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Development Trends and Challenges For Local e-Governments: Evidence From Municipalities in Chile and Peru

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Abstract

In Latin America, the introduction of e-government has been a driving force in the development of Information Societies. As the citizen-government relation is often more intense at the local level, the digitization of information and communication processes in a municipality become a showcase for the demonstration of the opportunities and threats of a new technological paradigm. This study is based on a survey conducted among 106 Chilean and 77 Peruvian municipalities, investigating Information and Communication Technology (ICT) infrastructure, generic services in the front- and back-office of the local government, financing aspects, human capital development and requirements, regulatory frameworks and the identified objectives and obstacles of the transition towards digital municipalities. Characteristics and development patterns are identified in order to contribute to a better understanding of this key area of the Latin American Information Society.

I. Local e-Government: The context of this study

The effective use of Information and Communication Technologies (ICT's) by governments plays a central role in ensuring that these new tools serve society and its development. This effort parts with the transformation of the public sphere itself. Electronic government (e-government) is an important catalyst for the so-called information society.[1] It contributes to bring the benefits of ICT's to the daily life of people. In this task, local governments take a crucial role. Local governments are closer to citizens and this is not only in a geographical sense. The relationship of citizens and local authorities tends to be one based on proximity and mutual interest since direct interests of both parties at stake are clearly visible. Citizens feel concerned and are concerned with the performance of the local governance, because it has a noticeable impact on their everyday lives, ranging from practical services, to education and health, to environmental concerns and city planning. Similarly, local government is often more concerned about citizens' perception of their actions than national executive powers. Thus, it is at the local level that the impact of new technologies on the government-citizen relationship can be most effectively demonstrated.

This study shows that local e-government is not only an ambition of developed countries. Municipalities of Latin America are starting to use ICT for development, in this particular case for the development of an efficient, effective, accountable, transparent and participative public sector. This study illustrates the state of development of local e-governance in the region (using the specific examples of Chile and Peru) to reflect regional particularities and necessities, in the search of an adequate development agenda in the transition towards information societies in the region.

[1] The idea of using ICT to improve government performance dates back to the first years of the Internet. In 1993, the Clinton administration of the U.S. set up the team "Reengineering Through Information Technology", as one of the teams involved in the "National Performance Review (NPR)" of the federal government. The NPR report used credit card and ATM machine services as the benchmark, and raised the interesting question why governments (as a national monopoly for a large part of information) are so far behind the private sector in making efficient use of ICT to more effectively process the vast amount of information.

1. Taking inventory in Chile and Peru

The information presented in this study is based on qualitative and quantitative input. Starting in August 2002, interviews were conducted with civil servants from municipalities in Argentina, Bolivia, Chile, Cuba, Ecuador, Germany, Peru and Venezuela. From December 2002 until February 2003 a questionnaire containing 31 questions was circulated between Latin American municipalities.[2] Eleven countries from Latin America and the Caribbean participated in this questionnaire. However, the degree of participation varied widely between countries and only the samples obtained in Chile and Peru were significant. Thanks to the proactive help and involvement of SUBTEL (Subsecretaría de Telecomunicaciones de Chile), almost one out of three municipalities in Chile answered the call. In Peru, thanks to the effective help of CONCYTEC (Consejo Nacional de Ciencia y Tecnología) and INEI (Instituto Nacional de Estadística e Informática) almost every third provincial municipality filled out the questionnaire. It should be noted that at the time of the survey, Chile and Peru were among Latin America's most connected countries, reaching overall Internet penetrations of 20% and 12% respectively.

It should also be kept in mind that the questionnaire was posted at a Website and was mainly completed through email. This means that those municipalities that already relied upon more advanced ICT infrastructure were more likely to participate in the survey. Even though some questionnaires were filled out and handed in manually, the bias toward PC existence in the municipality needs to be taken into account when considering the conclusions of this study. Given this pre-selection in the sample, the findings of the survey might show a more positive picture about ICT usage compared with what would be found if all municipalities would have been involved through a mere physical distribution of the questionnaire. Limited resources, however, made this impossible.

In Chile, 106 questionnaires were obtained from the 341 municipalities in the country. Chile has slightly over 15 million inhabitants. From Peru, 77 questionnaires were obtained. At the time of the survey, 194 provincial municipalities and 1634 district municipalities existed in Peru to serve the country's 26 million inhabitants.[3]

2. Theoretical set-up

The study adopts the perspective of the municipality and mainly tackles the problems and demands of the municipal mayor and his team. In order to take on this challenge, a three-dimensional conceptual framework developed by ECLAC in 2003 is used, which structures the complex discussion about issues related to the construction and functioning of an e-government in the information society (Hilbert, 2002).

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[2] The questionnaire can be found under http://www.eclac.cl/ddpe/municipios/municipios.htm in Spanish and Portuguese.

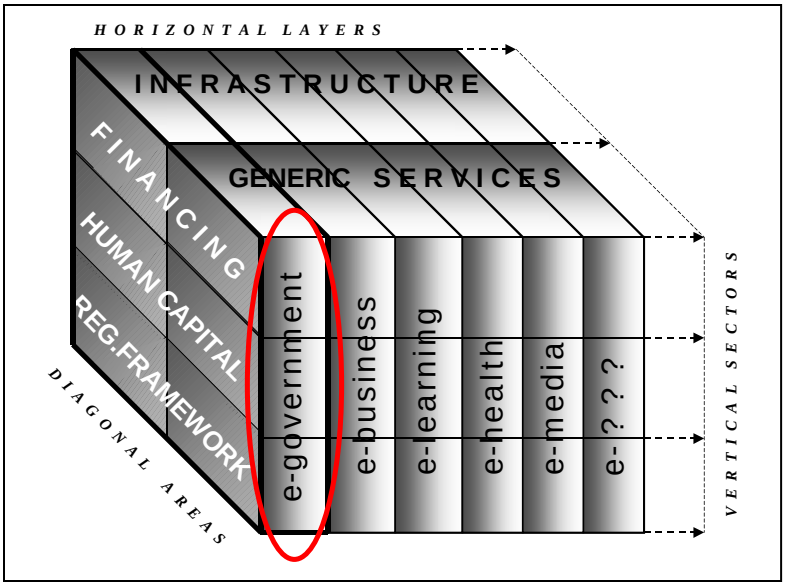
[3] Even though the majority of the municipalities that participated in the questionnaire have been provincial municipalities, for the purpose of this study it does not make a difference to distinguish them from district municipalities, since both have juridical powers and public rights, as well as economic and administrative autonomy. Besides, there is no demographic or economic rule distinguishing provincial and district municipalities, since in some cases district municipalities are richer or larger than provincial municipalities, and the other way around. Therefore, for the purpose of analyzing the trajectories and particularities of digitization in Peruvian municipality, both are merged in the same sample. Furthermore, in Peru exist 1969 "municipalities of less populated centers"/ or "delegated municipality". As the name already states, those municipalities depend on the next district municipality. They do not have a political administrative nature, but carry out those tasks assigned to them. For more information on Peruvian municipalities see http://www.peru.gob.pe/gobierno/list_municipalidades_alfabetico.asp

As shown in Figure 1, the first requirement for a "digital activity" in the information society is the physical *Infrastructure* (the "Net"). Computer networks, digital TV, digital cellular phones, telephone lines, fiber-optic networks, wireless networks, and all types of hardware and telecommunications belong to this layer. Secondly, *Generic Service* applications are needed which make it technologically feasible to create value in conjunction with the physical infrastructure. All kinds of software, including Web hosting, browsers, multimedia applications, and everything based on "bits and bytes" fall into this category. The structure of the applied information and communication systems determines the functionality of the digital municipality. It sets up the framework of the entire system and constitutes the new organizational structure. The analysis of the Generic Service Layer helps in understanding the functionality of a digital municipality. The largest section of this study will therefore focus on a theoretical analysis, as well as on empirical data of the Generic Service Layer.

Based on the technological foundation of the Infrastructure and Generic Service Layers, the digitization of information flows and communication mechanisms in different sectors of society (such as the business and commerce sector, public administration, the health sector, education, etc.) takes place. It is the "application" of technology which provides the "content" of networks in an information society. Given the fact that information flows and communication processes take place through electronic networks in a given sector, it is usually underlined in literature by adding an "e-" as a prefix. Many different "*e-Sectors*" can be identified. This study will focus on the sector of "e-government" on a local level, which includes all kinds of digital processes in and around a municipality. This is the second dimension of the analytical framework.

