednesday, April 04, 2012. This department appears to facilitate the communication between various departments and companies involved in the maintenance of infrastructure and utilities for gas, water, electricity and transportation. Permissions are issued to construct new or maintain existing utilities, etc. The department further deals with complaints regarding construction works or supply issues (e.g. citizen complain about insufficient gas supply). Some of these complaints may, however, be made directly to the supplier instead so that the management of such complaints is not entirely the responsibility of this department. The department appears to produce or use no information products related to those associated with a cadaster based GIS and none seem to be of great relevance in the daily operation of preparing permissions and facilitating communication. This department can consequently be eliminated from the list of potential partners.

3.2.3 Housing Department

The housing department, visited on Thursday, 14th March 2012, consists of only three staff members, including the head of department. It is this department´s responsibility to manage the allocation of apartments to eligible applicants for free housing. Entitled applicants are entered in a list that chronologically assigns vacant apartments to the applicants at the top of that list. The applicants have the option to decline the offer and wait for a more suitable vacancy. The process of checking an applicant´s eligibility, the management of the vacant and occupied apartments and other associated tasks are all managed without a digital database. No records of the apartments´ properties and attributes (e.g. floor no# or whether there is access via an elevator) are kept nor is the applicants´ decision history (e.g. repeated decline of apartments offered) recorded. Another, seemingly minor, responsibility of the department is the partial facilitation of first ownership applications for buildings acquired from a construction company. The role of this department in this process is limited to approving the application unless the constructional integrity is in doubt. How exactly that is assessed, however, was not made clear to the author.

3.2.4 Housing, Communal Economy & Production Union

The responsibilities of this department involve the management of the following subsections:

- Residential Building Constructions
- Disposal of solid wastes
- Street lighting
- Maintenance of roads
- Beautification of parks
- Management of green spaces

The individual tasks are performed by divisions of this department that are located in separate locations throughout the city. In cases of constructions and repairs, the work is tendered by this department and its responsibility extends to the supervision as well as to the final inspection and acceptance of the works. The head of department expressed his interest in a modern management of these tasks that rely heavily on geographic data. One such example that the head of department mentioned was the knowledge of the locations of all manholes, the lack of which had caused problems in the past since road maintenance works have often resulted in the accidental pavement of manholes. All responsibilities of this department are prime examples of applications of a GIS in administrations, however, the divisions are sparsely staffed and a lack of financial backing is evident. The head of the street lighting section reported on poor maintenance standards and the dependency on physical inspections of all street lights every night, a practice that can hardly be called efficient. Similarly inefficient is the management of waste, as the head of that section reports. The strategic positioning of waste collection points is impossible without proper mapping tools as these locations may be too far from the residents who are urged to dispose of their waste at those collection sites or the side streets in residential areas may be too narrow for the garbage trucks to reach suitable collection sites. The lack of strategically well placed collection points is reported to have had negative impacts on their acceptance amongst residents and thus contributes to the already considerable environmental pollution of this industrial city. Similar issues have been reported for the “green space management” division, though with less severe consequences.

3.3 Municipal departments

3.3.1 Tax Department

The three relevant departments at the municipality that the author interviewed staff members of on Wednesday and Thursday (March 14th & 15th 2012) are the Tax Department, the Department for Architecture and the Department for Property Management.

The taxation office is responsible for collecting land and property tax and lease fees and has divided the city into tax zones for that purpose. Each tax zone is processed by one tax inspector who collects the annual taxes in that zone. The inspectors keep paper lists with the tax amounts and the dates they were collected for each tax payer. The tax amounts are mainly based on the size of the land parcel and would consequently require a reliable basis for that information which, in the absence of a comprehensive real estate cadaster, does not exist. The tax inspectors are not informed about changes in ownership. Whenever land is sold the buyer must request the seller to proof that there is no outstanding tax owed. The inspectors will always collect outstanding amounts from the current owner of the land parcel, regardless of when this owner acquired the land. In that respect, as in many others, a digital cadaster would be a valuable source of information that future tax collection ought to be based upon. The underpayment of taxes due to a lack of reliable cadastral data is a common phenomenon in developing economies (Kent 1988). Other issues arising during tax collection are related to the uncertainty in ownership of some land parcels. Again, the cadastral data prepared for Sumgait will provide a definitive answer in many cases and at least a sound basis for juridical processes in others.

3.3.2 Department for Architecture

The Department for Architecture is processing applications for the purchase or lease of municipal land. The application is checked for completion and forwarded to the Department for Architecture and Urban Planning at the city administration (see section 3.2.1) for further processing. Given positive feedback, the department will then hold a meeting where possible conflicts or issues such as illegal seizure are discussed. If permanent occupants or veterans are competing for the right to acquire this land parcel, they are given preference under Azeri legislation. The application is then submitted to the State Land and Cartography Committee (SLC) for approval and evaluation of

possible conflicts with utilities using aerial orthophotos. The SLC provide zoning information as well as the normative price for the parcel and the relevant air photo if there are no objections to the purchase or lease. The land parcel is then subject to a public auction (by decree issued in 2007). Commercial use of the land is usually auctioned for lease while private applications are processed in a sales auction. The outcome of these auctions, and those for private land use in particular, are usually predetermined and very possibly subject to bribery. This is a widely known and common occurrence of corruption. Lease contracts are signed and managed by the Tax Department.

3.3.3 Department for Property Management

The Department for Property Management is situated in an external office off the municipality premises and was visited on Thursday, March 14th 2012.

The responsibilities of the department are:

- The identification and management of illegally seized land during the process of privatization
- Protecting municipal land against encroachment

The first involves site visits to privatized land parcels with dachas in a specific region of Sumgait. The accuracy of the boundary lines of those land parcels is determined and identified discrepancies between the parcel size in the ownership documents and the actual parcel size are processed further. In most cases, the land parcels fenced by their owners is larger than what their ownership documents entitle them to. In that case, the engineers from the Department for Property Management discuss with the owner which part of the parcel should be considered excess land. The criteria, however, are that it is not built on and that it has access to a road. The engineers then launch a formal application to assign ownership of the excess land to the municipality and once that process is completed, the parcel owner is offered the excess land for purchase. If the owner does not agree to purchase the excess land, it remains the property the municipality until another buyer is found. An example of this process is illustrated in Figure 7 below.

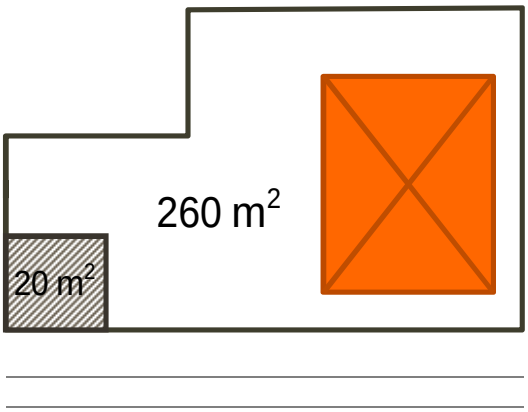

Figure 7: Example of excess land management by the Department for Property Management. The ownership documents for this parcel specify the parcel size with 240 m^2, the actual size fenced by the owner however is 260 m^2. Consequently the department´s engineer and the owner agree on a section of 20 m^2 that is to be cut out of the current parcel and prepared for purchase. It must not be built on (must not intersect orange building) and it must have access to the road (line feature).

The second responsibility of the department involves periodic site visits of municipal land and a profound knowledge of its boundaries in order to detect encroachment. The department engineers stated that there were uncertainties as to whether some parcels belong to the municipality or not, particularly in the vicinity of a certain industrial site in Sumgait. It is clear, therefore, that this department would greatly benefit from access to an official cadaster with well-defined and agreed upon boundaries and associated ownership information.

3.4 Selection process

All visited departments have been found to suffer from poorly structured and mainly paper based data management, resulting in inefficient work processes and a strong dependency on the knowledge of individual workers. All departments would definitely profit from a computerized management of their work processes but may not warrant the development of a specific GIS solution, notwithstanding their need to get access to the cadastral information. Communication among departments is minimal and no notable exchange of data or information was found to occur on a regular basis.

Apart from the technical issues, an evaluation of the most suitable candidate for the proposed introduction of cadastre based GIS technology must also consider the given institutional, political and structural conditions that the author had intended to assess during his visits. It is self-evident that such an assessment cannot be comprehensive given the temporal constraints and will always depend, to some degree, on subjective perceptions of the author and the interpreter during the interviews. The author is nevertheless confident that the post interview discussions with the attending interpreter and other local GIZ specialists present during the interviews have given him an adequate picture of the departments´ hierarchical position and political relevance. The financial situation, perceived level of corruption as well as present relations with the local GIZ representatives also found consideration where they were known or could be assessed. Figure 8 shows the individual factors and their weighing in the decision process.

		Departmental size	GIS related information products (x2)	Preparedness to introduce GIS solution	Political relevance	Existing IT infrastructure	Financial independence	Past cooperation with local GIZ	Potential for corruption	Total score	Notes
City Administration	**Department for Architecture and Urban Planning**	*****	****	****	*****	*	****	****	****	**27**	currently cooperating with GIZ; information products interesting for SCPI
	City Management Section for Economy	**	-	-	***	**	***	-	*	9	little potential for and interest in GIS
	Housing Department	*	**	***	**	*	*	-	*	11	too small for investment; future relevance of department uncertain
	Housing, Communal Economy and Production Union	****	*****	*****	***	*	**	-	**	23	fragmented - multiple offices in city; waste management receives int. dev. help
Municipality	**Tax Department**	***	****	****	*	**	*	**	*	**20**	plays critical role in self-financing of municipality; no tax enforcement w/out cadastre
	Department for Architecture	**	*	**	*	*	*	**	***	10	mostly administrative, GIS related work done at City Architecture Department;
	Department for Property Management	***	****	*****	*	-	*	-	*	17	work impeded by uncertain boundaries of municipal land

Figure 8: Selection matrix with relevant technical and institutional factors assessed during personal interviews and post interview discussions with local experts.

It is evident that a decision based on purely technical aspects would have resulted in the selection of the "*Housing, Communal Economy & Production Union*" of the city administration (see section 3.2.4) and the municipality managed "D*epartment for Property Management*" (see section 3.3.3) as the most suitable candidates for GIS diffusion into public administrations in Sumgait. Given the importance to address the persistent lack of interdepartmental communication and the need for strong political backing in this project, the **Architecture and Urban Planning Department** of the city administration was selected as the most suitable candidate for a successful GIS implementation. Its head, Mr. Hasan Hasanov, is a well-respected, authoritative figure in the local political landscape and the department´s size and financial stability further warrant the investment into this administration. The responsibilities of this department include the registration and supervision of new constructions which will need to be communicated back to the SCPI for future surveys of newly constructed buildings and their registration in the cadastre. This possible information feedback may be an incentive for SCPI to agree to the exchange of cadastral data which is a critical prerequisite for the project´s success. The communication with the municipality is also guaranteed as at least minimal information exchange already takes place when the municipal department for architecture intends to sell or lease out municipal land. Content-wise there can be no doubt that architectural administrations always greatly benefit from access to accurate cadastral information for the management of construction and renovation activities.

In accordance with the intention to facilitate the improvement of future communication between city and municipal departments, a second partner was to be chosen from the municipality. The municipal **Tax Department** was the obvious choice for the following reasons. Firstly, a GIS based application giving access to the cadastral data and allowing the collection and management of tax relevant information could be developed with minimal effort which is relevant owing to the very limited investments the GIZ was prepared to make at this early stage. Secondly, a cadastre based GIS application for the tax department will provide that department with a solid basis for tax collection and is anticipated to generate greater tax revenue as past experience shows that land parcels are, on average, significantly larger than their ownership documents state and higher tax payments would thus be due. This financial benefit will consequently result in a strengthening of the local, democratically elected municipality.

3.5 Requirements analyses

Once the cooperation between the GIZ as donor and the city department for architecture and the municipal tax department had been agreed, the author next performed detailed requirement analyses during his field work in September 2012. These analyses were conducted in order to:

- collect all relevant information on the work processes that would later be incorporated into the GIS solutions
- identify all critical factors that influence the chances of success under special consideration of institutional settings and cultural factors, where applicable
- create an initial draft concept for the proposed GIS software solution

The interviews were structured in a similar way to those conducted in the suitability analysis only with a greater focus on the internal work processes. The interviewees were asked to explain the structure of their divisions and describe their roles in it. They were also asked to explain the work processes and state the frequency with which they performed them. They were further questioned about their views on GIS technology, what their expectations, anticipations and concerns were, which features a GIS software for their department should have and which ought to be excluded, where they saw potential and what they feared might the negative impacts of GIS diffusion be. The interpreter was asked to pay particular attention to the preparedness with which the respondents answered the questions and later inform the author when he detected a noticeable reluctance to elaborate on a point such as, for example, the fee payment process that interviewees were hesitant to detail throughout all interviews presumably due to the prevailing corruption in the provision of services to citizens.

In addition to these in-depth interviews, the author also hosted another two-day workshop on the potentials of GIS technology in public administrations, addressing the concerns voiced in the initial workshop as well as during the first round of interviews. The workshop was directed at a selection of employees and decision makers from the chosen local administrations and SCPI and aimed at informing and including critical stakeholders in the process of GIS diffusion into their administrations. Continuous workshops and seminars complement the analysis stage and ensure the actively involvement of all stakeholders and their staff from the very beginning; an explicit requirement of successful GIS implementations as stated by Tomlinson (2007) among others.

The third activity that the author initiated in September along with GIZ representatives was the drafting of a memorandum of understanding (MoU) between the three actors, the city administration, the municipality and SCPI. This MoU states that the actors agree to exchange the SCPI owned cadastral data including both the graphical and alphanumerical components and is thus the single most important agreement that all other efforts depend on. It is also a hitherto unique agreement between these actors as data exchange was and continues to be viewed very critically by all involved parties.

In the following, the author describes the requirement analyses for the Department for Architecture and Urban Planning and the municipal Tax Department as well as their outcomes.

3.5.1 Requirement Analysis (Architecture Department)

The author visited the Department for Architecture and Urban Planning over the course of several days and interviewed relevant staff members and the heads of each division.

The structure of the department was briefly outlined in section 3.2.1 and is illustrated in Figure 9. Since the author´s last visit, the division Design & Urban Planning has been closed and their work has been partially outsourced to external, private architecture offices. The effectiveness of this step is currently evaluated and many employees assume that the division will be reinstated in the future.

Figure 9: Individual divisions within the Department for Architecture and Urban Planning

3.5.1.1 Internal Information Flow (Architecture Department)

The internal communication and workflow between the divisions is illustrated in Figure 10. The **Administration** division is involved in all work processes as all applications to the department are made to this division and all outgoing correspondence is sent from here. **Administration** assigns tasks to one of the other divisions for processing and is the first and last point of contact to all clients, citizen or otherwise.

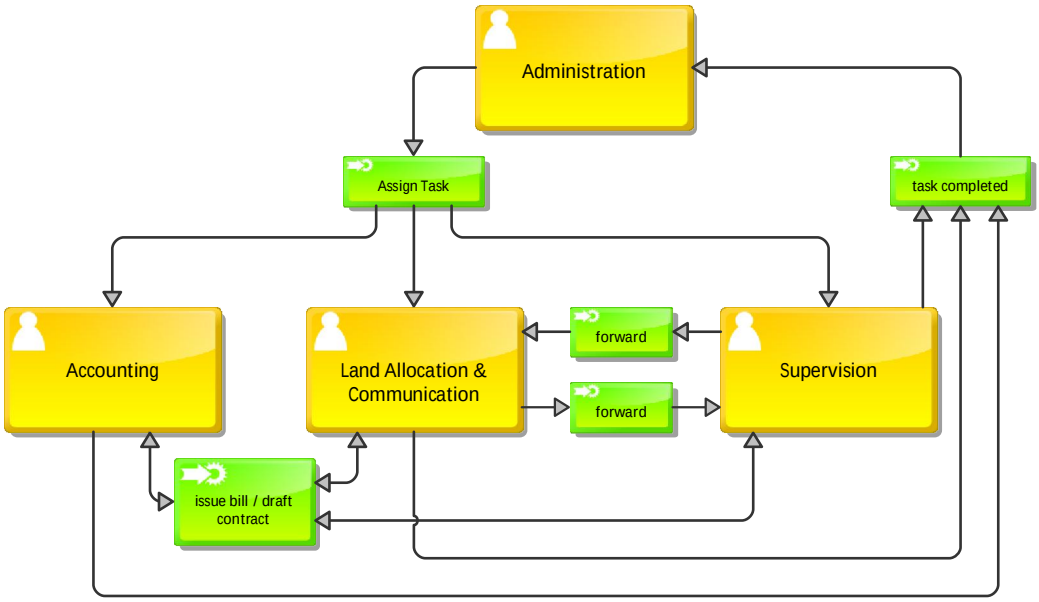

Figure 10: General workflow for applications to the Department for Architecture and Urban Planning.