Besides the different technological layers and organizational sectors, it becomes clear that the process of digitization must be supported by a number of interrelated fields, which might otherwise bottleneck the formation of digital organization in an information society. Such fields diagonally permeate different subjects and create an *enabling environment* for the digitization process. This enabling environment includes financing mechanisms that support the diffusion and the implementation of these technologies while using human capital as the driving force behind the technology, and the establishment of regulatory frameworks that adequately embrace and foster the new forms of conduct.

FIGURE 1
LAYERS, SECTORS AND AREAS UNDERLYING AND INFLUENCING E-GOVERNMENT DEVELOPMENT IN THE INFORMATION SOCIETY



Source: Hilbert, 2002.

The second Chapter of this study focuses on the characteristics of the e-government sector. The particularities of this specific "e-Sector" are presented and the underlying concepts are discussed. The third and largest Chapter analyzes Chilean and Peruvian municipalities (infrastructure and generic services) and takes inventory of the present financial situation, the challenges involved and the facts about human capital building, and the affected regulatory frameworks in and around municipalities. This analysis enables a better understanding of the transitional process towards digital municipalities. The last Chapter identifies behavioral patterns and development trajectories of local e-government. The challenges identified will also enable the drawing up of policy verifications that can be useful for the development agenda of a local e-government initiative.

Such an exercise helps to understand the process of technology introduction into the governmental sector and to determine technological and institutional requirements. It is widely accredited in literature about ICT, Digital Economics and the information society –especially after the discussion of the productivity paradox of the 1980s and the hype about the "New Economy" in the late 1990s— that it is not the number of computers and software programs that raises efficiency, but rather an overall change in the way the sector functions. Path-dependencies and interdependencies with the physical, social, cultural and industrial environment introduce inertia into the process of digitization and require the "cognitive embodiment" of the technology in the organizational mechanisms of the sector. This is not an overnight process and requires an analysis that goes beyond technological dimensions. As this study shows, a learning process is involved in the transition toward e-government on the local level, which provokes changes and progress in the structure, functionality and leadership of the municipality.

3. From e-business to e-government?

Before taking a closer look at electronic, administrative, and democratic processes in municipalities, it should be remembered that the functionality of the public sector can hardly be compared with that of the business sector. In the current discussion about "lean-government," "citizens-as-clients" and "from e-business to e-government" this issue is unfortunately often

forgotten. It is true that some of the "governmental mechanisms of the industrial age" can be improved tremendously through the effective use of ICT (Tapscott, 1996). However thoughts about "banishing bureaucracy" and to "transform bureaucratic systems and organizations into entrepreneurial ones" (Osborne and Plastrik, 1997) may lead the "dot-com bubble" to a "dot-gov bubble" (Osorio, 2002), which obviously confused means with ends.

Unlike business, government is not guided by the end of profit-maximization, nor will it ever be subject to competitiveness or run the risk of bankruptcy. The government is a "natural monopoly" and its actions cannot be arbitrary and are subjected exclusively to the law. There is no legitimacy for the public sector outside the public law. Every step and every action the government takes needs to be determined and justified by the common will of the people, which in a democracy is expressed through laws. Every arbitrary action of the government that is not based on explicit authorization through law would be despotism (Schachtschneider, 1994). Lawfulness is necessary to provide the citizen with the necessary certainty, security, and stability to assure the realization of the will of the people that make up a democracy.

The mechanism through which the lawfulness of public administration is implemented nowadays is referred to as 'bureaucracy.' The general theory of bureaucracy began with the work of Max Weber in the early twentieth century (Weber, 1947). Max Weber describes the functionality of bureaucracy as a "principle of fixed and official jurisdictional areas, which are ordered by laws or administrative regulations" (Weber, 1968). "It is hard to imagine today, but a hundred years ago bureaucracy meant something positive. It connoted a rational, efficient method of organization – something to take the place of the arbitrary exercise of power by authoritarian regimes. Bureaucracy brought the same logic to government work that the assembly line brought to the factory. With the hierarchical authority and functional a specialization, they made possible the efficient undertaking of large complex tasks" (Osborne and Gaebler, 1992).

Max Weber defended "that the purely bureaucratic type of administrative organization... is... capable of attaining the highest degree of efficiency, and is in this sense formally the most rational known means of carrying out imperative control over human beings. It is superior to any other form in precision, in stability, in the stringency of its discipline, and in its reliability. It thus makes possible a particularly high degree of calculability of results for the heads of organization and for those acting in relation to it. It is finally superior both in intensive efficiency and in the scope of its operations, and is formally capable of application to all kinds of administrative tasks" (Weber, 1947).

Even today, for activities in which functional tasks need to be repetitively and routinely completed, bureaucracy still proves to be essential and ubiquitous. Through task specialization and expertise, assignment and reward based on competence in fulfilling duties, and ease of monitoring task success, bureaucracies produce efficient results, while minimizing arbitrary action. This also includes efficiency in terms of resources, the timely completion of jobs and, especially, the largest possible objectivity and neutrality in treatment, which is a key element of the public service provision. To the extent that quality is built into task assignments, rewards, and monitoring systems, bureaucracies should also produce high quality products or services (Jenei and Witte, 2000).

Nevertheless, the failures and disadvantages of bureaucracy –especially regarding creative innovations in process reorganization— are frequently reiterated in classrooms and scholarly treatises (see for example Roethlisberger and Dickson, 1939; Goodsell, 1983; Osborne and Gaebler, 1992), and the model that sees the citizen as a humble petitioner of public services no longer fits reality. The citizen demands tailor-made attention and individualized timely service delivery (Saueressig, 1999). The result is that the public sector in many cases grew in an uncontrolled and often irrational manner, in order to (a) satisfy the demands of citizens whose

demand-patterns are heavily influenced by the high-quality performance of an innovative private sector, and (b) to justify its actions in accordance with the established bureaucratic legal framework that provides the public sector with legitimacy. This leads to a contradiction between the various determinants of "good performance of the public sector," such as determinability, reliability, calculability and transparency on one hand; and high-quality services, fast service delivery, individual attention, cost-effectiveness, and productivity on the other hand.

The main objective of many "state-modernization projects" and "administrative reforms" is to seek out ways to manage this complex constellation. ICT's and the efficient use of digital communication and interaction are tools for these goals. Digital conduct fits many of the requirements of bureaucracy. One requisite of bureaucracy is the "depersonalization" of public procedures, meaning that procedures are defined for roles and ends, not for the specific individuals who carry them out. Automated and digitized information processing systems fulfill this requirement. Also, the necessary supervision and monitoring, which is another one of the basic characteristics of bureaucratic mechanisms, can be improved through the digitization of the principal-agent relations inside the public sector. Another core process in public office management is to "file" and "protocol" the actions of the public sector. This is indispensable to be able to control and to justify public actions. Recording, protocolling and filing can be accomplished more efficiently and more accurately through digital information systems. Digitization can also contribute to improvements in service quality, transparency, democratic participation, cost saving, etc. Therefore, contrary to current talk about "banishing bureaucracy through digital tools", the digitization of public processes does not mean to abandon bureaucracy, but to build effective, transparent, and efficient bureaucratic processes. The goal of digitization in government should therefore not be to imitate private sector business models and short-living trends, but rather to reinvent public sector performance to meet the public demands of the 21st century (Fountain, 2001).

4. Focus, particularities and limitations of local e-governments

In a State structure based on the separation of powers between the legislative, executive and judicial branches, the concept of e-government normally refers only to the digitization of information and communication processes in the executive branch. As obvious as this may sound, literature often confuses the scope of e-government. The executive branch enforces law and is lead by the "head of government." Neglecting the strategic planning duties of the executive power and focusing exclusively on its operational tasks, this paper will consider "e-administration" (the digitization of administrative services) as the major focus of this study.

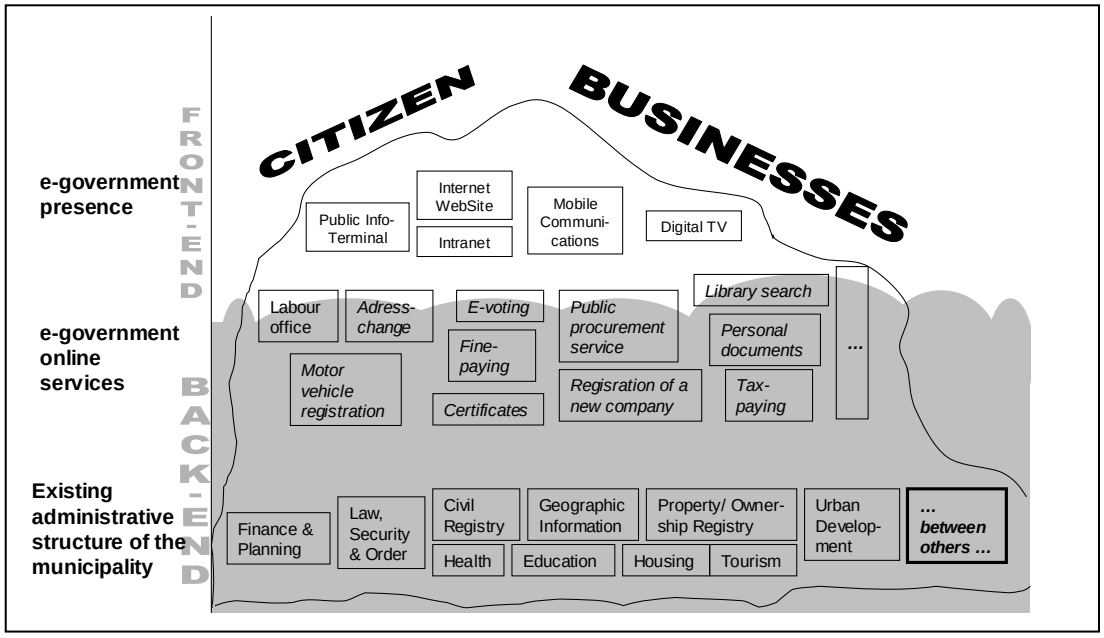
Thinking of e-administration, automobile-registration processes, income tax declarations or e-voting applications come to mind. However, in Latin America it becomes clear that –similar to what happened with B2C (Business-to-Customer) and B2B (Business-to-Business) e-commerce— the majority of digital transactions takes place within an organizational unit or between organizational units. The demands of lawyers, architects, construction engineers, accounting clerks and private banks constitute the vast majority of inquiries which a municipality has to handle every day, while an individual citizen only contacts the municipality once or twice a year. Besides, the financial and human switching-costs involved in the learning process of using e-administration applications are often too high for citizens. For a law firm that has to contact the municipality's civil register various times a day in order to obtain the personal data of its debtors, the usage of such a system might turn out profitable in the short term.

Besides, e-administration in Latin America is often aimed at basic necessities and does not necessarily require the direct interaction of the citizen with ICT. The introduction of information systems in clinics and hospitals and the digitization and interconnection of health reports and inventories can substantially improve the information about the current illnesses and most urgent health problems in a country. In 'La Havana Vieja' of Cuba, the main focus of the

current ICT effort is set on the digitization of the information related to housing. The historical houses of the city are very fragile and the municipality averages two house collapses every three days. House evacuations become commonplace and a digital system that is keeping track of the current state of the buildings, as well as of the citizens that live in those buildings, is becoming a life-saving necessity. The quick identification of disabled, sick, pregnant or old citizens is also decisive in the case of natural disasters, which are quite frequent in the Caribbean's costal cities. Generally speaking, e-administration goes beyond the commonly recognized applications of civil registration and tax payments, and extends to the provision of basic necessities in health and education services and brings live saving benefits to the poor. The individual is often not in direct contact with ICT (as in the case of the digitization of housing, databases in hospitals and clinics, the use of information systems for fire fighters or the police, etc). Through the effective use of e-administration of crucial information and communication crossroads, the standard of living of an entire community's population can be improved considerably.

To distinguish between the direct contact of the citizen with digital services offered by the municipality, and the part of information and communication optimization that takes place inside the municipality, a separation between *front-office* and *back-office* of a digital municipality can be made. Tax payment makes up part of the front office, while the database of the housing status is part of the municipality's back-office information system. The part of e-government that the user can see from the outside is referred to as the "*front-end user-interface.*" It is the Website of the municipality, or the portal, which appears in the monitor of an open computer-terminal. In most studies about e-government, the front-end part is in the center of attention (eEurope, 2002; WMRC, 2001). Estimates from European service providers however, claim that the front-end part of an e-government project on a local level represents only 10% of the total effort involved in an e-government project (Curiavant Internet GmbH, 2001). The vast majority of e-government initiatives are focused on the adjustment of the intra-municipal workflow, the establishment of intelligent document management systems, the introduction of new software and the integration of existing ICT systems. In short, the digitization of the "*back-office processes*" in a municipality is a main challenge. The visual part of e-government is only the "tip of the iceberg" (see figure 2), whereas the entire iceberg is subjected to digitization in a media-frictionless e-government process. The entire potential of digital communication can only be achieved if information flows take place through inter-operable digital networks, including front-end and back-office processes, without the need of falling back on some substitutive media, such as paper forms, traditional mail, or physical money.

FIGURE 2
THE DIGITAL MUNICIPALITY ICEBERG CONCEPT

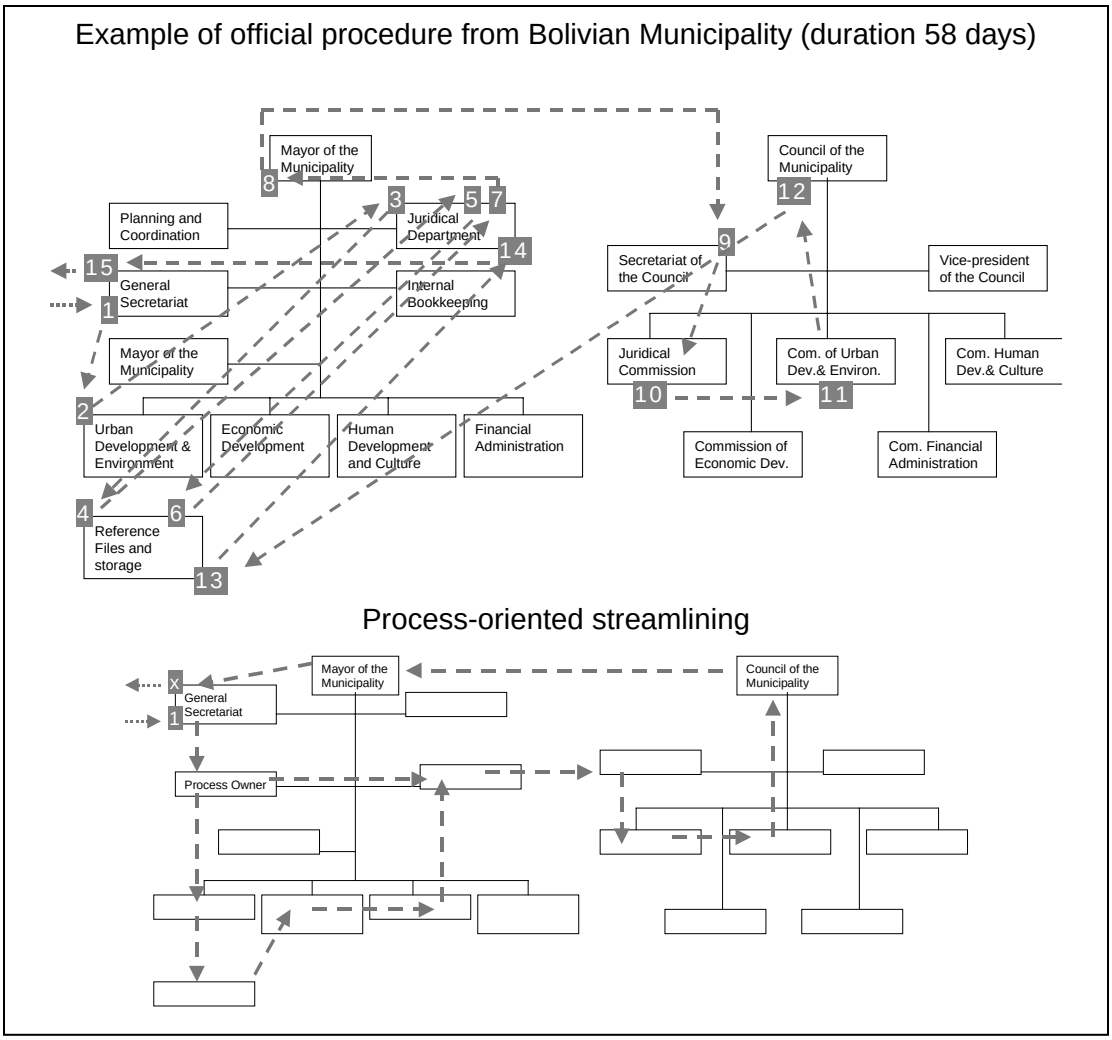


Source: Prepared by author, based on 100 world, Curiavant.