The applications are processed and their results are either returned to **Administration** directly or indirectly after **Accounting** was involved in case of services that require billing. While the internal process chain for applications to the department is straight-forward, the work flow within the divisions is less clear in many cases. **Supervision** is generally responsible for the monitoring of approved constructions and their final acceptance. Violations of the approved building plan and other irregularities are pointed out and their rectifications are supervised. Completed constructions are accepted by members of this division and other external experts. The **Land Allocation & Communication** division is processing all other land related applications which is the bulk of the work load processed in this department.

3.5.1.2 Work Process Analysis (Architecture Department)

It is certainly beyond the scope of this paper to elaborate on the work of the author in terms of understanding the individual processes, however, their complexity, the potential for corruption as well as the discrepancy between their theoretical construct and practical implementation, as they were reported by the interviewees, have significant implications for the design concept of the GIS solutions and consequently for the overall project success. To illustrate one prominent and important example, the process of an application for **municipal land allocation** is outlined in Figure 11 and described in the following paragraph.

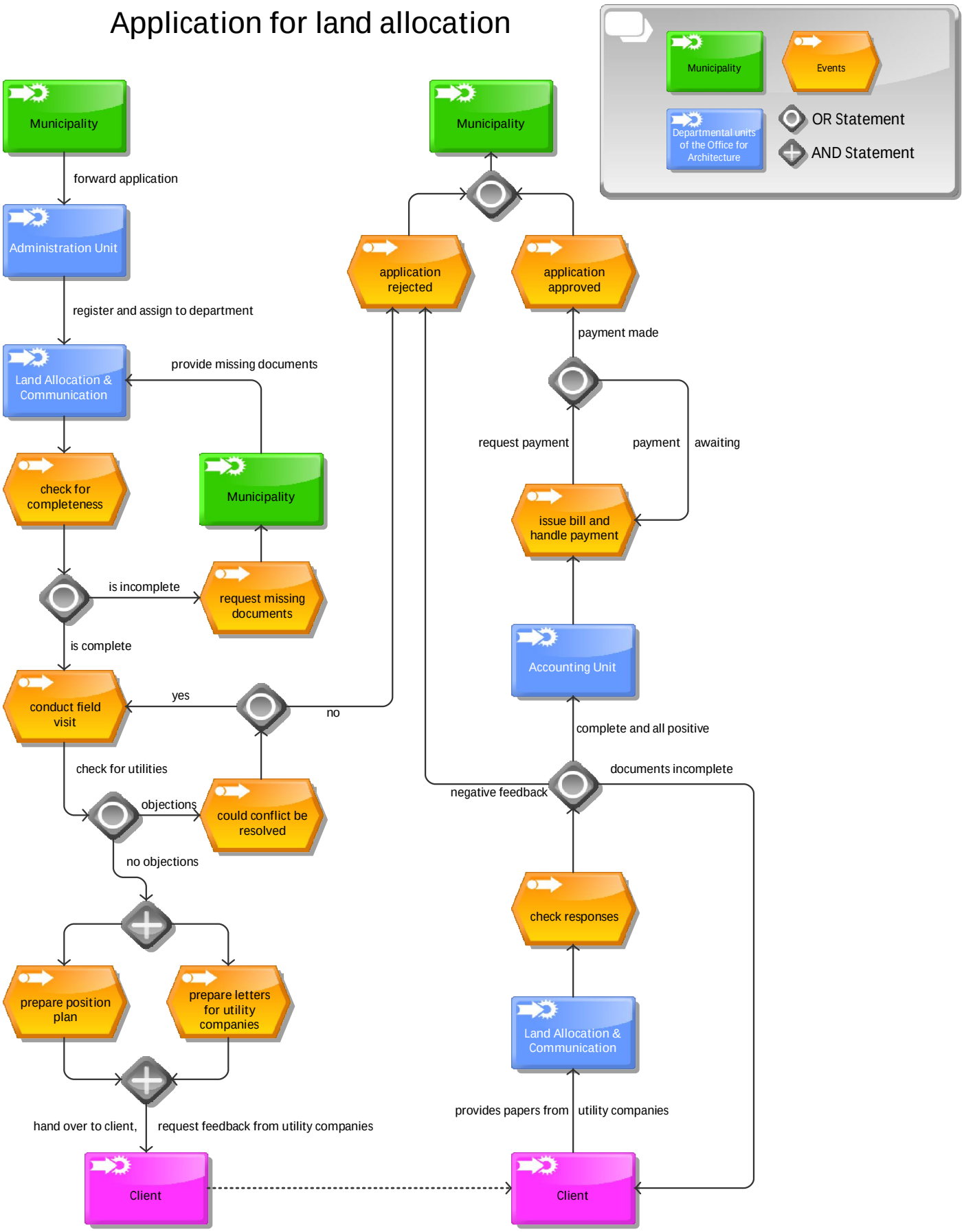

Figure 11: Application process for land allocation in the Department for Architecture and Urban Planning.

While this type of application is made to the Architecture Department at the municipality, the city Department for Architecture and Urban Planning is responsible for an assessment of the land in question and prepare an expert opinion as to whether the allocation process may be continued by the municipality. In essence, it is this departments task to ensure that all regulations regarding minimum buffer distances between the proposed land and public utilities such as water pipelines and power lines are met. The Land Allocation & Communication division conducts field work for an initial assessment of the land parcel and prepares letters to utility companies that are handed to the customer, the applying citizen, with the request to seek approval directly from the selected utility companies. The citizen must get the green light from each of the utility companies listed by this department and return with the approved letters for further processing. The number of utility companies that the citizen is required to contact and get approval from may vary significantly from none to as many as fourteen or so. The decision rests with the employees of this department and is the most often abused means to generate unlawful income to support the corruption scheme. While the employee ought to request approval from certain utility companies based on the location of the land parcel, in practice, the number of utility companies he or she needs to get approval from depends on the preparedness of the citizen to pay a significantly higher fee for the service. Given the citizen is very cooperative and pays substantially more than the legal fee would be, the need for external approval may be waived altogether. Such irregularities save the applicant a considerable amount of time as getting external approvals may take the better part of a year, as the interpreter, who himself has gone through that process as a private person, reported. A noteworthy example of the severe consequences such practices may have is described in section 2.3 (Azersu demolition case). The interviewees certainly did not directly admit to active corruption, nor have they been asked about it, however, they did state that the number of external utility companies the client is asked to seek approval from varies greatly and that citizen may be asked to make voluntary contributions for the purpose of “city beautification”. In the specific case of the interpreter the author worked with, the legal fee was 40 Manat; he was asked for 500 Manat or however much else he was willing to pay. It should be noted that the evidence for corruption as described above is purely anecdotal and based on subjective accounts by the interpreter and other local contacts.

3.5.1.3 Findings (Architecture Department)

Overall the interview partners were very forthcoming and cooperative. The suggestions for features to be included in a GIS solution were few owing to the limited understanding of the potentials this technology offers but **access to cadastral information** was very welcome and much anticipated by all interviewees, especially considering the many land related (boundary and ownership) conflicts that most respondents mentioned. Most interviewees have asked for simple tools that will allow them to **view the status of an application** and **locate the corresponding object in a map**. The head of department wants the software to produce **automatic reports** on processed applications and their deadlines. Several respondents asked for full **Azeri or Russian language support**. Interviewees from Administration have asked for a fully **digital archive** to replace the tedious book-keeping currently in place for the management of all incoming and outgoing correspondence. Supervision employees want to produce **maps of current construction sites** and **view the location and status of construction violations**. Senior respondents were often skeptical about digital data processing mainly because they are unfamiliar with computers and are reluctant to start learning the required skills. Another concern that was voiced is related to underemployment. Two respondents feared that a modernization of work processes would make certain activities obsolete and result in the reduction of the workforce.

Including the author´s impressions, the outcomes of the requirement analysis can thus be summarized as follows:

- Access to cadastral information is of paramount importance to all employees and is anticipated to solve many existing land related conflicts
- All tools must be as simple and intuitive as possible in order to achieve user acceptance. Data entry forms need to be identical to their paper counterparts.
- Individual processes are often complex and the respondents have often stated that practice diverts, in some cases significantly, from the theoretical process they have described
- Some processes occur with a frequency of only once or twice a month
- Users need to be able to manage applications and easily access their status
- A digital archive of current and past applications is desired

- GIS functionality will be limited to the most basic mapping functions as users first need to familiarize themselves with digital data processing before more complex GIS analyses can be used
- The GIS solution must be available in English and Azeri (alternatively Russian)
- Not all employees can be expected to acquire the necessary skill set to operate the software. Younger users will need to handle processes on senior members´ behalves

3.5.1.4 Application Concept for AzArchitect (Architecture Department)

The author concludes that modeling detailed processes at this early stage presents too much of a risk to the proposed software called **AzArchitect** and would consume more temporal resources than can reasonably be justified considering the low frequency with which some processes take place. Furthermore, certain processes or parts of processes are at **risk of compromise by corruption** and their integration into the software solution might negatively impact user acceptance as a consequence of an inevitably restrictive, theory based process model that does not reflect the practical handling of such processes. A more general approach to modeling the well-understood process chain for applications will allow the users to manage these applications more effectively, view their status and manage their deadlines while allowing the employees their degree of freedom when processing an application. While these are chiefly non-GIS functions, their implementation coupled with basic GIS functionality is considered a useful and gentle introduction to GIS technology in particular and to digital data management in general. Uncontroversial tasks such as the generation of cadastral extracts and the mapping of construction sites, violations and zoning for site inspectors should also be included since visually appealing and functionally sound tools enhance user acceptance. Some applications require the drafting of a manual sketch of a parcel, a task that should be replaced by a tool that enables the user to print a cadastral extract.

Table 1 shows the agreed functions of the proposed GIS software AzArchitect.

Table 1: Proposed functionality for AzArchitect including estimates for development effort in working days.

Category	Effort (days)	Description
Management	3	Archive all incoming and outgoing documents
	3	Manage all applications and requests to the department
	1	Manage application deadlines – notify users when deadline is approaching (15 days for ExCom; 1 month for other applications)
	1	Implement search functionality for applications. Search by applicant, date, status, etc.
	1	Check if polygon landuse (from cadastral survey data) matches proposed use type from application – notify user if it isn´t.
	1	Check if parcel intersects contaminated sites in Sumqayit – notify user if it does.
	2	Check for nearby utilities (around building / parcel) and add appropriate remarks to the application.
	3	Create reports. Number of applications processed by type; Average processing times by application type; etc.
GIS Views	1	View by application status; highlight those with imminent deadline.
	1/8	View by construction work in progress – sort by supervising staff member
	1/8	View construction violations by status (open, fixed)
	1/8	View by owner type (ExCom, Municipality, Private)
	1/8	View by landuse
GIS tools	1	View parcel information (all available info from survey data, including referenced tables)
	1	View building information (all available info from survey data, including referenced tables)
	2	Manage constructions and violations and produce corresponding maps for field work

3.5.2 Requirement Analysis (Municipal Tax Department)

The author visited the municipal Tax Department over the course of several days and interviewed relevant staff members and the head of division.

The department consists of 14 members, the head of department, three internal staff members and ten tax inspectors responsible for tax collection in the field. The department is not subdivided into smaller sections.

3.5.2.1 Internal Information Flow (Tax Department)

The information managed in this department is limited to that on tax zones and tax objects, tax payers, their balances and outstanding amounts due. The records are kept in writing in three separate books for the three main types of payments this department handles, land tax, property tax and lease payments for municipal land.

Tax inspectors are provided with printed lists of tax payers, their addresses and balances for the field work in their respective zones. They attempt to collect the taxes or leases from the citizens and enter the information in the list. These lists are the primary record for tax payment histories. In rare cases tax payers make their payments directly to the department. The information flow is thus confined to the communication between data managing internal staff and data collecting tax inspectors (Figure 12).

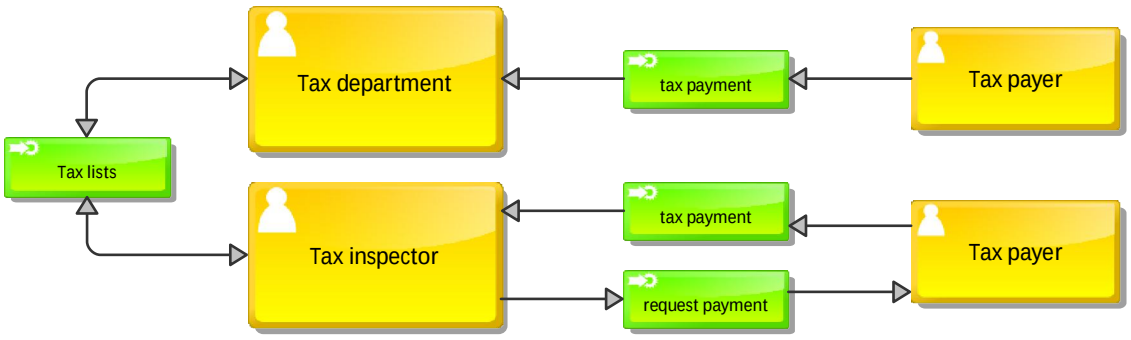

Figure 12: General information flow in the Tax Department.

3.5.2.2 Work Process Analysis (Tax Department)

The work processes, too, are pretty much straight forward in this department. Internal staff is responsible for keeping information on tax objects up-to-date, prepare tax lists for inspectors and provide payment histories to citizens upon request. Tax inspectors visit tax payers in person at their registered address and attempt to collect due taxes or lease payments.

Keeping tax information up-to-date implies, of course, that the staff must be made aware of changes in ownership however, no such information exchange between SCPI and the municipality exists to date. As a result, tax inspectors may only learn of a sale when they collect taxes for the sold building or apartment. In practice, they charge the new owner all outstanding taxes as it is the buyer´s responsibility to ensure all taxes have been paid up to the moment of change of ownership.

Inspectors have frequently stated in the interviews that they have no satisfactory means of enforcement and heavily rely on the preparedness of the citizens to pay their due taxes. Also, several inspectors mentioned that there is no readily available written evidence for the basis upon which the respective taxes were calculated, thus increasing the skepticism among citizens.

Another issue concerns the apparently common trick used by some tax payers to claim the cheapest land use category for their land when the officially registered and binding land use is known by the tax inspectors to be of a different type. The land use is often not self-evident since taxes are collected for all parcels owned by a tax payer, including agricultural parcels outside the city. Without an official cadaster stating the binding land use, however, the tax inspectors have no means of enforcing it.

3.5.2.3 Findings (Tax Department)

The employees of the Tax Department were also very forthcoming and cooperative and demonstrated an active interest in the capabilities of GIS technology that they had previously been introduced to in the seminars given by the author. During the interviews, the tax inspectors informed the author that they have no clear definition of municipal land boundaries available to them, which results in a loss of much needed tax revenue. Furthermore, the lack of an official real estate cadaster also means that the tax

inspectors have no unambiguous basis for the enforcement of taxation. **Access to cadastral information**, and with it a clarification of the land related issues between the municipality and the city administration, has been mentioned most often as the most eagerly expected feature of the proposed GIS solution. Tax inspectors were overwhelmingly in favor of **digital record keeping of tax payments** and the **automatic generation of tax receipts**, however, they were often concerned about their personal technical expertise and wondered what skills they would need to acquire in order to enter the data into the system. **Azeri or Russian language support** is a prerequisite as none of the employees speak English. **Data security** was not a significant concern of the employees and was only mentioned by the head of department. A majority of the tax inspectors asked about the **mapping** capabilities when it came to **tax zonation** and a few expressed the hope that **land use** could be integrated into the solution in order to facilitate the accurate calculation of taxes. Visualizing the differences between **actual and documented parcel sizes** will help identifying parcels that are significantly undertaxed. Such information would help to justify an amendment of the ownership documents and would thus increase tax revenue. The head of department suggested that existing **reports of tax revenue statistics** by tax inspector be generated automatically, if possible. The chairman of the municipality expressed the wish to introduce **web mapping** and enable **online tax payments**, however, the author pointed out that such capability is beyond the scope of the envisaged solution and may only be considered after a successful introduction of a more limited solution, if at all.