The problem in back-office processes is less technological and rather organizational in nature, but ICT may provide technological solutions to organizational problems. Business management sciences related to "business reengineering" (Hammer and Champy, 1995) and "business process redesign" (Davenport, 1993), deal with the organizational change from functional- to process-oriented concepts. Maintaining a basis on the analytical distinction between process-oriented organizations and responsibility-oriented organizations (Picot and Franck, 1995), the goal is to reduce organizational intersections and to focus mainly on the pattern of the involved value-chain. Business-processes are "streamlined" in a sense that every step follows the logic of the value chain, and unnecessary deviations are rationalized.

The functionality and organizational structures of a municipality are often historically determined. They might be irrational and unproductive in many cases. In most cases, administrations are structured hierarchically along different functional areas and do not follow the logic of the demand-oriented process-orientation. The following graph shows a typical organizational structure of a municipality. The case illustrated is that of a Bolivian municipality consistent with the mayor's executive structure and the council's legislative structure. The illustrated procedure takes 58 days and follows some kind of functional organization, which is based rather on historical power and responsibility distributions than on an efficient process orientation. Instead of digitizing those irrational processes, it is advisable to take advantage of the opportunity to rethink process structures; digitizing them before would not make sense. The organizational structure and power distribution could be redesigned according to the second graph. The introduction of process-owner, the softening of vertical hierarchy and the strengthening of horizontal workflow mechanisms can in many cases simplify the process.

FIGURE 3
FUNCTIONAL VS. PROCESS ORIENTATED ORGANIZATION



Source: Prepared by author, based on www.elalto.gov.bo

However, the optimization process needs to consider legislative and bureaucratic requirements of the public sector, such as required administrative checks and balances. The required lawfulness and the legitimacy requirement of public administration do not allow the restructuring of a municipality like an enterprise. Even though modern business administration and management theories would suggest moving toward "streamlining" public administration (from a responsibility oriented functional organization to process-oriented organization) the public sector often does not permit this type of revolutionary reorganization. For example, in the public sector it is not possible to "cut off" services or processes, simply because they are inefficient and do not fit requirements of "lean-management." Legitimacy and lawfulness are relevant, guiding principles of public administration, not efficiency and profitability, like in private management.

Digital information and communication systems can be an effective alternative to this dilemma. In the back-office of a municipality, information systems could coordinate incoming and outgoing processes in accordance to required legal framework, fulfilling the particularities of the administrative culture and regulations, while at the same time moving toward an automated

workflow. Software systems that automate the workflow of an official procedure may be an adequate solution for the reorganization of the public sector from functional to process orientation.

However, this would require individual software architecture for almost every single municipality according to its specific processes. The software system needs to rebuild the historical and political circumstances of the functionality and organizational structure of the individual municipality. The high prices of individualized software programs prohibit this alternative utopia, especially for developing countries. In order to accelerate the diffusion of information and communication systems between municipalities, solutions need to be found that allow the exploitation of economies of scope and software production, combining scale with the particularities of public sector administration in different countries and regions. Systematic research done in Germany regarding this problematic situation offers potential solutions.[4] Component-modules of different applications for local governments are based on a detailed analysis of the different processes in a municipality and its modulation on a certain level of abstraction (see Box 1). The component-module framework allows for sufficient flexibility to digitize the particular information and communication process required by the legislative framework of the local government, while benefiting from economies of scale through the re-usage of different module combinations in various municipalities. Therefore, it bears a vast potential for cost-reduction. By falling back on existing and proven application components, the responsible authority can develop new services in a quick, secure, and easy manner according to local priorities. As this study will show later on, this is a very important aspect.

BOX 1
FRAMEWORK SOFTWARE COMPONENT-MODULES FOR FLEXIBILITY AND ECONOMIES OF SCALE IN DIGITAL SOLUTIONS FOR MUNICIPALITIES

The level of abstraction chosen to describe the process has a decisive effect on the transferability of systems (Rosenlehrer and Ott, 2001). The lower the level of abstraction, the more precise is the description of the processes in a particular municipality. If this description is then used to program software systems, the margin of flexibility of the resulting system diminishes. Thus, the adoption of the system and the transfer between municipalities requires administrative intensive efforts and limits the self-determination of the municipality. The same system can be used in many different municipalities and for many different tasks, which then lowers costs, through economies of scale. In these cases, the software program would require intensive adoption to the individual process. The optimal level needs to be found to describe municipal processes in order to ensure that the information system adequately reflects the organization and functionality of the particular government, but also that enables the transfer of e-government solutions from one to another.

The creation of a "product and service catalogue" that lists the different tasks carried out by the municipality is a good starting-point for the modulation of municipal processes. Such a catalogue serves as a basis to systematize and characterize various municipal process-types. After a closer investigation about the various products and services that are offered by a municipality, the involved processes can be classified by distinguishing marks and features (Saueressig, 1999). Through the classification and alignment of such

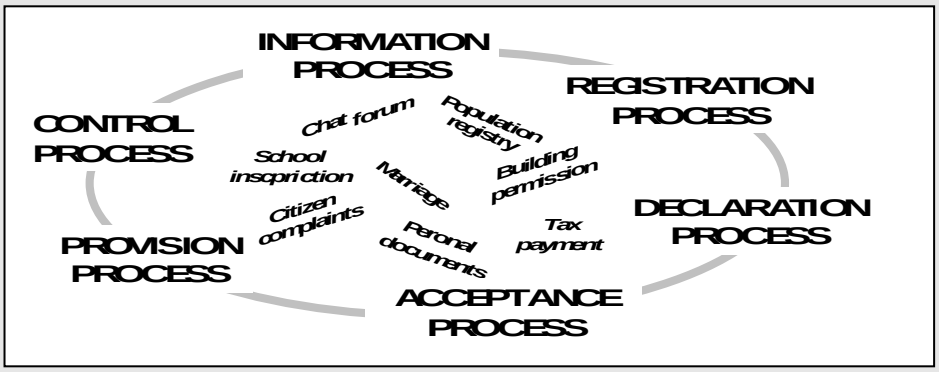
[4] In the German Media@Komm project (www.mediakomm.net) the cities of Nürnberg, Fürth, Erlangen, Schwabach and Bayreuth have confronted this problem. The federation of the five cities won a public grant of several million Euros to develop and implement e-government applications in their municipalities. However, even though the five cities are geographically close to each other, the different organizational structures and administrative cultures limited the transferability of the e-government solutions between them (100world, 2001). A solution needed to be found to enable the efficient use of resources in the project federation and to assure the recognition of the different organizational structures and functionalities of the municipalities. The presented research bases primarily on the experience from this case.

characteristics, typical and recurrent patterns become recognizable, providing the basis for the abstract modulation of process-types in a municipality (Rosenlehner and Ott, 2001; Rosenlehner, Ott and Schmitzer, 2002).

In order to typify service processes of municipal administration, Saueressig (1999) uses the so-called "morphological method," which follows a systematic scheme of abstraction and classification (see Ropohl, 1972a; 1972b). The procedure of the morphological method is divided into three parts. First of all, the various products and services that present the "main-outcomes" of the municipal daily work are listed (e.g. through the creation of a "product-catalogue" of municipal services). Secondly, the most obvious and frequent characteristics of these processes are gathered, and are classified by their alternative variables (e.g. the characteristic of a service could be the cost of a service; the related variables could be 'free of cost', 'single charge', 'yearly fee', etc. Another characteristic could be the number of departments involved in the process; the related variables would be 'one', 'two', 'three', etc.). Then, the multitude of services and products that are carried out by a municipality are clustered according to similarity and frequency of the variables. A certain combination of characteristics determines a certain process-type (e.g. one process-type could embrace all services that fulfill the variables "free of cost," "involve three different departments of the municipality," "obligatory for the citizen" and "have to be documented and stored"). The process is no longer linked to a specific service, but can be characterized by the activities involved to perform a service. In a subsequent step, this enables the definition of generic processes that are characteristic for municipal administration.

Through this kind of modulation Saueressig (1999) determines six different sub-processes, which make up the pillars of administrative processes in a municipality:

FIGURE 4
PROCESS-TYPES IN LOCAL GOVERNMENT



Source: Saueressig, 1999.