Including the author´s impressions, the outcomes of the requirement analysis can thus be summarized as follows:

- Access to cadastral information is of paramount importance to all employees and is anticipated to solve a number of existing land related conflicts
- All tools must be as simple and intuitive as possible in order to achieve user acceptance. Data entry forms need to be identical to their paper counterparts.
- Mapping tax zones and due tax payments would be very welcome features.
- Internal staff needs to be able to generate tax receipts and statistical tax reports and provide information on tax payment histories on demand.
- GIS functionality will be limited to the most basic mapping functions as users first need to familiarize themselves with digital data processing before more complex GIS analyses can be introduced.

- The GIS solution must be available in English and Azeri (alternatively Russian).
- Tax inspectors cannot be expected to enter the data into the system themselves on a daily or so basis. A better solution would be to train the internal staff and have them enter the data based on the lists handed in by the inspectors.

3.5.2.4 Application Concept for AzFinance (Tax Department)

Unlike the work processes in the Department for Architecture & Urban Planning, those within the Tax Department are simple, few and are not potentially compromised by corruption. It is possible, therefore, to develop a solution that models the actual work processes without risking user rejection due to an overly transparent or rigid system structure. The management and mapping of tax objects, the production of statistical reports and printing of payment receipts and payment histories for the tax payers thus constitute the primary purposes of the software. Issues such as the uncertainty surrounding the exact boundaries and locations of municipal land may in some cases be resolved through mere access to the common cadastral database. Since the cadastral data contains attribute information on the parcel size, it is possible to implement a tool to visualize the difference between documented and actual (calculated) parcel sizes. Judging by the findings from the pilot projects in Sheki and Ganja, the documented size is significantly less than the actual size in the majority of cases and this information will help the department to amend lease contracts and tax demands to meet the actual situation. This increases equality and fairness in tax payment processes and likely results in a noticeable increase in income for the municipality. Information on land use (also part of the cadastral data) will further serve the tax inspectors as evidence in cases where stated land use does not conform to that assigned by the city planners. Inspectors are thus given a tool to enforce proper tax payments that are calculated based on officially registered land use.

Table 2 shows the agreed functions of the proposed GIS software AzFinance.

Table 2: Proposed functionality for AzFinance including estimates for development effort in working days.

Category	Effort (days)	Description
Management	5 ½	Manage tax objects and tax records for all parcels and buildings Manage (add,edit,delete) inspectors, tax payers, tax payer addresses, tax objects, object addresses
	1 ¼	Allow user to add payments and penalty fees to the tax records. Charge tax & lease automatically on Jan 1st of each year.
	2	Implement search functionality for tax objects. Search by ID, TIN, tax payer, tax payer address, tax object address, etc.
	1	Display tax record history for tax payer.
	1¼	Create monthly, quarterly and annual report. Show by type (land tax, property tax, lease) for each category (private property on public land, private property on private land, commercial leases [parking lot, garage, enterprises of local importance]). *Exclude categories in [] brackets in AzFinance version 1.0.*
GIS Views	¼	View by parcel ownership (municipal, state, private OR municipal and non-municipal)
	¼	View by tax zone
	¼	View by inspector zone
	¼	View by tax balances
	¼	View by parcel size discrepancy
	¼	View by object type (private property on private land; private property on public parcel; leased parcel)
GIS tools	¼	View parcel information (all available info from survey data, including referenced tables) View building information (all available info from survey data, including referenced tables) (already planned for AzArchitect – copy / paste source code)

4 Application development

The software solutions AzArchitect and AzFinance are most efficiently realized as modular plugins for a base GIS software solution, particularly given the small financial scope of the project. The choice of that base software is of fundamental importance for future maintenance and development activities and must be considered carefully and with realistic estimates of future funds and expertise available for these activities.

It is the experience of the author that small projects such as this, particularly with only basic requirements for GIS analysis capabilities, are best realized based entirely on open source software as the maintenance license costs can hardly be borne by the described local administrations once the development project has come to a conclusion. The use of open source software is becoming increasingly popular for budgeted implementations (Steudler and Törhönen 2010) and similar GIS solutions based on the open source principles have proven very successful (Solovov 2010). The author chose the well-established GIS software Quantum GIS (QGIS) as the base solution. QGIS has sophisticated GIS functionality and incorporates other solutions such as GRASS GIS and SEXTANTE, is easily extendable writing plugins in either Python or C++ and well documented (including Russian manuals).

PostgreSQL along with its spatial extension PostGIS were chosen as the spatial database management system. PostGIS is fully compatible with QGIS and vice versa and the author has extensive experience in the design and implementation of PostgreSQL/PostGIS databases. The plugins are developed using the programming language Python and the PyCharm IDE.

In the following, the development of both AzArchitect and AzFinance are presented with the purpose of introducing the developed solution to demonstrate how the analysed software requirements were met and presenting the reader with the thought process behind the realization, in particular, where tools were specifically designed to accommodate the individual circumstance of the department in question.

4.1 Cadastral data model

The first step in the development of AzArchitect and AzFinance was to create PostgreSQL base data model to store the cadastral data created by SCPI that could then be extended to accommodate the data storage needs of the two plugins. The cadastral data itself is available in, and will be exchanged between the actors using, the INTERLIS format. It was therefore necessary to translate the INTERLIS format into an identical set of PostgreSQL schemas using the software FME. This translation was done by the author´s colleague Michael Wagner of GCI; the resulting model is illustrated in Figure 13 with the tables for the graphical objects *parcel* and *building* highlighted in green.

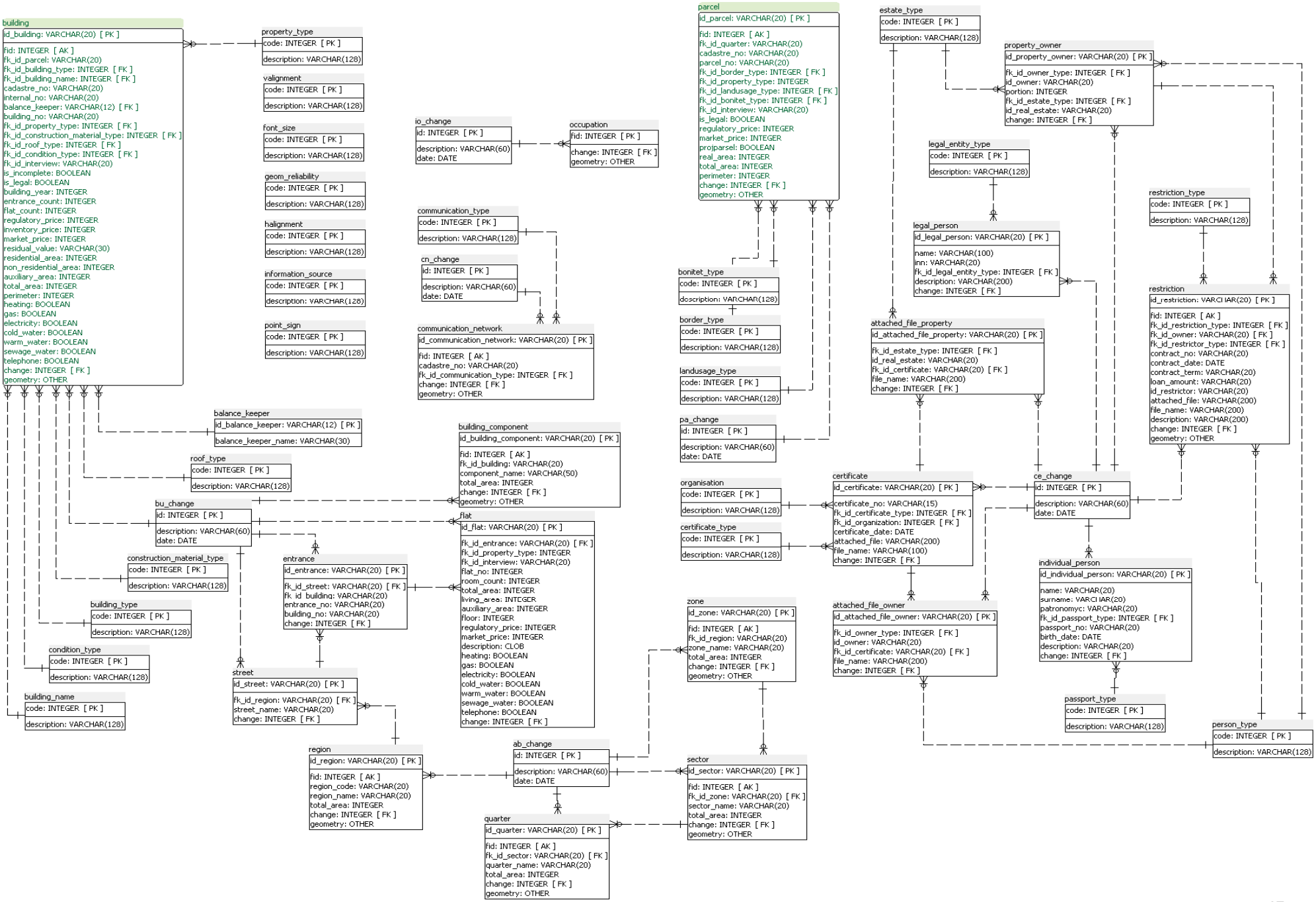

Figure 13: PostgreSQL data model for cadastral data. The model was constructed from the official INTERLIS schema template for the Sumgait cadastre.

Individual schemas (*azarchitect* and *azfinance*) have been created and their data embedded into this data model to store the department specific data and interact with relevant cadastral information. The highlighted tables represent the interface that the *azarchitect* and *azfinance* schemas use to access the cadastral data. Graphical illustrations of the complete data models with the embedded schemas for AzArchitect and AzFinance are available in appendices A and B, respectively.

4.2 AzArchitect

Following the creation of a database that can hold the produced cadastral data, it needed to be extended by an additional schema for all data related to the modelled information flow and work processes of the Department for Architecture and Urban Planning. Designing that schema, that is, defining tables to be created, their structure, data types and relations, is a task that was performed parallel to the development of the software component and remained subject to continuous change throughout. It is described in the following section (4.2.1). As mentioned before, the functional focus of AzArchitect shifted from an originally anticipated, mainly GIS-centred solution to one that manages all applications within the department and their spatial location using the cadastral data of SCPI. The development of the associated tools and their functionality is basically outlined in section 4.2.2 with comments on important considerations that influenced the software design. The GIS related tools are presented in section 4.2.3 before a concluding paragraph describes the reporting functionality of AzArchitect (section 4.2.4).

Altogether fourteen individual tools have been developed to meet the functional requirements of AzArchitect and even exceed them in parts. They are collectively provided in a tool bar that is added to QGIS when the plugin is loaded (Figure 14).

1:	Log in / out
2:	Manage divisions [Administrator only]
3:	Manage employees [Administrator only]
4:	Show / hide AzArchitect dock widget
5:	Launch Application Finder
6:	List all Applications for selected parcel/building
7:	Map views
8:	Create statistical report
9:	Print cadastral extract
10:	Cadastral information (parcel)
11:	Cadastral information (building)
12:	Manage constructions [Supervision members only]
13:	Manage constr. violations [Supervision members only]
14:	Settings

Figure 14: Task bar of the AzArchitect plugin with a tabular listing of the basic functionality of the individual tools. This task bar is added to the QGIS panel when the plugin is loaded.

4.2.1 Data model

The data model for AzArchitect (Figure 15) revolves around the "application" object (table *application*) that can assume all types of applications processed by the department. All applications can thus be stored in the model along with relevant information on their type, status (i.e. progress), applicant, location and the staff member currently processing them. Every relevant change is logged in the *application_log* table so to create a process history and a source for statistical information on processing times, overstepped deadlines, divisional workloads, etc.

The lookup tables store information in English and Azeri, extending the bilingualism of the software solution to the database. This is necessary to ensure that future international contributors and local users understand all values read from the database, namely status types (e.g. *pending*, *in process*, *completed*, *etc.*), application types (e.g. *construction permit*, *building design*, *land allocation*, *etc.*) and document types (e.g. *application letter*, *blue print*, *etc.*). The graphical output to QGIS is provided in the form of views to facilitate the combination of all relevant information in just two vector layers, *arc_building_view* and *arc_parcel_view*.

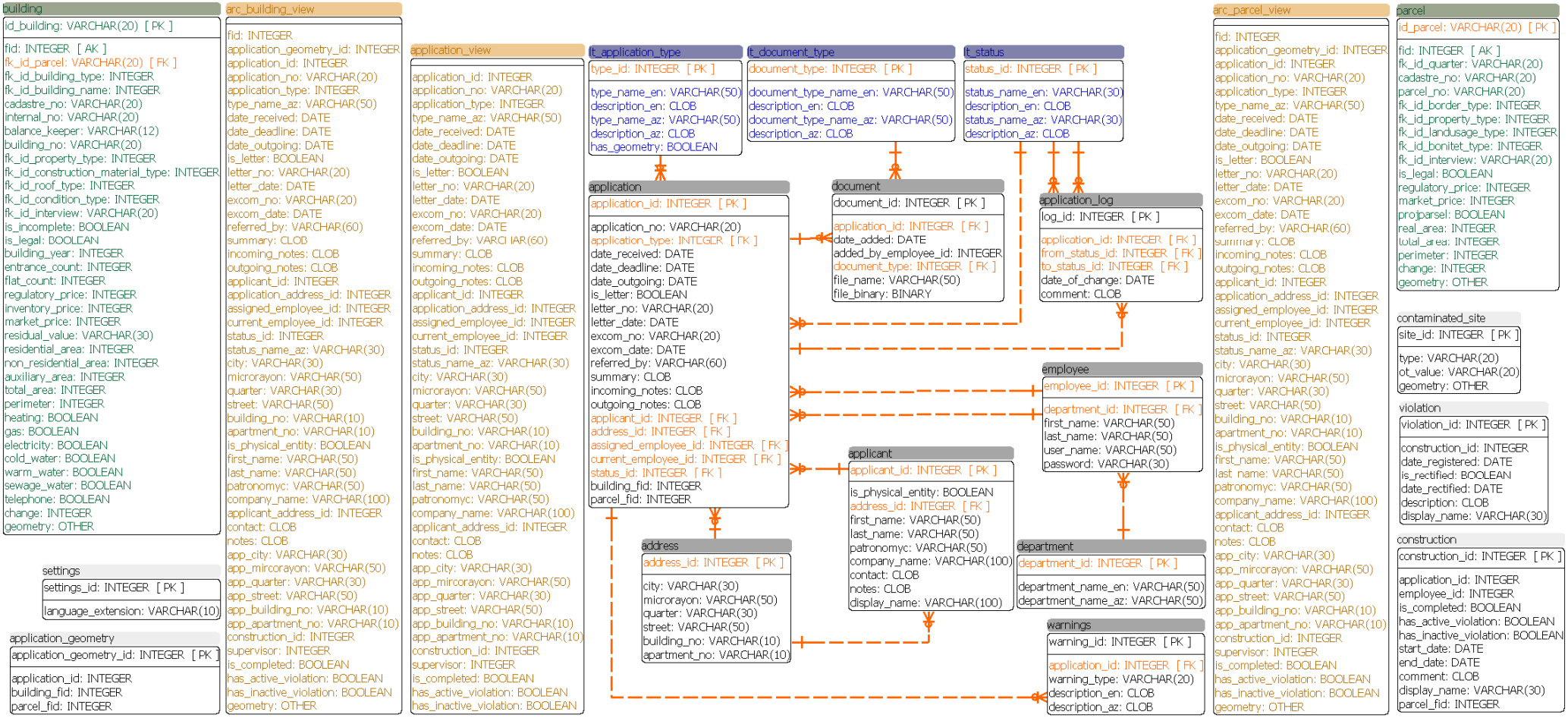

Figure 15: AzArchitect data schema and its data interface tables building and parcel (green). For clarity lookup tables are highlighted in blue and database views in brown. Referenced primary and foreign keys (PK and FK, respectively) are colored in orange, as are their relations.