Of course, the different process-types vary in their potential for digitization. Some of them are predestined for online services, while others are much more difficult to digitize (Saueressig, 1999). Related studies show that the process-types that are most frequently subjected to digitization in a municipality are the "information process" (required for almost all online services and products), the "provision process" and the "acceptance process."

This kind of modulation demonstrates that there are certain process-types that transversally penetrate the different G2C and G2B services that are subject to digitization in e-government. The most efficient procedure would therefore be the implementation of software for those process-types. In order to ensure better transferability of component parts and to facilitate technical implementation, it is advisable to subdivide the presented process-types into programmable software functionality (Rosenlehner, Ott and Schmitzer, 2002)[5].

This can be completed with the help of a so-called framework or component-model software solution (Schmitzer and Ott, 2002). The middleware of the system (the "framework") possesses several points of intersection that are compatible with the individual code-modules. The component-modules are autonomous software, which present small and logically subdivided software functionality (for example a "payment module" as part of the "provision-process; a "password and username component module" as part of the "registration-process"; or "digital signature module" as part of the "declaration-process"). The more general the determination of the functionality, the higher is the possibility to re-use them in different services and

[5] Rosenlehner and Ott introduced minor changes into the classification of Saueressig. The Registration-process has been modified to a "certification-process" and the Control-process has been replaced by a "permission process" (Rosenlehner and Ott, 2001).

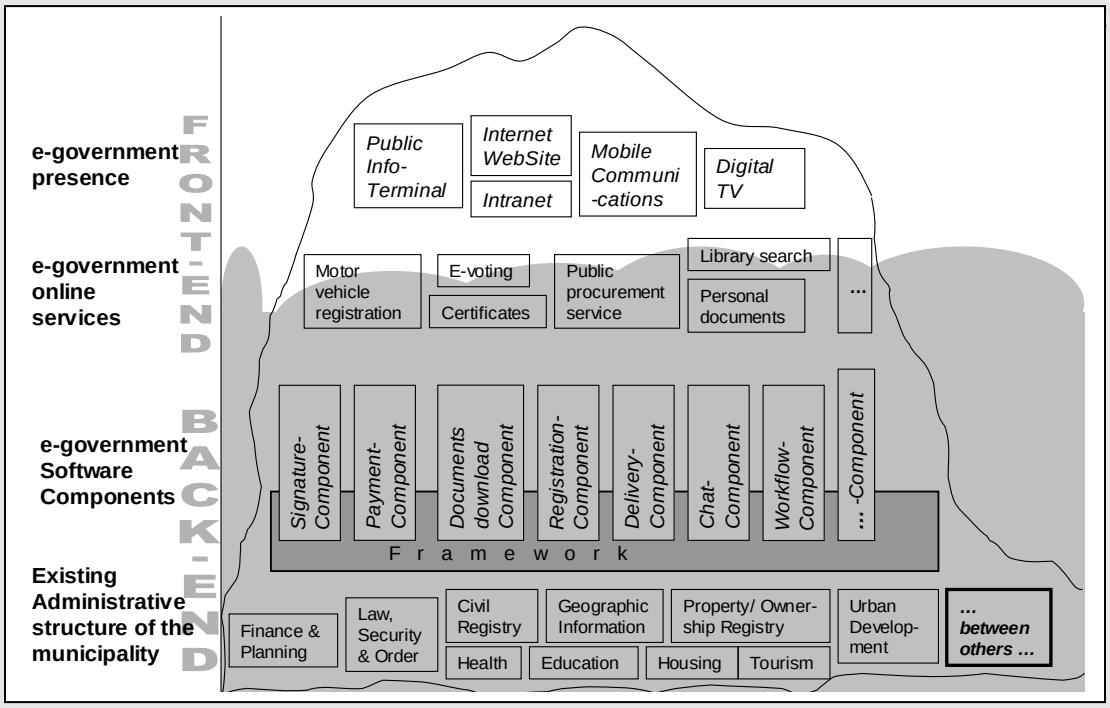
Box 1 *(concluded)*

products of the municipality. For example, the "payment-module" could be used for library services, tax-payment services, as well as for license-plate services. The high level of abstraction also permits the use of the same code-module in different municipalities. Therefore, a payment component-module, which fits the legal requirements of the national legislation, can be used across the country.

Such component-modules are embedded into frameworks. The programming of the framework determines the functionality of the different component-modules. The re-use of the framework depends on the similarity between the organizational structures and functionality between municipalities. In this respect, the programming of the framework can be done very generally, or can be closely linked to specific structures. Studies with business administration frameworks show that the contribution of frameworks to the final application varies between 10-90%, demonstrating the vast difference amongst frameworks, which tightly predetermine process functionality and frameworks, and are very flexible with regard to their implementation (Schmitzer and Ott, 2002).

Summing up, combining the front-end and the described back-office solutions in one graph, the following architecture presents the Generic Service Layer for digital municipalities:

FIGURE 5
THE DIGITAL MUNICIPALITY ICEBERG CONCEPT BASED ON FRAMEWORK SOFTWARE SOLUTIONS



Source: prepared by author, Based On 100world, 2001, 2002

Not only can the cost of software development be shared if the same solution (or solution parts) is used in various municipalities, but also the cost of implementing the system. Experience from Germany shows that for a single municipality, the time of implementation of framework software is not shorter than with individualized software. However, the time of implementation for the second municipality is reduced by half, if the same framework solution is used (Schmitzer and Ott, 2002). Furthermore, through the open points of intersection, frameworks enable the gradual extension and development of the e-government system. Therefore it reduces the necessity to make huge front-end financial investment in order to guarantee systematic and organized e-government architecture. The software system can be built gradually, implementing one component-module after another into the framework. For example, if a municipality decides not to provide digital signature services yet, this does not prohibit the provision of registration services, payment services, or chat forums. Frameworks also enable the constant development of the system. Modifications in the digital signature legislation, for example, would not require the installation of an entirely new system, but only the modification of the "digital signature component-module" within the existing framework.

II. The implementation of e-government in Chilean and Peruvian Municipalities

1. Municipalities in Latin America: a short introduction

One of the most decisive particularities in an international analysis of municipalities is the difference in national and regional legislation. Different structure of the State, variations in patterns of juridical comprehension and interpretation, different levels of autonomy, and self-determination of municipalities can limit the comparability of local e-government solutions.

In Chile, for example, local government is mainly in charge of social issues, such as education (elementary schools and high schools, which make up for more than 80 % of the educational system in Chile) and health (basic clinics, which satisfy 60 % of the demand in the Chilean health system). However, civil registry, for example (and therefore also birth and marriage certificates, etc.), is under the control of the national government and is usually executed by a specialized authority in the community.[6] In Peru, on the other hand, health and educational sectors belong mainly to the national government, while civil registry pertains to the municipality.[7] In Bolivia, a mix of both can be found with regard to public sector responsibilities. The construction and maintenance of health and educational infrastructure is a task of the municipality (meaning the building of schools and hospitals), while the national government is responsible for the sector itself (professionals, curricula, etc.).

Besides structural differences, there are also large variations with regard to public sector procedures. Evidence from a recent NBER study (NBER, 2000) illustrates that the procedure to create a new enterprise in Latin America takes between 7 and 20 steps, according to national, provincial or local legislation. This often requires the entrepreneur to visit different public entities in a different sequence, depending on domestic regulations. To complete the procedure can take

[6] However, since this authority is often physically based in the city hall (especially outside the metropolitan area) and given the close cooperation between the municipality's staff and the civil registry authority, it is by many considered to be "part of the municipality".

[7] In both countries, basic infrastructure and services (water, streets, garbage, etc) are tasks of the municipality.

between 14 and 171 working days (in Panama and Peru respectively, 78 working days in Chile).[8] Thus, an international comparison of municipalities should take different definitions of public procedures, administrative legislation and varying spheres of responsibility into consideration.

In non-federal countries the nation-wide uniformity of municipal legislation surely has a positive effect on comparability and also on the transferability of solutions from on to another. In a federal country (Argentina, Brazil, and Mexico), the autonomy of states led to different organizational structures. For example, experience from Argentina shows that the national effort that was started in 1994 to homogenize budget definitions across the 23 provinces in the country achieved little until now. Differences are deeply rooted and are not only caused by varying legislation. Even in cases where a common legislation explicitly assigns the duties and rights of a municipality, the mechanisms through which the tasks are carried out, the determination of responsibilities and the definitions of competencies vary widely. Such differences should have a decelerating effect on the transferability (and therefore the adoption) of information and communication systems.