4.2.2 Application management

The management of all applications received by this department is of key importance to the introduction of modern technology, increased efficiency and greater transparency for both the management and the applicants. Consequently, the software is designed in a way that integrates and involves all employees in their respective roles. In order to achieve this integration while constraining the data access privileges of each employee to their role in the application process, it was necessary to incorporate user management in the software.

An *Administrator* role was created and given the rights to create, edit and delete employees (Figure 16) and divisions (Figure 17) using the tools 2 and 3 shown in Figure 14. The latter was implemented to allow the necessary flexibility regarding the reintroduction of the "Design & Urban Planning" division mentioned in section 3.5.1.

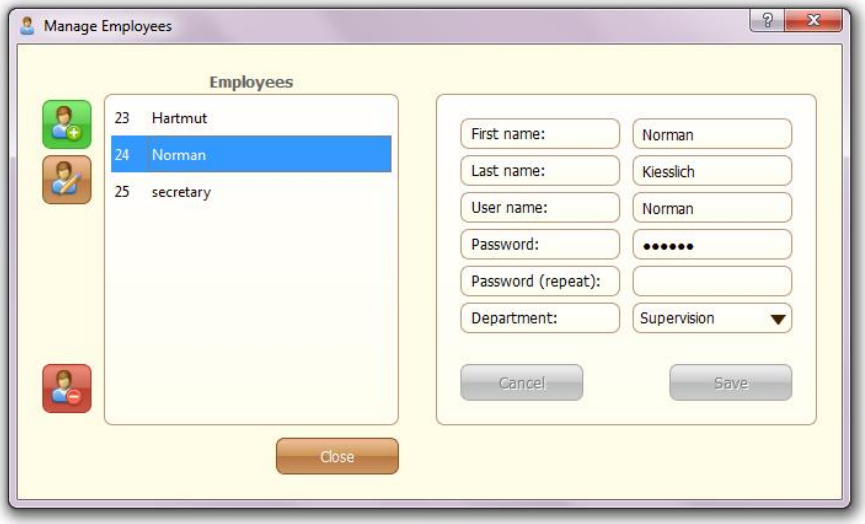

Figure 16: The Manage Employees Dialog can only be accessed by the Administrator. Employees can be added, edited and removed; each employee is assigned to one division (here: department) which sets the data access privileges for that user role.

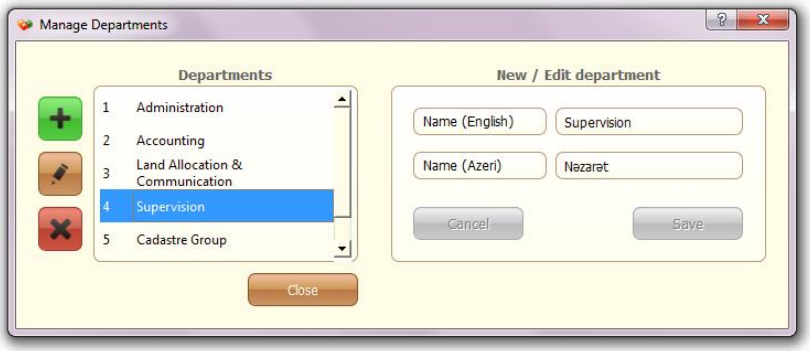

Figure 17: Manage Departments Dialog can also only be accessed by the Administrator and facilitates the management of departments (or divisions) within the Architecture Department. Each division has a set of data access privileges that all members of that division inherit.

The AzArchitect plugin is thus designed to be accessible for every employee and consequently requires login validation. In addition to the described tool bar, the plugin offers a dock widget for the display and access of all applications the logged-in user is responsible for, listed in order of the applications´ deadlines (Figure 18). The dock widget is used to register new applications (green button - *Administration* division only), delete them (red button - *Administrator* only) and access their management hub (brown button).

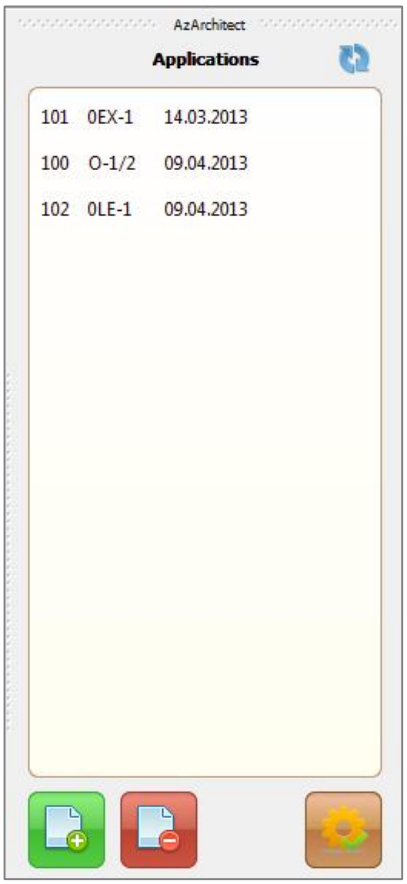

Figure 18: AzArchitect dock widget listing the applications to be processed by the logged-in user with id, application number and deadline date, sorted by the latter.

Having created the basis for role based user access the next step was to implement the application management following the information flow depicted in Figure 10. The application cycle always starts and ends with the *Administration* division, whose members are responsible for the registration of an application, their assignment to a member of the appropriate division and their conclusion when the application has been processed and completed. The Application launcher (Figure 19) is consequently exclusive to the *Administration* division.

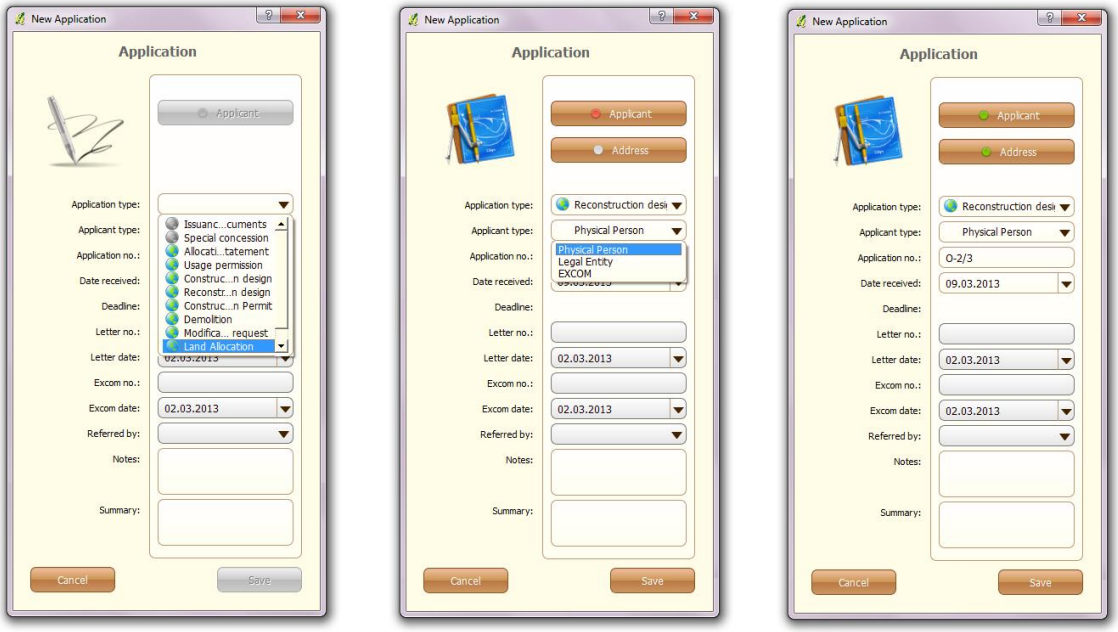

Figure 19: The Application launcher is used by members of the *Administration* division to register (and edit) applications in three steps: selection of application type (left), selection of applicant type (middle) and entry of associated information (and selection of applicants/addresses where necessary).

While it is beyond this paper to describe the detailed functionality of every tool, the following points regarding the registration of an application illustrate the thought process behind the implementation strategy and their relevance for the perceived usefulness and acceptance of the software by the users.

- In the three-step application registration, the application type is chosen first from a drop-down list with icons for applications which require no localization in the cadastral map and icons for those that do. This is relevant for the staff members processing the application and the linking it with a cadastral object later in the process.

- The selection of the applicant type (*Physical Person* for private applicants, *Legal Entity* for companies or *EXCOM* for applications received by the Sumgait city administration) in the second step has implications for the deadline assigned to the application as requests from the city must be processed within 15 days from the date of reception while all other applications have a 30 days deadline. The selection also prompts the calculation of the Application number ("O-2/3" in the example) which is constructed from the first letter of the applicant´s surname, the number of applications received by that particular applicant and the

sequence number of applications in that letter category. O-2/3 thus means that the applicant´s surname starts with “O”, it is the second application launched by this citizen and it is the third application in the archive under the letter “O” (in chronological order). This numbering system was described to the author by members of the *Administration* division during the requirement analysis and adopted in the software despite the fact that it is now obsolete since its primary purpose, the swift retrieval from the archive upon request, is handled by AzArchitect in a more convenient way using the application finder (see Figure 23). The programming effort necessary to implement and automate this numbering system originating from the analogue book keeping of the department is justified with the greater user acceptance that a familiar numbering system promotes. AzArchitect strives to introduce as few changes as possible in the application registration process.

- In a final step, the user is presented with clear indicators of what information is mandatory, optional, has been entered or does not apply. Data fields are enabled and disabled accordingly, preventing systematic input errors as much as possible.

The management of applicants and addresses, too, is implemented and designed to ensure maximum possible user friendliness and reduce the potential for incorrect data entry and address concerns voiced during the interviews. This is achieved through the integration of **convenient search filters** and **sorting**, the enforcement of application related **constraints** as well as **auto-completion** for text fields. All applicants (private persons and companies) are registered, edited, deleted, found and selected using the Applicant Manager (Figure 20). When selecting an applicant for an application, logical constraints ensure that, for example, no private person can be selected for an application made by a company and vice versa. Auto-completion for the drop-down text fields suggests existing entries while the user types and for as long as the spelling matches an entry in the database. This feature, in particular, is of importance both to significantly reduce the work load when entering similar addresses, etc. many times over and avoid several entries of the same *name*, *street*, *city* etc. with slightly different spellings as a result of a typo or different conventions (e.g. the spelling in different languages Sumgait[English] and Sumqayit [Azeri]). The programming effort was considered

worth the expense since comfortable handling is always important but particularly critical in the initial introduction of such a solution (Gläsel, Schindler et al. 2013).

Figure 20: The Applicant Manager is used to register new or edit, delete, find and select registered applicants (both physical and legal entities). It provides comprehensive search and sort functionality as well as auto-completion for maximum comfort.

Once the application has been entered into the system, it is exclusively handled using the application hub (Figure 21) launched from the dock widget  .This central tool provides all information on the application itself, the applicant and the address, logs all changes in the application status including user comments with date and allows the responsible employee to reassign or pause it, as is necessary in some cases. It clearly indicates the days remaining until its deadline both in textual form and as a color changing progress bar (e.g. green = progress is on time).

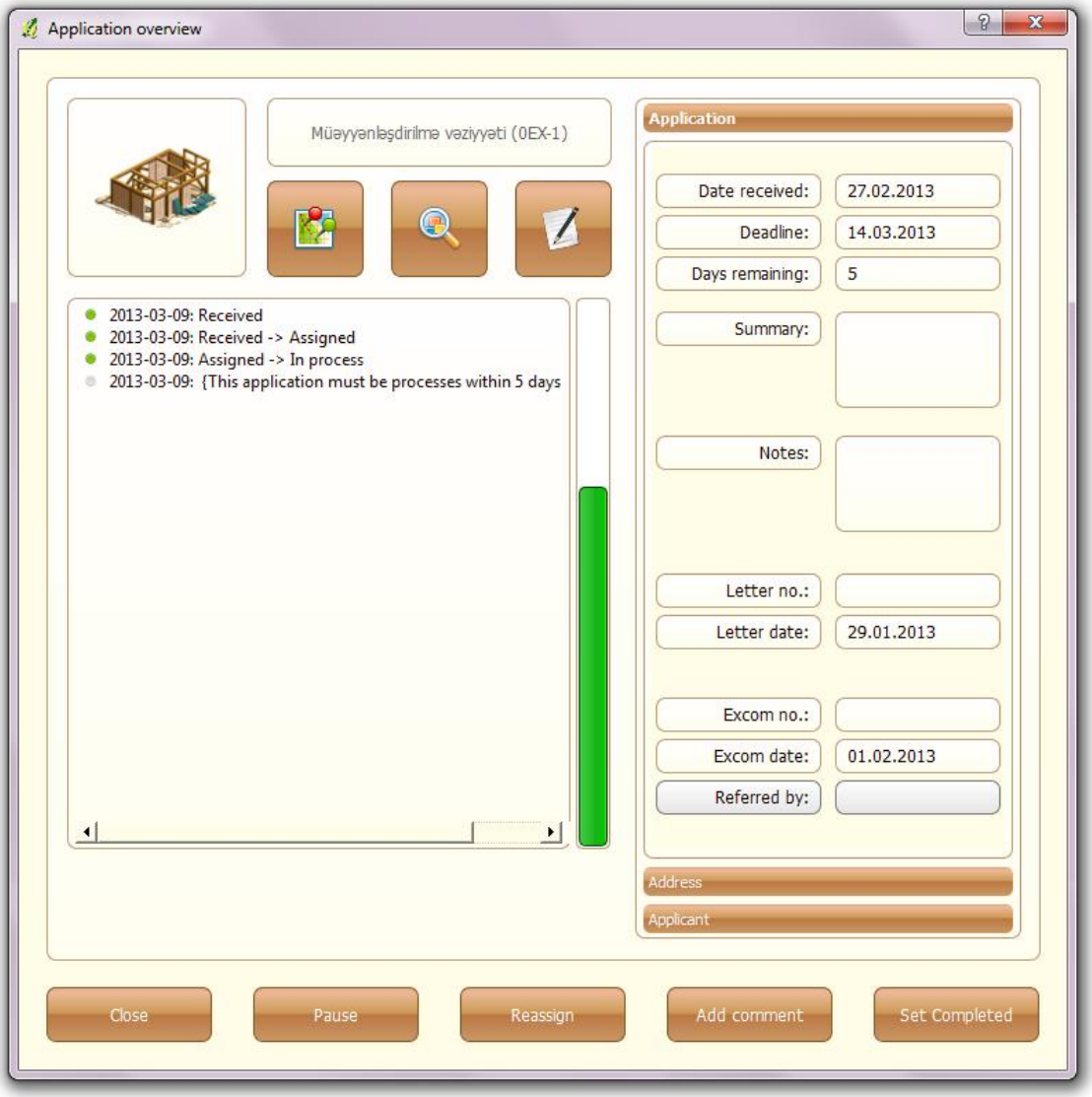

Figure 21: The Application hub is the central application management tool.

The bottom right button is used to change the status to the next stage in the “Received” – “Assigned” – “In Process” – “Completed” – “Sent out” chain of statuses (Figure 22). Furthermore, an application can be paused at any time to accommodate circumstances such as, for example, the time that is needed by the applicant to collect the feedback from utility companies described in the sample process in section 3.5.1.2 before the application can be completed. In that case the application assumes the status “pending”. It thus accommodates all possible scenarios in the internal application flow and offers the user the advantages of digital document management.

Documents such as images, text or pdf files can be attached to applications and later retrieved using the document tool . The geo-referencer tool allows the user to

assign the application to a parcel or a building feature while the zoom-to-feature tool sets the map extent to center on the map object of the application and zooms in on it.