In many non-federal countries of the region, recent efforts of decentralization of the public sector are creating new organizational structures. In Bolivia, for example, the decentralization reform created 237 new municipalities in 1994 (from 77 municipalities to 314). The largest municipalities (such as La Paz or El Alto) are right now creating new sub-municipalities, in order to advance in the decentralization effort. Introducing ICT systems into such new organizational structures right from the start can be a major contribution to the effort to decentralize government activities, in order to bring it closer to the people. The nine new sub-municipalities of El Alto (700.000 inhabitants),[9] are currently connected to a fiber-optic network, which will then help to capacitate and to coordinate the new organizational sub-units. In such cases, the immediate use and reliance on ICT systems can help to create adequate and innovative e-government structures right from the start. In this case, e-government becomes a central part of institution building.

Another important factor to consider is that a municipality might offer a large variety of services to their citizens or companies. However, often the users only demand a small number of services. A large number of services are very rarely needed. In the municipality of Belo Horizonte in Minas Gerais, Brazil, for example, 19 % of the services that are offered by the municipality make up for 90 % of the demand (77 services from 410 services). This needs to be considered when answering the crucial question about which services to digitize first.

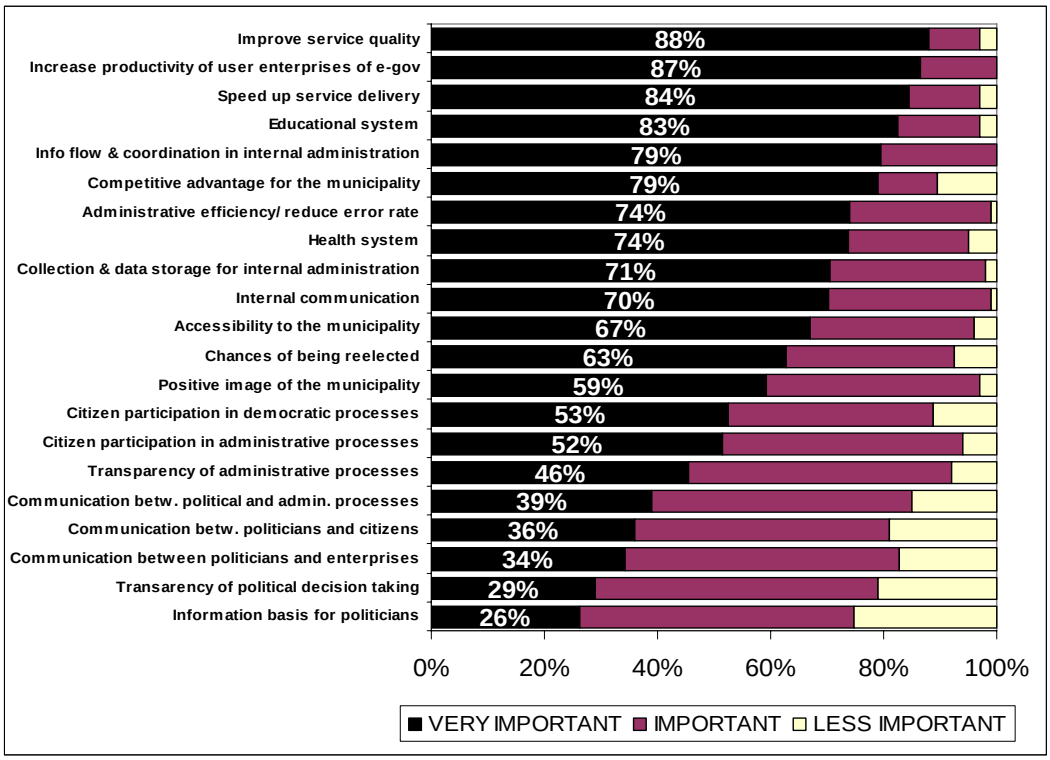
[8] Ecuador: 141 days; Venezuela: 124 days; Mexico: 112 days; Uruguay: 105 days; Bolivia: 82 days; Chile: 78 days; Argentina: 71 days; Brazil: 67 days; Colombia: 55 days. This procedure can cost between 0.055 times and 2.6 times of the GDP per capita (Uruguay and Bolivia respectively). Such costs contain spending on fees, documents, photocopies, stamps, and legal charges.

[9] El Alto is a new and fast growing community, above La Paz. El Alto ("the high one") is one of the highest situated communities in the world (4000m). However it is characterized by poverty and heavy immigration from the rural areas. The main municipality employs 900 civil servants, whereas the new sub-municipalities employ about 20 civil servants each. The process of capacitating the coordinating this new "network of municipality units" presents the current challenge.

2. Objectives of local e-government initiatives in Chile and Peru

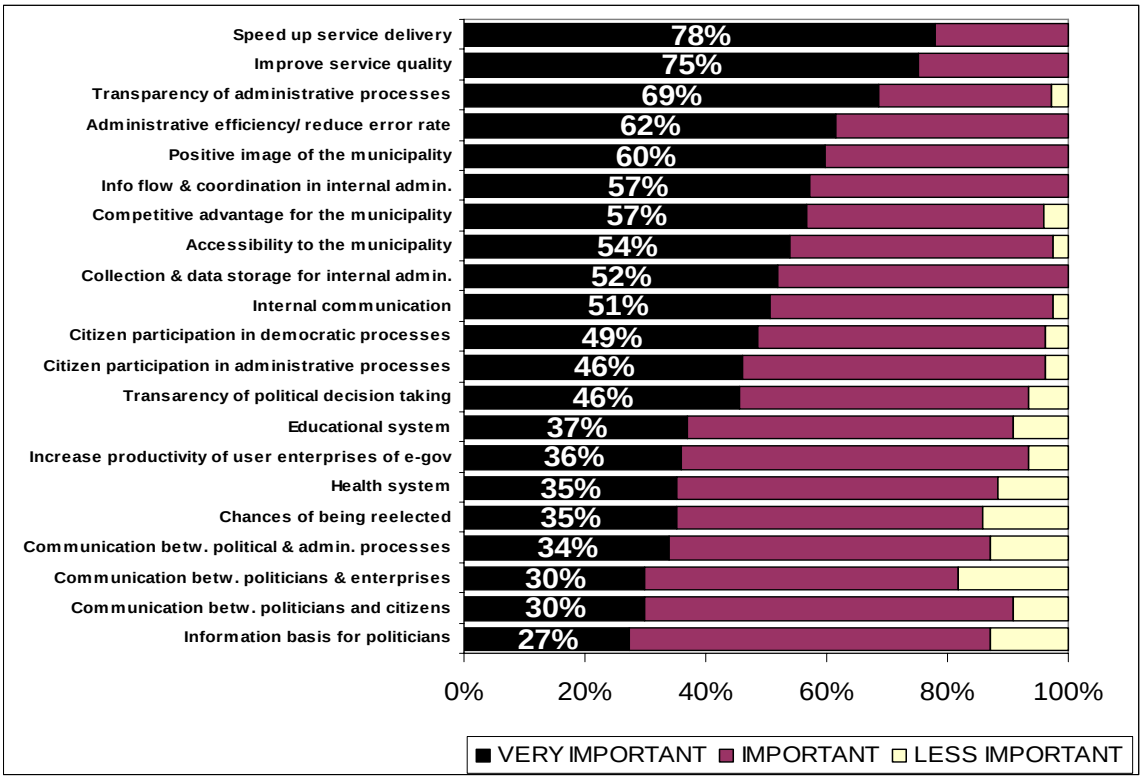
The first question to be addressed is the question of the purpose of the whole exercise of introducing e-government services. As can be seen from Figures 6 and 7 below, Peruvian and Chilean municipalities have very different priorities in terms of their digitization efforts. Even though the '*improvement and the acceleration of service delivery*' is a top priority in both countries and the use of ICT in order to '*improve the information for political decision taking*' is the least important one in both, the differences in the rest of the list are quite remarkable.

FIGURE 6
E-GOVERNMENT OBJECTIVES OF CHILEAN MUNICIPALITIES



Source: Prepared by author.

FIGURE 7
E-GOVERNMENT OBJECTIVES OF PERUVIAN MUNICIPALITIES

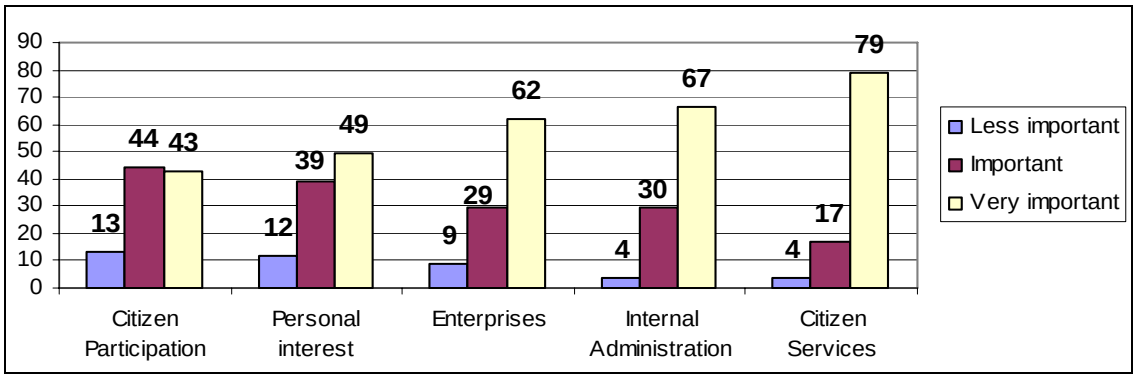


Source: Prepared by author.

First of all, this might stem from the different tasks and authorities that municipalities have in Chile and Peru. For example, health and education systems are a major priority of municipalities in Chilean State structure, while in Peru those demands are mainly taken care of by the national government. Not surprisingly, e-health and e-learning are far more important to Chilean municipalities than for Peruvian ones. Other differences are not as obvious. Chilean municipalities, for example, put a lot more emphasis on using ICT in order to make their municipality more attractive to private companies and the industry. In Peru, on the other hand, municipalities want to make e-government work for better citizen participation and for the introduction of transparency in administrative and political processes. Such objectives were not considered as relevant in Chile.

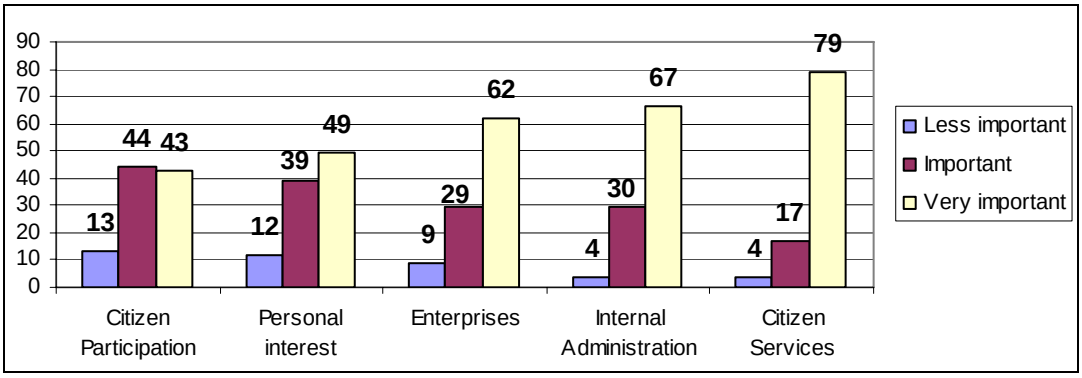
In reality, the objectives that drive an e-government project are not as specific as simply listing the results from the questionnaire might suggest. The different answers can be grouped into five target dimensions. These are: (1) the improvement of citizen services (incl. the accessibility of the municipality and service improvement, but also social services, such as health and educational services), (2) the improvement of the internal administration (incl. better coordination, less errors, cost saving, etc), (3) the better attendance and relationships with private enterprises (incl. better communication between politicians and enterprises, services which support the productivity of enterprises through time savings, etc), (4) citizen participation (transparency and direct participation) and lastly (5) a factor which could be called "self-interest." For this last factor the motivation of ICT introduction is to improve, for example, the chances of re-election for the mayor and its team, to improve the image of the community and to improve the information flow for better political decision taking in the local administration.

FIGURE 8
TARGET DIMENSIONS OF CHILEAN E-GOVERNMENT OBJECTIVES (IN % OF TOTAL TARGET DIMENSION)



Source: Prepared by author.

FIGURE 9
TARGET DIMENSIONS OF PERUVIAN E-GOVERNMENT OBJECTIVES (IN % OF TOTAL TARGET DIMENSION)



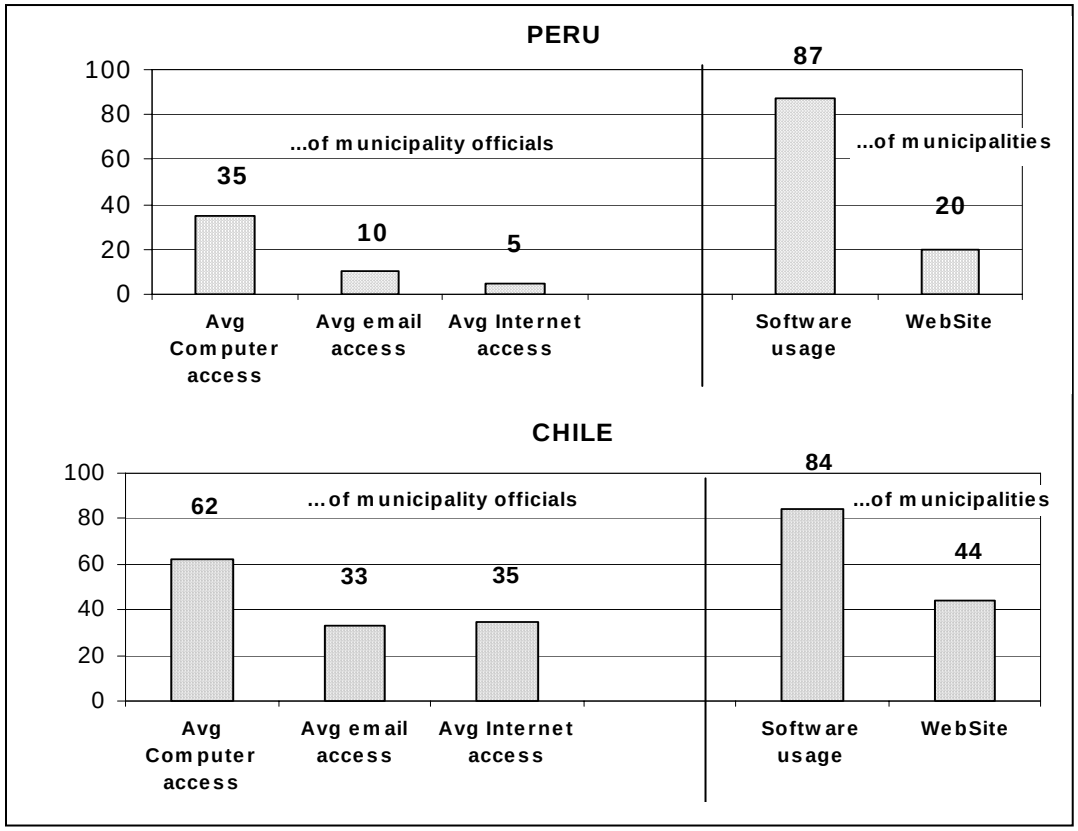
Source: Prepared by author.

Assigning the specific objectives to different target dimensions, the above-mentioned patterns become visible as shown in Figures 8 and 9. The improvement of 'Citizen Services' and 'Internal Communication' are the main motivations behind e-government initiatives in Chile as well as in Peru. Relations with private enterprises are more important in Chile than in Peru. In Chile, 62% of the municipalities consider private enterprises to be a "very important" target dimension. In Peru, the private sector and enterprises are only an "important" objective (48% of the Peruvian municipalities see it important, 43% very important). On the other hand, citizen participation and transparency introduction is not a major focus in Chile. In fact, it is the least important objective (only 43% of the municipalities consider 'Citizen Participation' as a very important target of their effort). Even the 'Personal Interests' of the present municipal administration are a more important objective in Chile. Contrarily, in Peru, 'Citizen Participation' is even more important than to attract and benefit private 'Enterprises' through the e-government project.