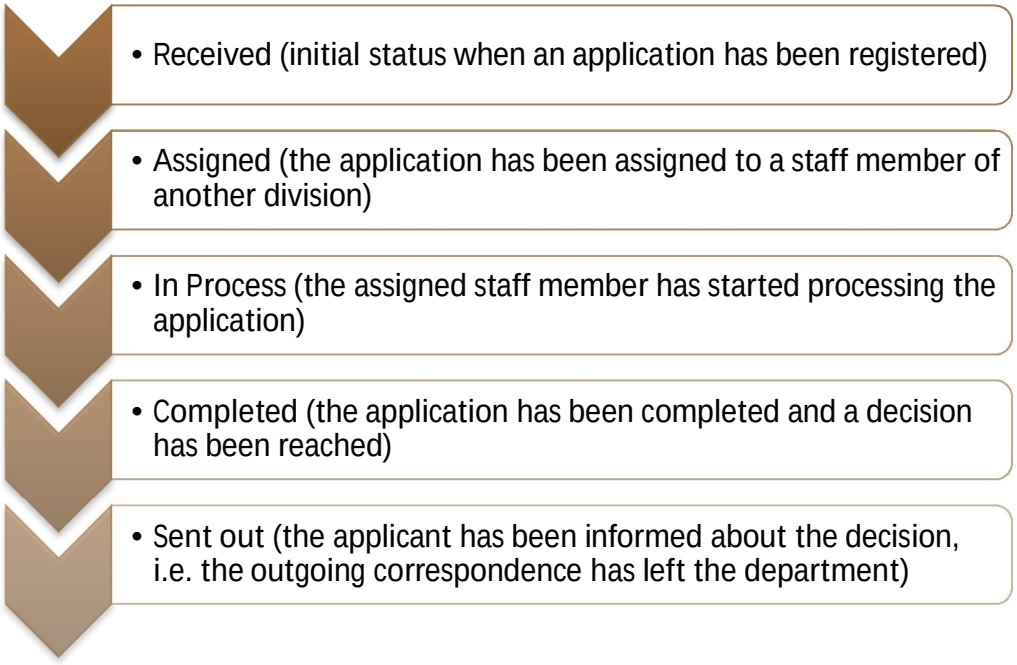

Figure 22: Chain of statuses and application goes through. An application can be paused at any time; it then assumes the status "pending".

The Application hub thus provides a simple tool to retrieve all attribute information, manage the application and locate it in the map.

Finally, the Application Finder (Figure 23) was implemented as a central search tool to swiftly find applications based on any set of attributes such as *status, responsible employee, application no, applicant name, date received* and many more. It replaces the need for manual searches in the physical archive and also makes the traditional numbering system obsolete, as previously mentioned.

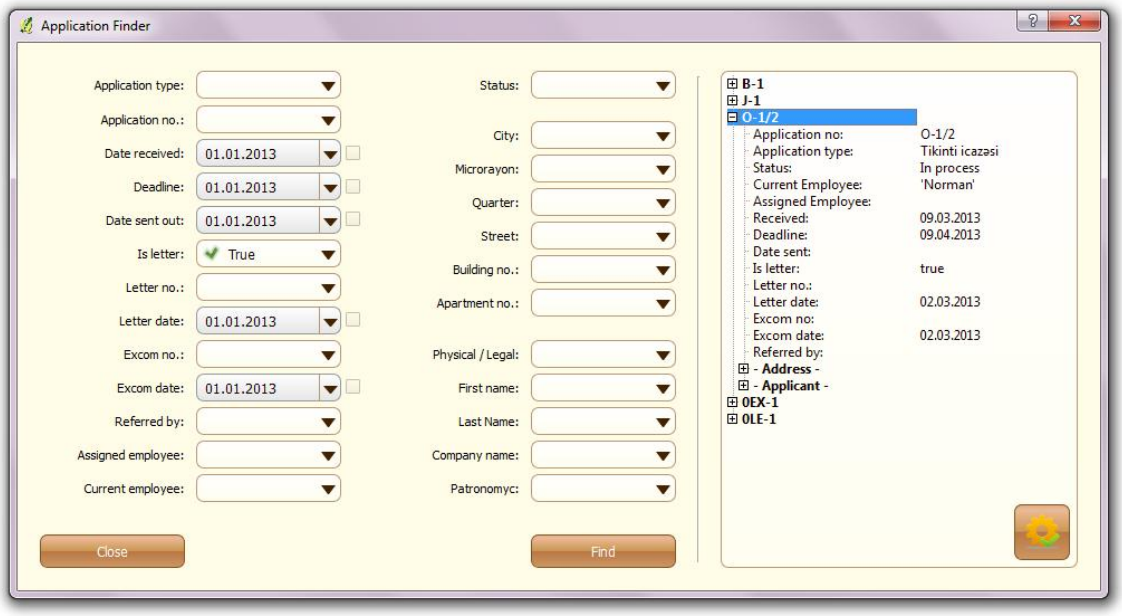

Figure 23: The Application Finder allows users to find and retrieve information on applications based on a large number of optional search variables. In this example, the user searched for all applications of type letter and found 5 matches.

4.2.3 GIS functionality

The GIS functionality of AzArchitect at this point is primarily focussing on visualizing application information related to cadastral objects (buildings or parcels) and facilitating the preparation of cadastral extracts. Applications are linked to cadastral objects using the geo-referencer tool described above, the visualization of various attributes of interest is facilitated by a selection of predefined and commonly needed views accessible through the view tool (Figure 24).

Figure 24: Predefined views for AzArchitect available with three different transparency values.

Every view is available with 0%, 40% and 80% transparency in order to ease data use when the layer is underlain by orthophotos. Figure 25 illustrates an example of the QGIS work environment with the AzArchitect plugin and cadastral data loaded. The application objects (4 parcels, 1 building) are coloured by status.

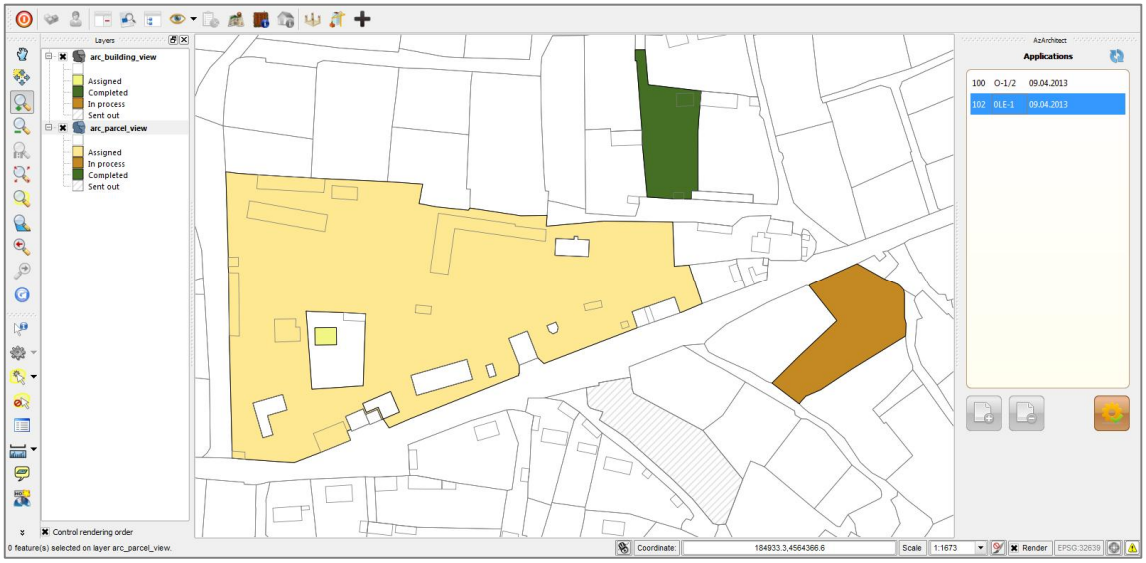

Figure 25: QGIS with the AzArchitect tool bar and dock widget loaded. The current AzArchitect user is responsible for processing two applications listed in the dock widget on the right. Applications are viewed by status.

Various info tool for selected map features were implemented, facilitating information access through location also. The application info tool lists all applications registered for the selected feature (Figure 26). Given the user has the necessary privilege the application hub can be accessed directly from this info dialog.

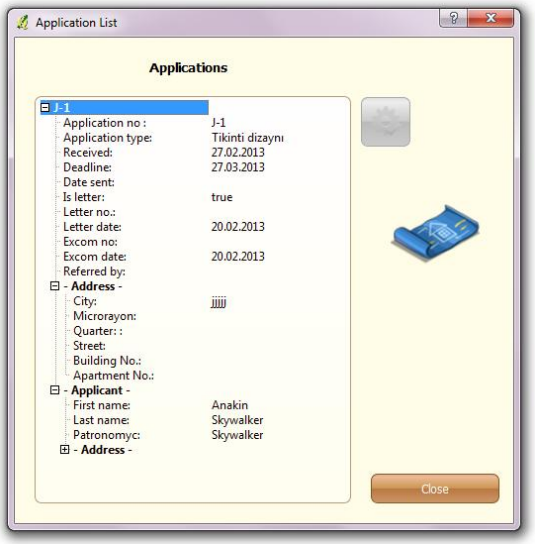

Figure 26: The Application list dialog offers an overview of the most important attributes of one or more applications registered for a selected feature.

A similar info tool was implemented for cadastral information on parcels and buildings (Figure 27). During operational trial of the software employees of the Department for Architecture and Urban Planning will thus have access to all information that was recorded for the cadastral objects and be able to identify information they may need in their own work processes but hadn´t thought of yet.

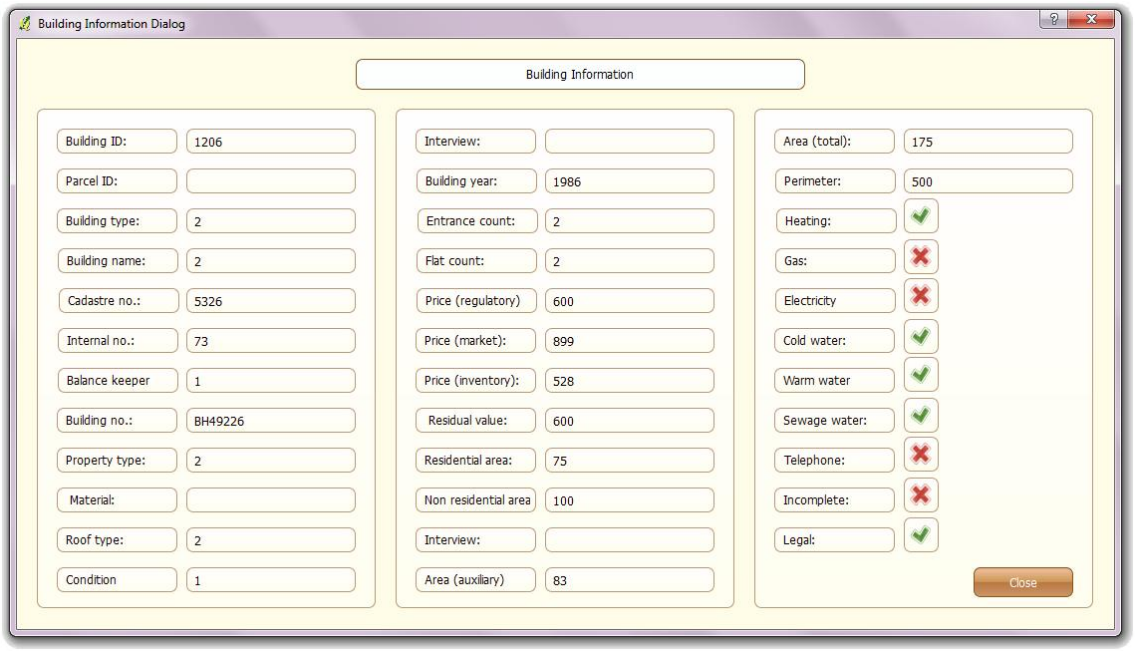

Figure 27: Information on cadastral objects recorded during the surveys is available through info tools that were implemented both in AzArchitect and AzFinance. The example shows information on a building selected in the cadastral map.

A hidden GIS functionality is the intersection check that occurs every time an application is assigned to a location (i.e. attached to a parcel or building). If the cadastral object intersects the contaminated site layer produced by some members of the department, a warning message appears in the application hub (Figure 28), notifying the user that additional steps may need to be taken in the application process.

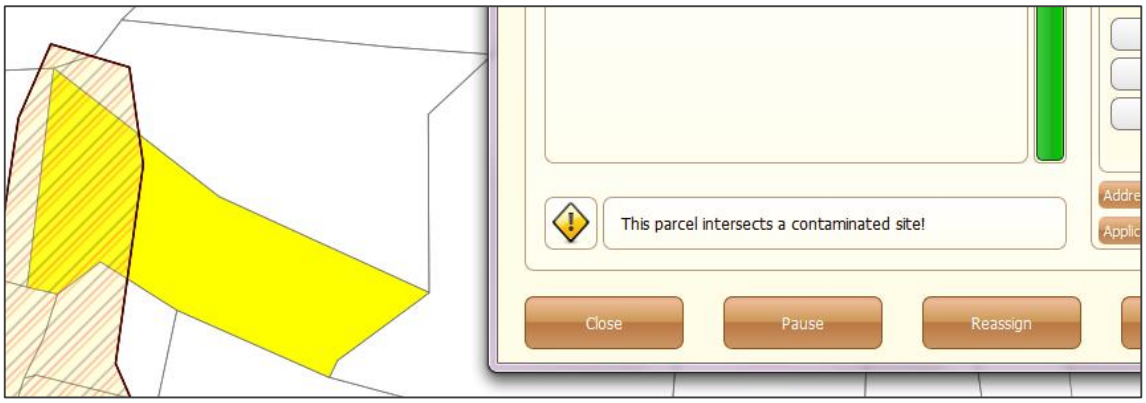

Figure 28: The selected parcel for the application intersects the contaminated site layer. A warning is displayed in the respective application hub. The contaminated site layer is not usually loaded in QGIS during normal operational use so that intersections would not be readily detectable.

Printing cadastral extracts is another core GIS functionality of both AzArchitect and AzFinance that was repeatedly mentioned as a highly desirable feature by the interviewed employees. Both software solutions enable the users to print cadastral extracts for a selected parcel as a PDF file with a selection of relevant attributes, a sample of which can be found in Appendix C. These extracts are not intended as legal documents such as those extracts issued by SCPI but as an information sheet for applicants and third parties.

Finally, another important aspect of AzArchitect, the visualization and management of current constructions and construction violations, was implemented with a focus of registration through map objects (Figure 29). Unlike applications, ongoing constructions and violations are registered directly by members of the supervision department and originate from field observations and supervisory visits. Consequently, a construction or violation can only be registered for a selected parcel in the map. The registration and management of constructions are subject to a number of logical constraints that are programmatically enforced in AzArchitect.

Figure 29: Constructions are registered and edited for a selected parcel in the upper section of the dialog while associated violations are managed (mark resolved, add, edit, delete) in the bottom section along with start/end dates and responsible supervisor.

One such constraint, for example, prevents the registration of a construction for a parcel that does not have an approved construction permit application associated with it. Another constraint affecting the management of violations prevents acceptance of construction work in cases where unresolved violations are associated with it. Such and other checks are routinely necessary in order to prevent later conflicts due to premature acceptance of construction work as has happened in the past as a consequence of insufficient information exchange on unresolved violations. The supervision department will thus benefit most from the

mapping capabilities of AzArchitect, utilizing it for the planning of field inspections and the allocation of supervisors to registered constructions.

4.2.4 Reports

Lastly, AzArchitect must also address the needs for statistical information of the head of department in order to secure continuing support for its introduction that is particularly critical in Azerbaijan. AzArchitect consequently provides functionality for regular statistical reports application volume, workload distribution, performance, etc. Reports may be generated on a monthly, quarterly and annual basis or for a custom period of time and are exported as PDF files. Most of this information is calculated from the log files that keep a record of every application registration or status change. These reports enable the management to identify bottlenecks within the department as information on processing time by status or department is readily available applications that passed their deadlines can be identified and quantified. This information may further help to increase efficiency through informed decision making on effective counter measures where needed.

4.3 AzFinance

AzFinance focuses on the individual work processes in the department and allows the workers to fully digitalize all their information products as well as produce relevant statistics and tax receipts. AzFinance functionality is accessed using the toolbar depicted in Figure 30 below.

1:	Register lease contract
2:	Register private land (home or dacha)
3:	Register private property (apartment)
4:	View tax object details
5:	Register payment
6:	Manage tax object
7:	Manage tax payer
8:	Manage tax inspectors
9:	Map views
10:	Cadastral information (parcel)
11:	Cadastral information (building)
12:	Create report
13:	Print cadastral extract
14:	Options

Figure 30: Toolbar of the AzFinance plugin with a tabular listing of the basic

functionality of the individual tools. This task bar is added to the QGIS panel when the plugin is loaded.

4.3.1 Data model

The AzFinance database (Figure 31) model is in many ways similar to the previously described AzArchitect model. The central object of this schema is the tax or lease object (table *tax_object*). Information on the location and address of the object, its responsible owner or tax payer, their addresses, tax zone, responsible inspector and payment history are all referenced to this object. Again the bilingualism of AzFinance is evident in the lookup tables. AzFinance makes extensive use of database views which are necessary for the management of tax objects that have either a one-to-one relationship with a parcel or a many-to-one relationship with a building (i.e. several apartments in a multi-story building) or summaries of tax payment details.

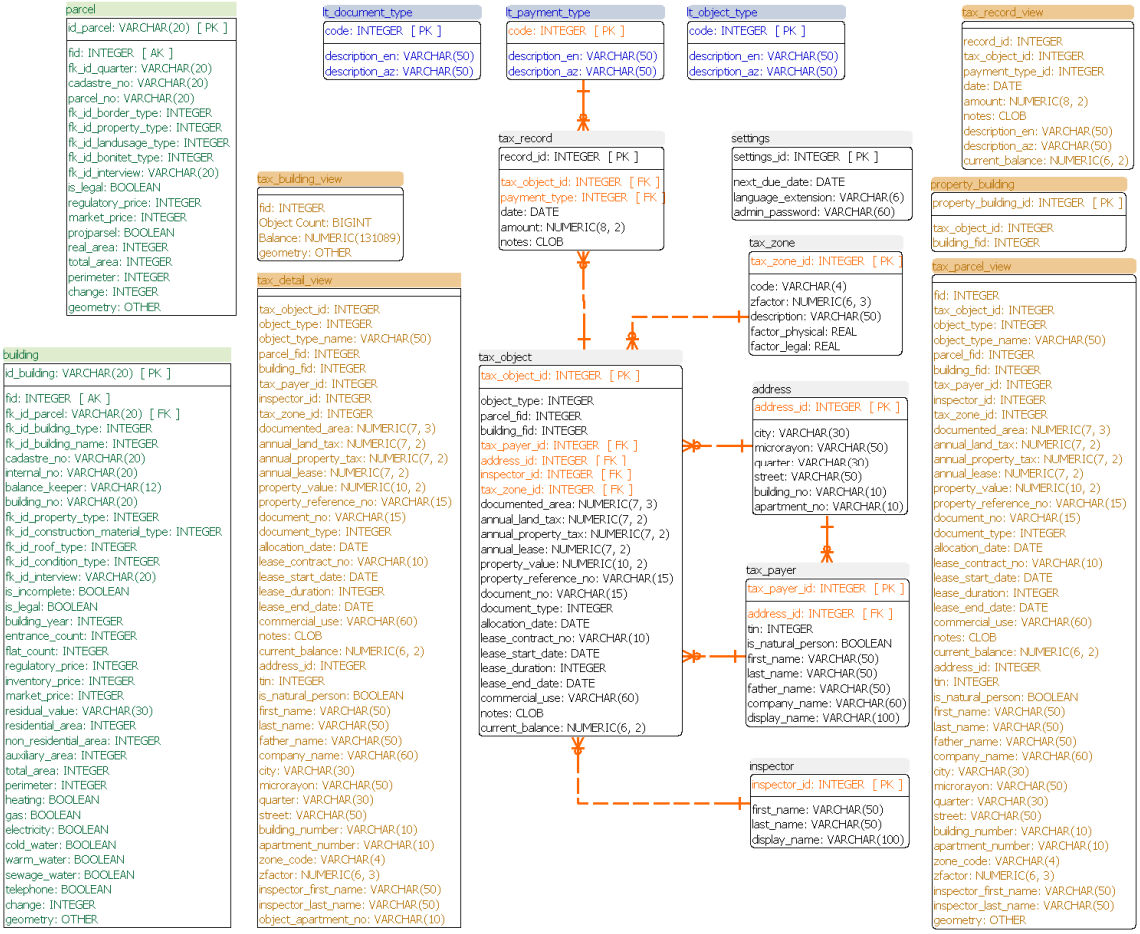

Figure 31: AzFinance data schema and its data interface tables *building* and *parcel* (green). For clarity lookup tables are highlighted in blue and database views in brown. Referenced primary and foreign keys (PK and FK, respectively) are colored in orange, as are their relations.

4.3.2 Tax/Lease object management

The primary tax or lease objects (hereafter referred to simply as *tax objects* for convenience) are leased parcels, privately owned parcels and private property (houses and apartments). The first two objects always relate to exactly one surveyed parcel, the latter either relate to a privately owned house on private ground, in which case it is registered along with the privately owned parcel, or an apartment in a multi-story apartment block on municipal land, in which case multiple apartment objects may relate to a single building geometry in the cadastral dataset. AzFinance allows the user to register the three primary tax objects by selecting a parcel or building geometry and entering all mandatory information such as *tax payer*, *address*, *registered parcel/building/apartment size*, *contract no#*, *lease duration*, *tax zone*, etc.

Annual taxes and lease payments are automatically calculated by AzFinance based on formulas provided by the Tax Department but can be overwritten by the user in order to allow amendments in special scenarios that have not yet been anticipated. Figure 32 shows the respective dialogs along with those for the tax payer and address management that allow users to choose an existing tax payer and address from or enter a new one. The tax payer management dialog further permits the user to query the database for existing tax payers based on their given name, surname, patronymic or tax identity number and sort the results by these same variables and in alphabetical or reverse alphabetical order so to make it easy to quickly find an existing tax payer an avoid registering duplicate tax payers in the database. Similarly, the address dialog facilitates user input through auto-completion of city, quarter, rayon and street names as can be seen in Figure 32. Auto-completion was implemented both to assist users who repeatedly enter data for the same city, rayon, quarter etc. and to ensure that nearly identical entries due to spelling mistakes, which were common in the data created in the Sheki/Ganja pilot projects, are avoided as much as possible as these will later complicate regional statistics reports.

An automated calculation of area (for parcels) and consequently the appropriate tax amount has not yet been implemented as tax collection is area bound and the agreed amount cannot be changed without prior amendment of the documented area in the land ownership documents. Future versions of AzFinance may, however, incluse such automated calculations given that the registration authority SCPI will henceforth be working with the identical cadastre dataset.

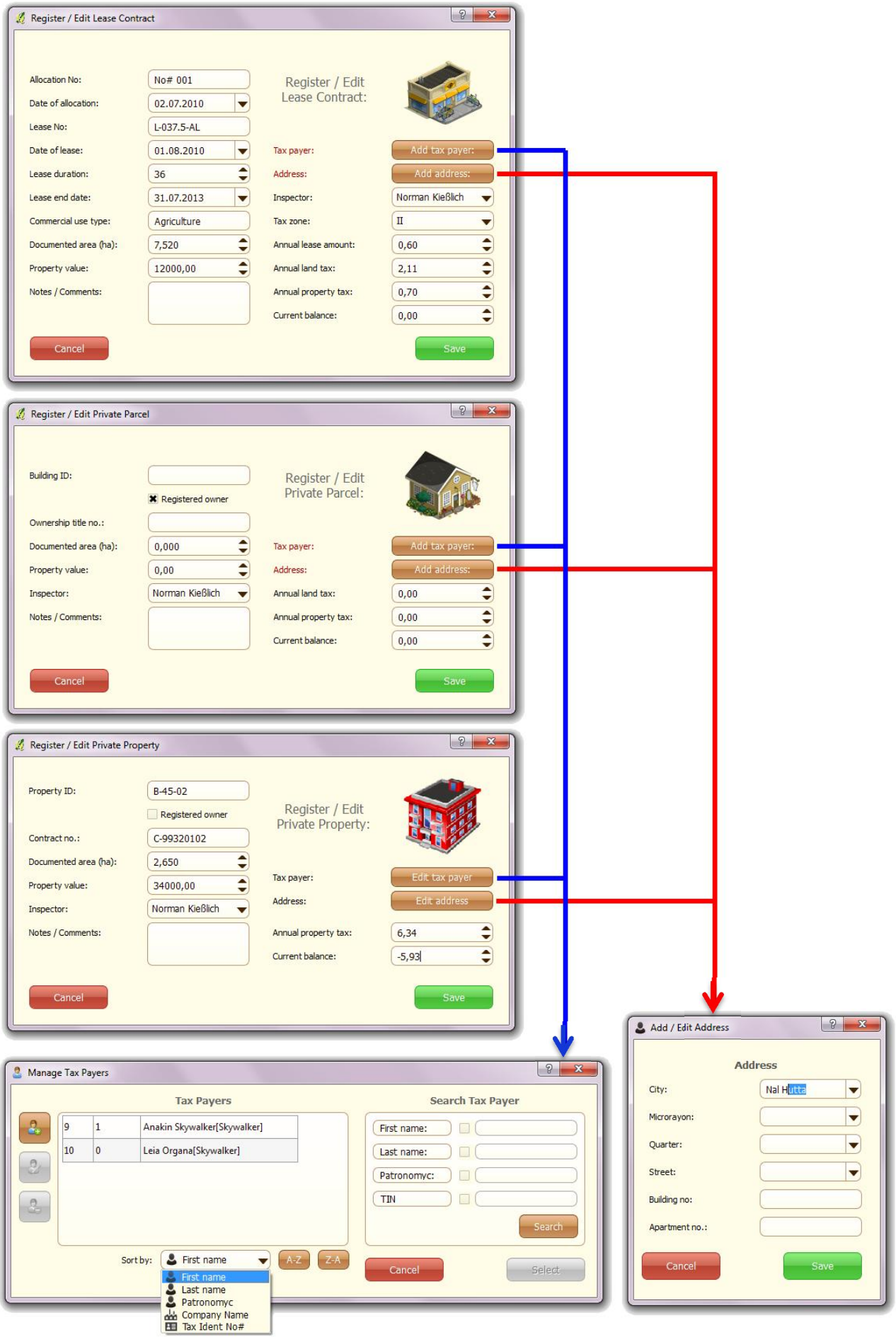

Figure 32: Tax object registration dialogs with their referenced tax payer and address selection dialogs. The Address Dialog supports auto-completion for maximum comfort and minimum data duplication.

Once the objects are registered, tax payments and penalty fees can be entered and tax receipts generated for them. AzFinance offers a comprehensive tax object manager to find objects based on their attributes and offer tools for registration of payments & fees, locating the object in the map, getting a detailed attribute overview and checking the payment history (Figure 33).

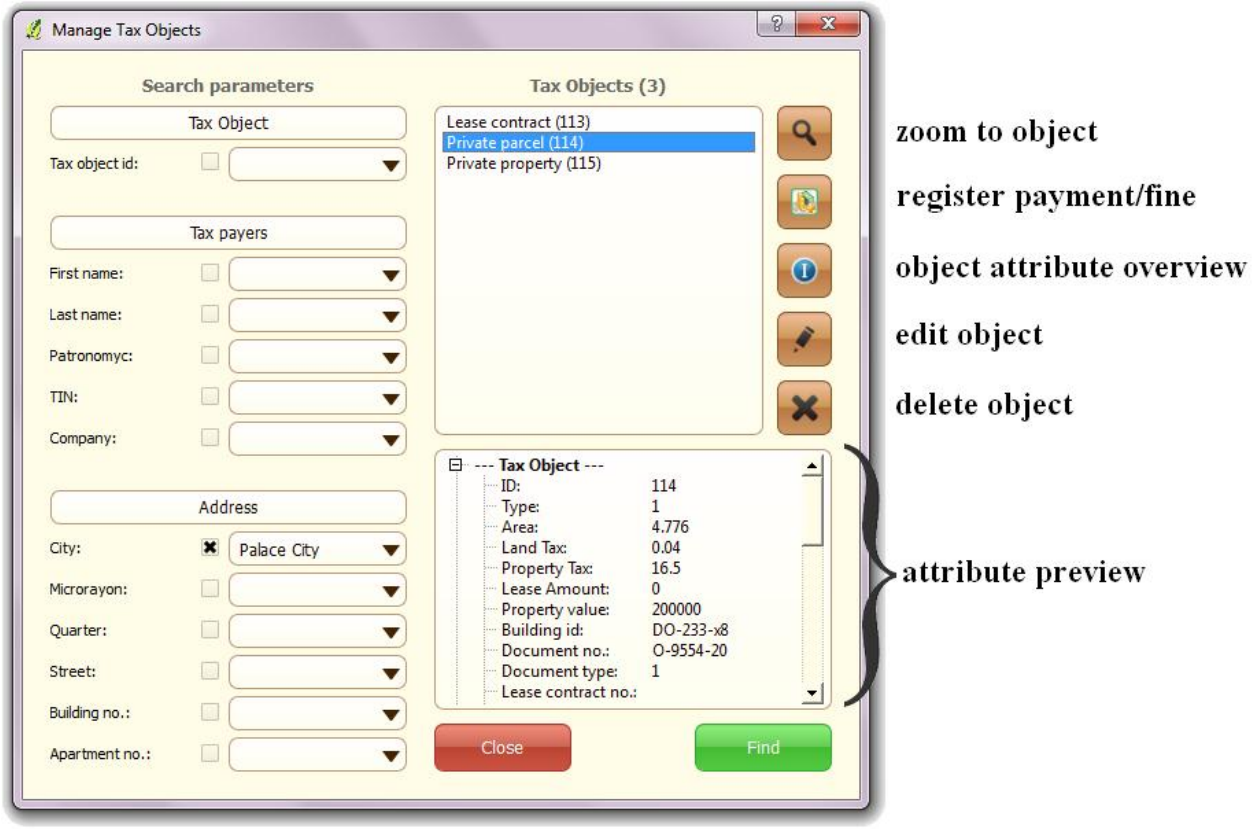

Figure 33: Tax object manager dialog in AzFinance. Users can look up objects based on any of the attributes listed on the left and any combination of them and locate the objects in the map, register payments, view attributes, edit or delete them.

The Info tool and the payment tool allow the user to view detailed information on the tax object (Figure 34) and its payment history and manage payments and fines (Figure 35), respectively. These tools form the basis for all inquiries about current and past payment obligations and general questions regarding tax objects made by tax payers or other authorized actors. The possibility to find and locate tax objects based on as little as a tax payer´s name is a significant improvement to the previous state of analogue record keeping where such queries would have been difficult, if not impossible.

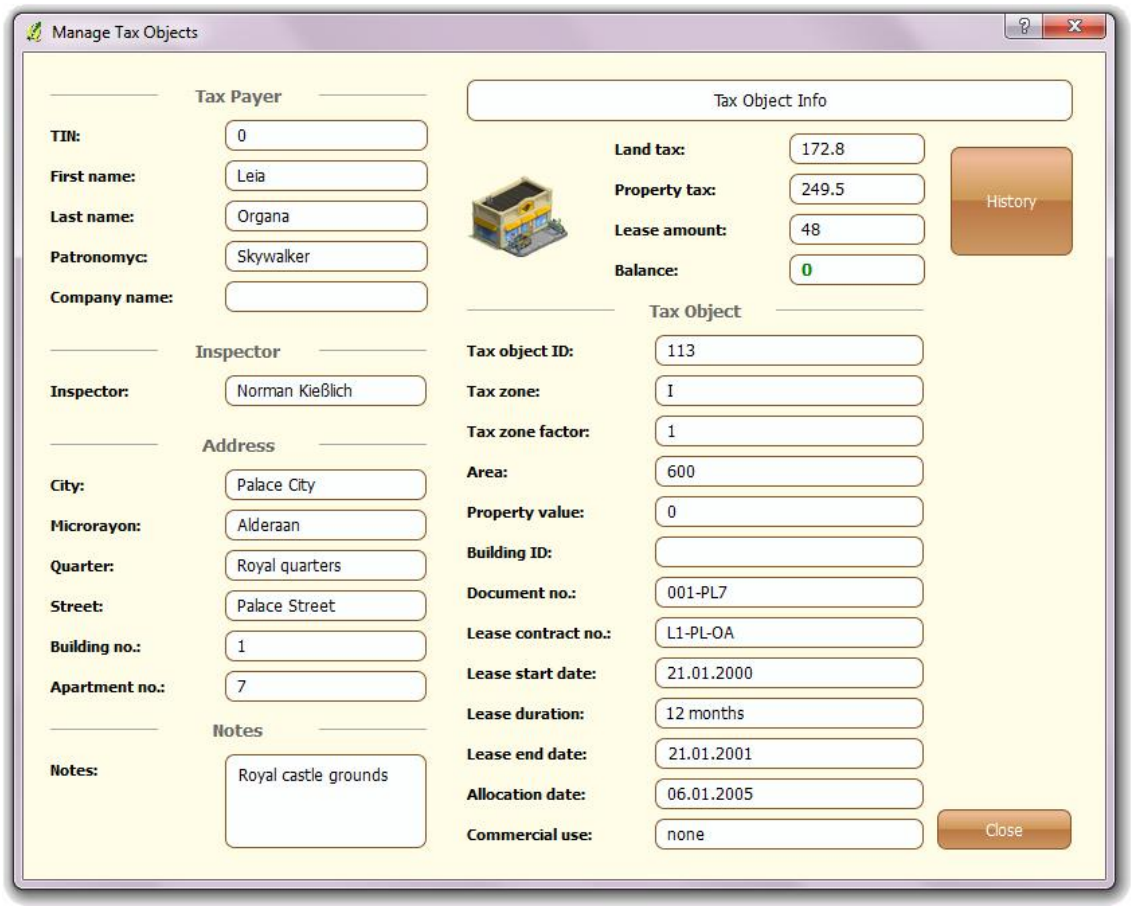

Figure 34: Tax object overview dialog offering a complete set of information on the object including the current balance and access to the payment history via the “History” button.

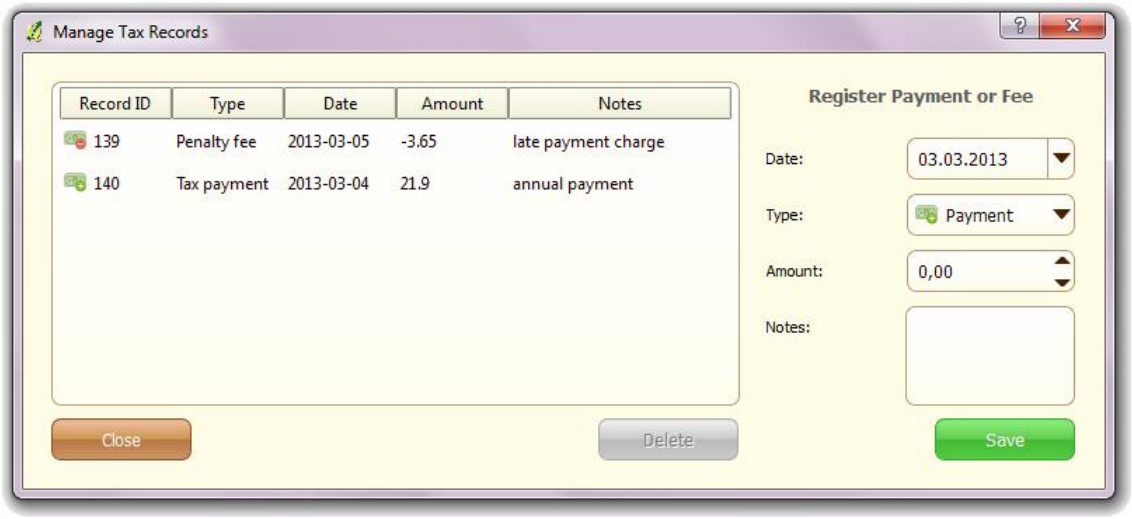

Figure 35: Manage tax payments for a single tax object. Users can add payments and fines along with notes where appropriate. Fines are not automatically calculated owing to the complexity and number of factors involved in their calculation.

4.3.3 GIS functionality

The GIS functionality is limited to the visualization of recorded information due to temporal constraints in the development. AzFinance also offers a number of views differentiating tax objects based on commonly needed attributes (Figure 36) facilitating all planning for field work. Future versions of AzFinance are scheduled to include a number of spatial constraints such as the logial assignment of tax zones based on a master plan, logical checks of declared land use as well as mapping functionality for the discrepancy between documented and actual (surveyed) parcel areas in order to identify parcels whose ownership documents need to be amended.

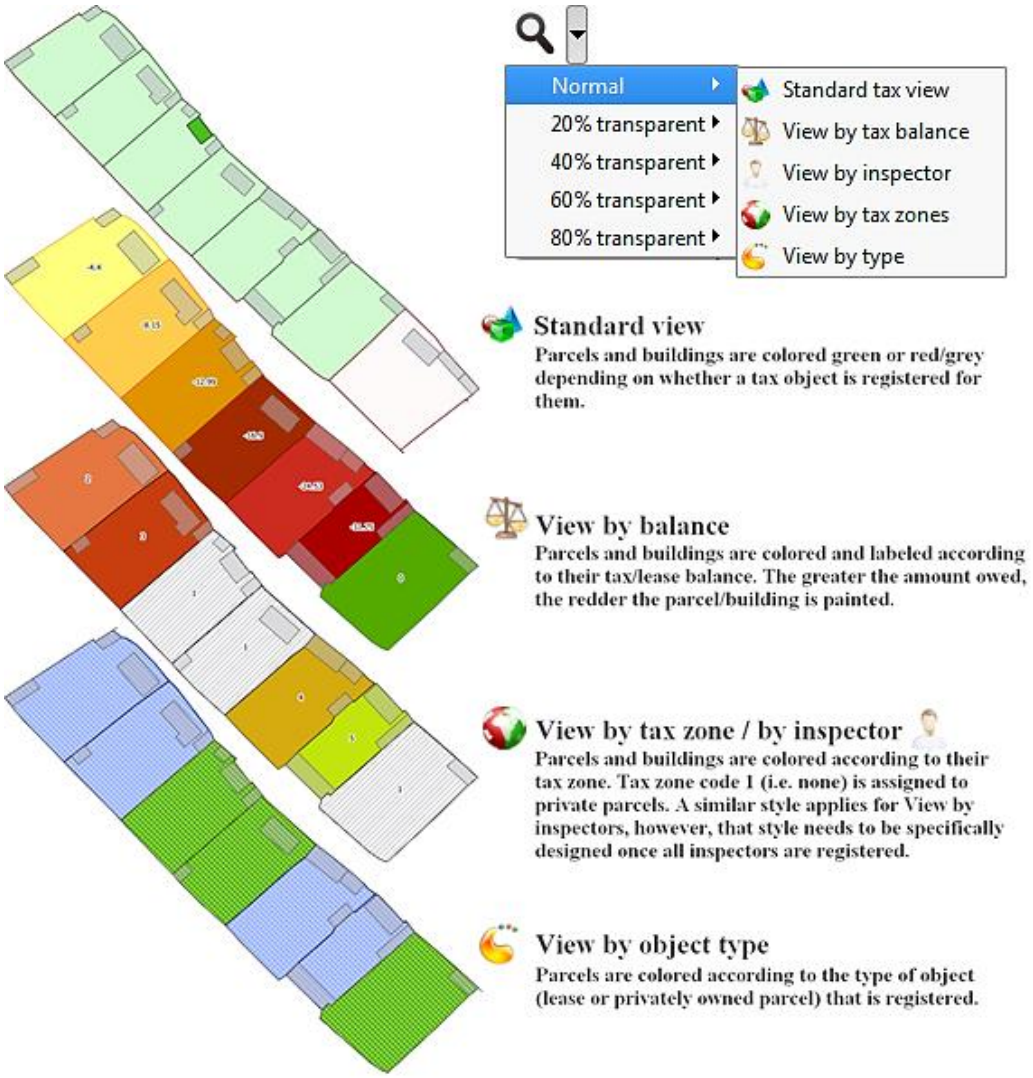

Figure 36: View-by styles implemented in AzFinance. Altogether five styles are available to provide the user with graphically illustrated information on the tax objects.

The info tools related to cadastral information are identical to those implemented in AzArchitect as is the tool to print cadastral extracts.

4.3.4 Tax receipt & Reports

AzFinance produces two standard documents, a financial report and an individual tax receipt. The financial report summarizes the statistics for a custom period of time and supports internal decision making while individual tax receipts are printed on request and list the outstanding tax or lease debts and other relevant details. Both documents are generated in a two-step procedure. Prior to the PDF file printing, the user is presented with an editable preview of the document (Figure 37). This step was implemented to allow for manual editing during the operational test period of the software solution. Once it is clear that the reports are generated correctly in all circumstances, the editing option will be removed.

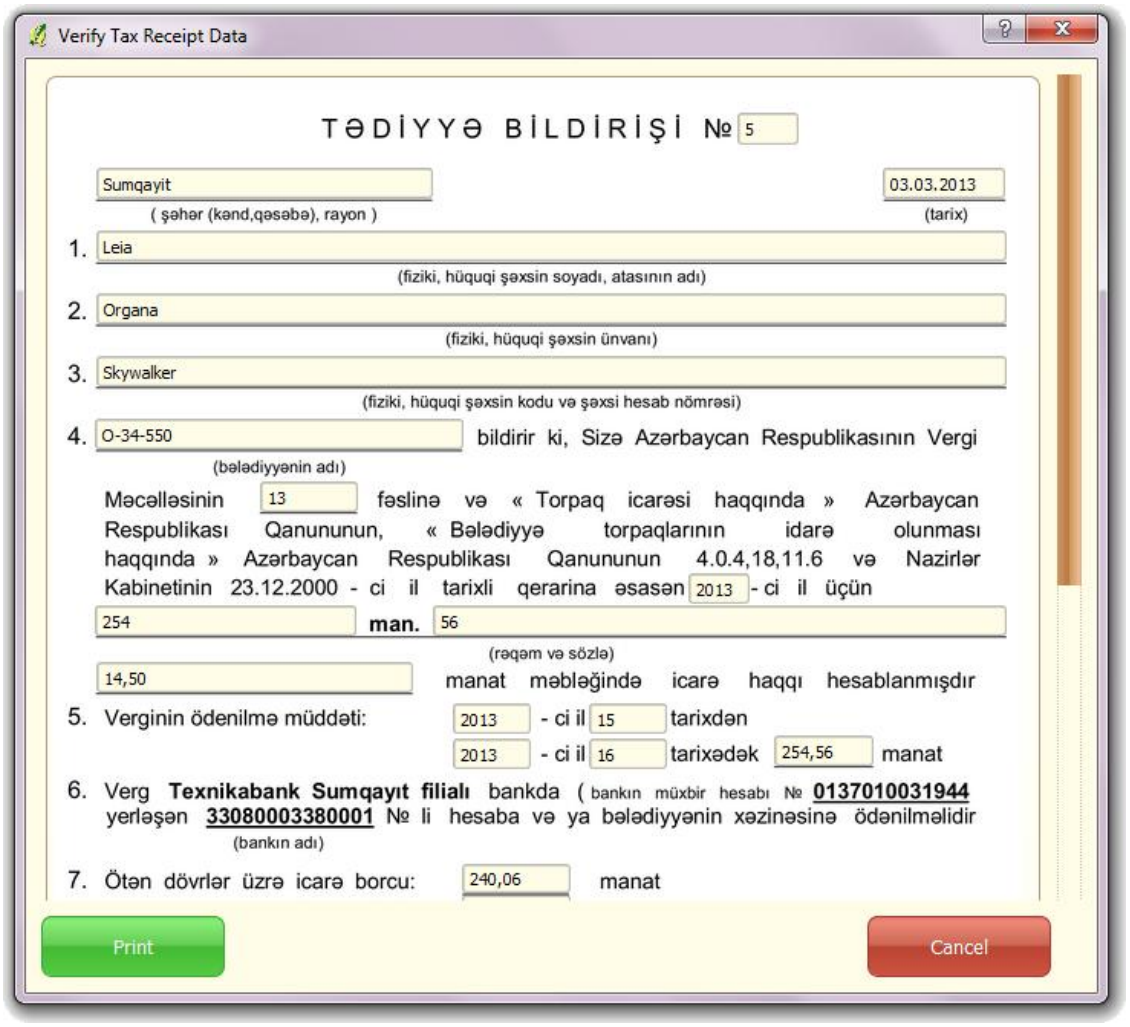

Figure 37: Editable tax receipt preview.

5 Introduction of software solutions

5.1 Introduction of AzArchitect and AzFinance

The author first introduced the developed solutions in a meeting with the heads of departments from all three involved parties (SCPI, City Architecture Department, Municipal Tax Department) on November 12th 2012. The meeting was held with all three partners simultaneously in order to inform them about the structure and capabilities of the individual solutions and how the data and information that shall henceforth be exchanged between the partners is utilized. The presentation further served the purpose of illustrating what type of information product each department produces and may make available to the other (where applicable). SCPI, for example, need to be informed about newly constructed buildings in order to initiate the mandatory field survey of the new structure. The anticipated information exchange between the three actors is illustrated in Figure 38 and remains subject to change based on the identification of additional information products required by any one of the three actors.

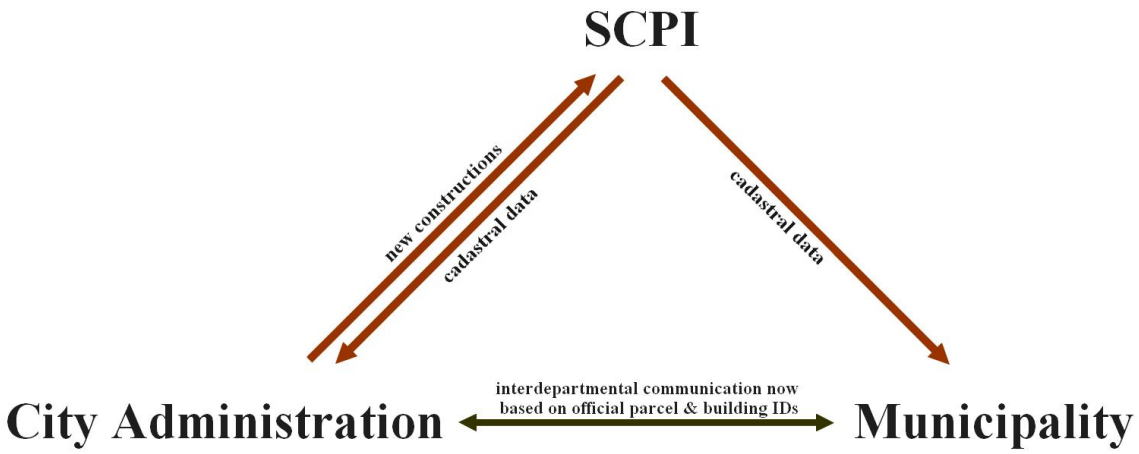

Figure 38: SCPI provides cadastral data and updates thereof to both administrations. The city administration (Architecture Department) informs SCPI about new constructions that need to be surveyed. All interdepartmental communication will henceforth be based on the common data base and the ids of its objects, eliminating the need for sketches, verbal and written descriptions of parcels or buildings.

The solutions received very positive acclaim by the decision makers who were evidently satisfied with the operational GIS applications presented to them. It is certainly not uncommon for recipients of software development products to become enthused by a

workable solution when it is finally presented to them and after they have contributed to it for longer periods of time with no immediate practical use to them other than an idea of a future solution, however, honest satisfaction is nevertheless a positive indicator for the introduction of a sustainable solution dependent on managerial backing.

Apart from the introduction of the software products, the current state of the cadastral data was discussed and appointments for installation and staff training sessions were made.

5.2 Trainings

Staff at the Department for Architecture and Urban Development received training over the course of two days. AzArchitect had previously been installed on the five personal computers that were procured and paid for by the GIZ and that will henceforth form the intranet of the department. The attending employees were trained in the operation of AzArchitect based on a sample dataset from Sheki that is comparable in information content to the cadastral data expected for Sumgait. All participants were trained in the full range of tools implemented in AzArchitect, not just those implemented for the work processes of their own divisions. It was considered important to provide all employees with an understanding of how the various divisions process data using AzArchitect.
The future users had no difficulties grasping the fundamental concept of this, essentially, electronic application management solution and expressed their appreciation for what they perceived to be a helpful development for their department. The mapping of information and the overview of statuses and deadlines raised keen interest in some of the attendants. One participant later confided to the author that she considered learning to use digital management systems in general and at least basic GIS technology in particular a welcome addition to her personal skill set. On the other hand, some senior staff members remain sceptical and have not yet overcome their resistance towards a modern data management system. It is clear that younger colleagues will have to enter information into AzArchitect on their behalves.

Considering that AzArchitect is primarily an application management system and a substantial amount of the internal logic operates independent of spatial locations, it can already enter operational use at the department even though the cadastral data is not yet available. The applications can be georeferenced retrospectively at a time when the

Sumgait cadastre is in place. Mr. Hartmut Lange, who is employed by the department and also acts as an expert consultant for the GIZ, has volunteered to supervise the operational introduction of AzArchitect during the first quarter of 2013.

The training for AzFinance was conducted in a single day owing to the lesser extent of the solution compared to AzArchitect. The author trained two tax inspectors, who were then replacing an internal staff member on maternal leave, in the operation of AzFinance. None of the workers at the Tax Department speak English and some younger members speak Russian poorly; the fact that AzFinance supports three languages, one of which is Azeri, is a much welcome fact that was unexpected by both trainees who had expected a Russian version only. No issues concerning the use of AzFinance arose during the training. The trainees were asked to pass the information regarding the use of AzFinance on to their colleague upon her return and the author provided sample cadastral data for that purpose.
Unlike AzArchitect, however, AzFinance will only become operational once the quality assurance work on the cadastral data for Sumgait is finalized and the data becomes available to the municipality. The data delivery is scheduled for early summer 2013 and both user groups will receive further training with the Sumgait data then.

5.3 Initial feedback

As of April 2013, the testing of AzArchitect by a small number of employees of the Department for Architecture has resulted in first constructive feedback. Minor bugs and a few desirable features were reported to the author, some of which have since been realized. An example of an additional feature requested by the staff is a general 1-click-overview dialog listing all applications currently processed within the department (Appendix D). The constructive feedback has been a first positive sign that the solution is being used and understood by the target user group.

6 Project findings

6.1 Limitations

The author recognizes the limitations of this study to the specific issue of GIS implementation in land related sectors in Azerbaijan and makes no claims that the findings apply to all projects that aim to introduce GIS technology in public administrations. This study presents the results of the author´s efforts to introduce GIS technology in local public administrations with particular attention to the findings of the study conducted by Karikari *et al.* (2002); it does not contrast the results of this project with similar efforts based on a more classical approach focusing mainly on technical and institutional components. Consequently, the results cannot be directly compared to those of another approach in a similar context, they rather confirm the success of the proposed methodology and present the author´s conclusion that the consideration and weighing of cultural and political factors in such projects enhances the chances of their success.

The presented case study was conducted within a limited financial and temporal scope and mid to long term results cannot be presented as of the time of writing. The findings cannot therefore be considered final but rather report on the immediate short term observations made by the author and other involved participants. The author does, however, make informed predictions for continuing developments that were in planning and preparation at the time of writing, based on current contractual commitments of all involved parties regarding the utilization and continuation of the introduced technology.

6.2 Conclusions

The aim of this thesis was to test the validity of the human based approach to GIS implementations in developing nations proposed by Karikari (2002) for similar projects in the context of development work in Azerbaijan and provide empirical evidence of the outcome, thus presenting a case study for future work in this field. As mentioned above, this approach gives more emphasis particularly to the given subjective institutional and political conditions instead of focusing solely, or at least dominantly, on technical conditions, as is often the case for GIS implementations in more developed regions of the world.

The thesis has guided the reader through the process starting with the presentation of the initial idea, via the selection of suitable partner administrations, their requirement analyses, the technical realization to the implementation and follow up activities, specifying the rationale behind the various decisions in the selection and development processes. It has demonstrated that the success of GIS implementations in Azerbaijan may largely depend on a thorough understanding of the effects of cultural and political factors such as the high levels of prevailing corruption and the balance of political power, authoritative hierarchies as well as interdepartmental and inter-organizational relations. Political relevance and the need to improve poor interdepartmental communication and information exchange have played a decisive role in the selection of partner administrations and the risk posed by prevailing corruption has significantly impacted the design and implementation of the software solution AzArchitect.

The author proposes that, unless these factors find consideration in the placement and technical scope of GIS technology, well-meant development efforts are likely to fail in the mid to long term due to a lack of acceptance by the workers and/or their superiors.
This thesis has shown how such issues may be addressed by designing the technical capabilities in ways that least interfere with current practises while still serving the purpose of improving customer satisfaction through a reduction of both processing times and the potential for conflicts as well as increased transparency. It further demonstrates how GIS technology can be strategically introduced in administrations competing for political power in order to enhance future communication and cooperation. It is therefore recommended that, when the aims for such projects are defined, the purpose of introducing GIS technology in comparable circumstances ought to consist of a combination of improvements to the work processes in question and the establishment or strengthening of information exchange between relevant actors.

The technical capabilities of the developed GIS tools presented in this thesis are intentionally limited to a useful minimum for the time being, despite the fact that the administrations´ work processes give grounds for more sophisticated GIS analyses. The newly constructed framework for cadastral data exchange involving the three actors SCPI, city administration and municipality, must first be strengthened through continuing support from international experts until the practical importance of this cooperation is fully recognized and appreciated by all relevant decision makers.

While there have been no simultaneous efforts following a more classical approach to compare these solutions to and evaluate their differences, the evident short term success of this development in terms of user acceptance and actual, operational usage as well as the certified commitment of all involved parties to take this initial implementation as a basis for ongoing cooperation and investment indicate that the concerns of the benefactors were understood and sufficiently well integrated in the present solution and that the selection of partners based on the suitability assessment detailed in section 3.5 was adequate.

The author thus concludes that the findings of Karikari (2002) for GIS implementations in developing nations in Africa also generally apply to similar efforts in Azerbaijan. Their adjusted methodology regarding the identification of critical factors for such endeavours prior to implementation ought to find consideration in both project planning and design in order to minimize the risk of rejection due to cultural or political issues or a combination thereof.

6.3 Next steps

Following the introduction of the software solutions and the initial user feedback, the next steps primarily concern the incorporation of the cadastral data into the AzArchitect and AzFinance systems. The cadastral data has been officially accepted by SCPI by January 31st 2013 and will now be available for implementation pending an official request by the Sumgait administrations. Preparations for this data exchange based on the agreed MoU are made at the time of writing. The data migration, that is the conversion from the exchanged INTERLIS format into the PostgreSQL database schemas for AzArchitect and AzFinance, will be performed with an FME schema prepared the the author´s colleague Mr. Ludger Sonntag. The GIZ has approved further funds for data transfer activities as well as a range of additional developments for AzArchitect and AzFinance during 2013. Apart from bug fixing and implementation of user proposed features, further developments are planned to facilitate regular data updates and integrate automated backup and restore functionalities.

The continuing support of the user groups in the daily operational use of the software solutions is ensured by the local GIZ representatives and Mr. Harmut Junge. In addition, staff in public administrations will be trained in GIS technology in a new national training centre that is currently being established in a joint PPP project.

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8 Appendices

The Appendices include the following documents:

- **Appendix A:** AzArchitect database model

  The complete data model including the cadastral and AzArchitect schemas

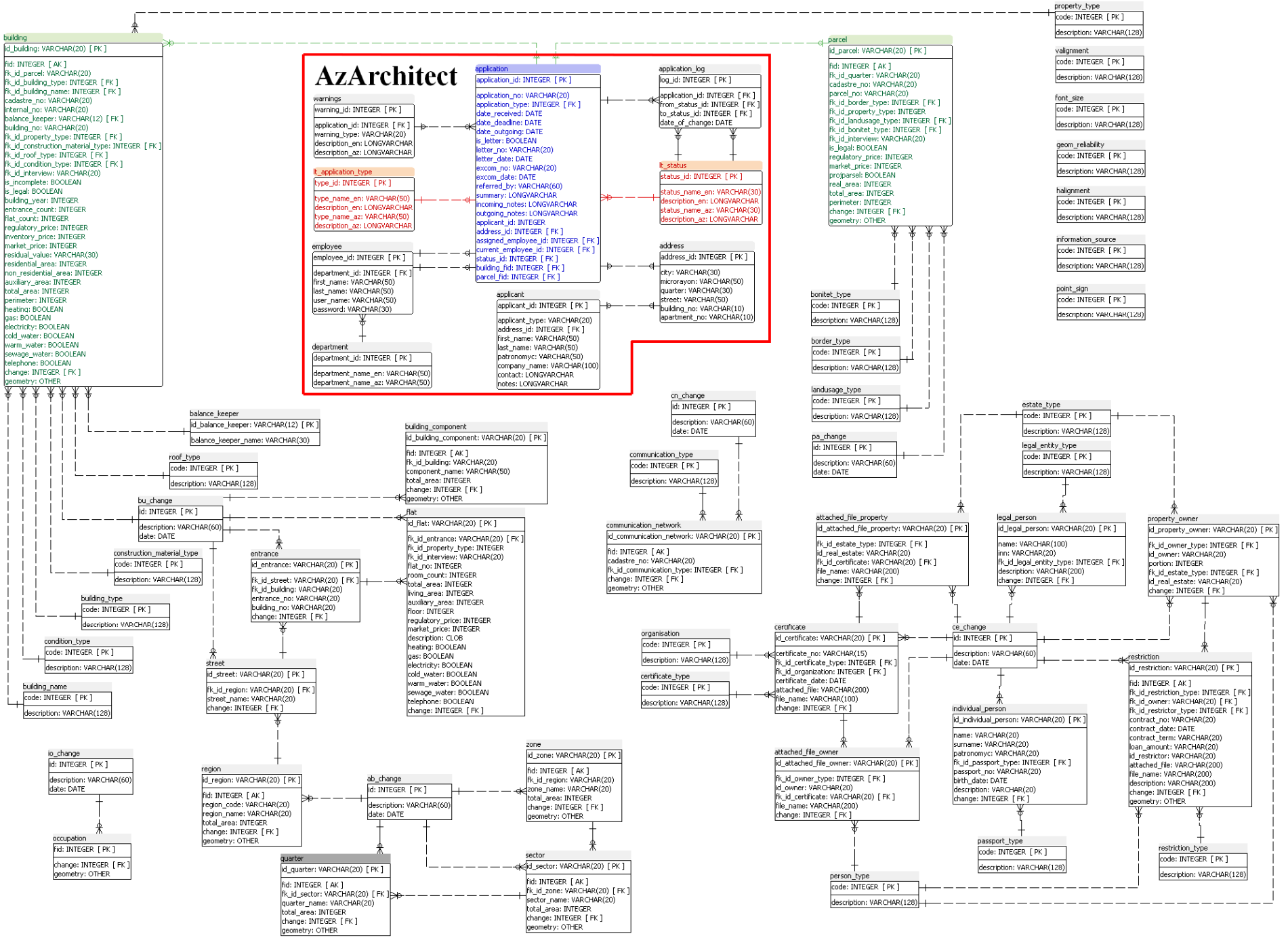
- **Appendix B:** AzFinance database model

  The complete data model including the cadastral and AzFinance schemas

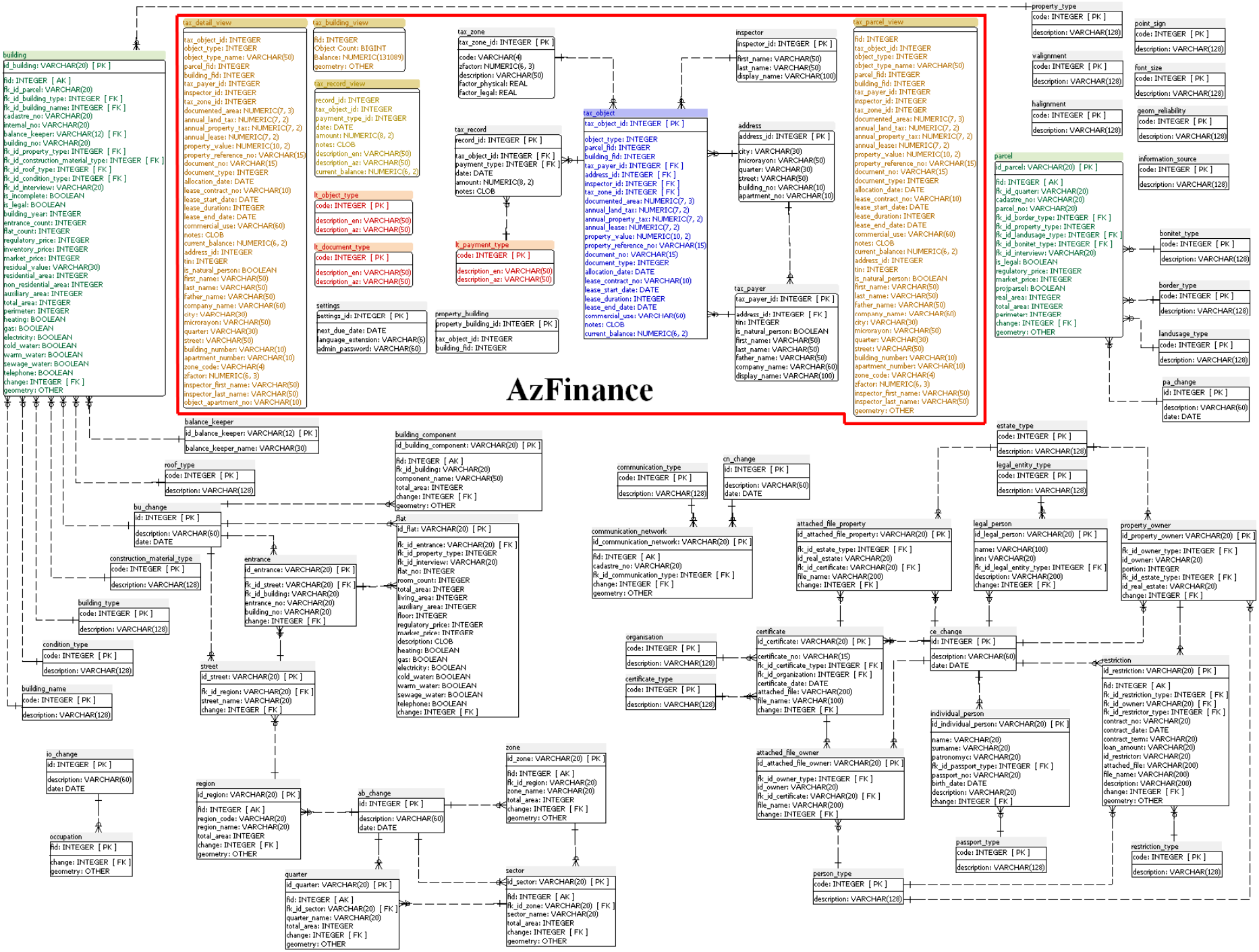
- **Appendix C:** Cadastral extract sample

- **Appendix D:** Application Overview (AzArchitect)

Appendix A AzArchitect database model



Appendix B AzFinance database model



Appendix C Cadastral extract

Sample of a cadastral extract from AzFinance. Details on what additional attribute information and geometric variables (vertex coordinated, edge lengths, parcel area, etc.) need to be included remain subject to debate, however, their inclusion will only require minor adjustments and not result in more than a couple days´ programming effort. A similar extract with another set of attributes can be generated using AzArchitect.

Appendix D Application Overview (AzArchitect)

Application overview for the Department of Architecture and Urban Planning. This dialog was added upon request by the employees of the department, following the operational trail period for AzArchitect in early 2013. All current applications are listed in a single dialog, sorted by department it is currently processed in and the status of the application. Additional information includes the application number, its deadline and the employee currently processing it. The author also included a statistics matrix (right table), summing up current application counts by status and by department.