3. Infrastructure advancement

The construction of an e-government platform parts with the establishment of an efficient ICT infrastructure that is based on various technologies. In this study, five of them have been selected as shown in Figure 10. Three of them are related to ICT usage by municipality officials, namely access to computers among them, municipality staff with email and officials with access to the Internet. Two indicators are related to ICT usage at the municipal level, specifically the question as to whether the municipality is using some kind of administrative software and the existence of a municipal Website. The following graph shows the general ICT infrastructure penetration rates in Peruvian and Chilean municipalities taken from the sample of the survey.[10]

FIGURE 10
ICT ACCESS IN PERUVIAN AND CHILEAN MUNICIPALITIES



In general it can be stated that Chilean municipalities are more advanced than Peruvian ones. In the case of 'access to computer' and 'Website existence,' Chilean municipalities roughly double Peruvian figures. This result is not very surprising, considering that Chilean income-per-capita doubles Peruvian per head income, as well as other development indicators. Regarding email penetration and Internet usage, Chile is even further ahead.

However, as explained in the introduction, the goal of this exercise is not to benchmark one country against the other, but rather to better understand the particularities of local e-

[10] It should be kept in mind that the questionnaire has been filled out electronically by most participants, indicating that most of the municipalities that participated already have at least the availability of one computer.

government development, with respect to economic and institutional differences. In order to assess the advancement of ICT infrastructure and other influencing variables of e-government development, an index was created for both cases. This so-called "advancement index" shows how far ahead a municipality is in its use of ICT. From it, a rough approximation for the municipality's advancement toward an e-government platform can be obtained. The index is based on five variables.[11]

(1) Is the percentage of municipality staff members that have a *computer* above the countrywide average?

(2) Is the percentage of staff members that can be contacted through email for work purposes above the countrywide average?

(3) Is the percentage of municipality staff members that have access to the Internet above the countrywide average?

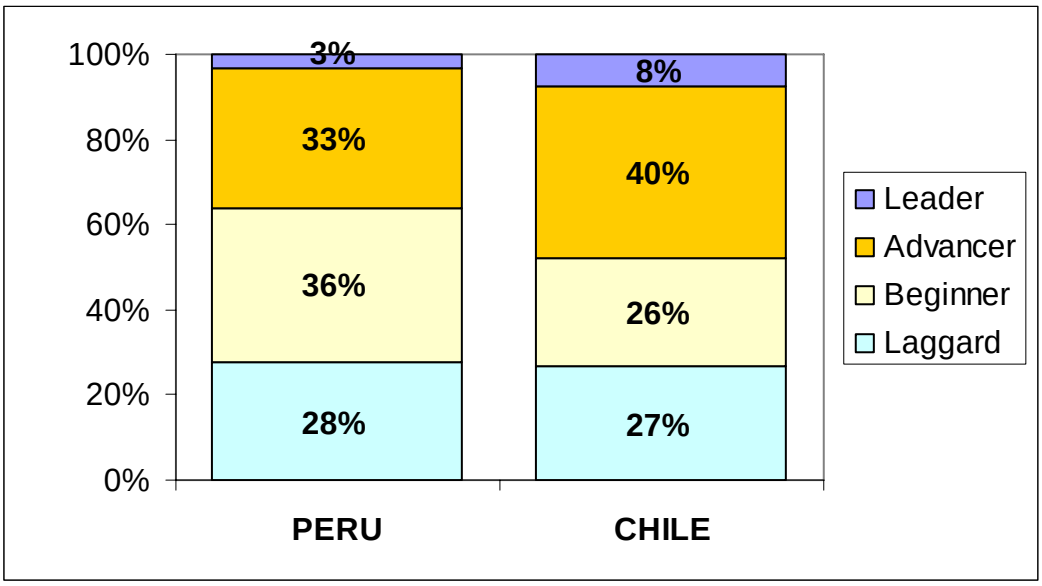
(4) Is a software program used in order to facilitate internal administrative work?

(5) Does the municipality have a Website*?*

A municipality that can answer all five questions with "yes" is classified as a countrywide "LEADER." A municipality that can answer four or three questions with "yes" (in which at least one has to be question (4) or (5)) is classified as "ADVANCED". A municipality that is answering only the three first questions with "yes" or only two questions with "yes", is classified as a "BEGINNER". A municipality that can only answer one question or no question at all with "yes" is classified as "LAGGARD." Figure 11 summarizes the level of advancement in Peru and Chile.

[11] The chosen "advancement index" is kept very simple by weighing all five variables equally and neglecting the dispersion from the countrywide average in questions (1), (2) and (3). On the one hand, this simple composition makes the index accessible for the heterogeneous composition of municipalities and, on the other hand, it is reliable enough to show trends in local e-government development. However, this does not imply that future econometric studies should not rely on more sophisticated "local e-government indicators."

FIGURE 11
THE ICT INFRASTRUCTURE ADVANCEMENT INDEX



Source: Prepared by author.

Both countries have almost the same amount of "lagging" municipalities. In Peru however, many municipalities are still in the "beginners" phase, while in Chile, most municipalities are already at the "advanced" stage, basically due to a high frequency of municipal Websites.

Following this classification, various significance tests and correlation analyses are carried out in order to determine which factors have a positive or negative correlation with the "advancement index." For example, to what extent the advancement index is correlated with the "*existence of a modernization project*" in the municipality. If so, how strong is the correlation? In order to be able to answer this question two kinds of tests are undertaken: (1) significance test; and (2) correlation. Regarding the significance test two kinds of hypotheses are formulated:

Hypothesis 0 (null hypothesis): the correlation occurred by coincidence

Hypothesis 1 (alternative hypothesis): the correlation did not occur by coincidence

Depending on the nature of the variables in use (interval, ordinal or nominal numbers;[12] dependent or independent variables) a number of tests can be utilized to determine the "significance level" of the correlation.[13] The significance level is the "probability to be mistaken" (short "p") if the null hypothesis is rejected and the alternative hypothesis is accepted. Probabilities are usually presented as values between 0 and 1 (representing the percentage of the probability to be mistaken, with 1 being 100% probability and 0 being 0%).

[12] Nominal Variables cannot be placed into an order (for example "yes" and "no"). Ordinal Variables can be placed into a sequence, but the difference between to code-numbers in not constant. For example, sequential orders like "less important", "important" and "very important". Scale Variables can be sequenced and the difference between two code-numbers has an empirical significance. For example USD1, USD2, USD3 and USD4.

[13] Pearson's Chi-Square and Cramers-V for cases where at least one variable is nominal; Spearman's rank correlation coefficient for ordinal variables (and for bi-variate Nominal variables allow for a meaningful ranking of the two variables, and Person's R for correlations between two scale variables.

Given the (relatively small) size of our samples, a significance level of 10% is used. If the probability to be mistaken is smaller than 10% ($p < 0.1$) the correlation is "significant". If it is smaller than 5% ($p < 0.05$) it is "very significant." Taking the significance test between the '*Chilean advancement index*' and the '*existence of a modernization project in Chilean municipalities,*' the result is $p < 0.021$. This means that with 97.9% probability the existence of a modernization project in a municipality and the advancement of a municipality toward e-government is not a coincidence in Chile. Since $0.025 < 0.05$ there is a "very significant" correlation between the existence of a modernization project on the local level and the advancement of a municipality toward e-government in Chile. In Peruvian municipalities the probability is $p = 0.083$, meaning that there is a relation, but since the probability of being mistaken is higher than 5% (in this case 8.3%), however smaller than 10%, the relation between the existence of a modernization project and the advancement index in Peru is "significant."

In case the correlation is significant, it is also possible to measure how strong the correlation between both variables is. This correlation coefficient is symbolized by "r" and lays between –1 and +1, whereby a value close to +/- 1 stands for a strong, and a value close to 0, for a weak correlation. If the correlation coefficient is negative, the relationship between the two variables is inverse: the larger the value of one variable, the smaller the value of the other one. For the purpose of this study, the following descriptions are used:

VALUE "r"	**Interpretation**
0 until +/- 0.2	Weak Correlation
+/- 0.2 until +/- 0.5	Medium Correlation
+/- 0.5 until +/- 0.75	Strong Correlation
+/- 0.75 until +/- 1	Very strong Correlation

Source: Prepared by author.

In the case of the correlation between the '*Chilean advancement index*' and the '*existence of a modernization project in Chilean municipalities,*' Spearman's rank correlation coefficient is $r = 0.237$, claiming a positive correlation between the existence and the advancement, that is medium-strong. In Peru the result is similar ($r = 0.224$). This leads to the conclusion that in both cases, the existence of a modernization project is a characteristic of a municipality that is far advanced in its transition to local e-government, while those municipalities that are less advanced tend not to have a modernization project.

A variety of such tests are undertaken throughout the study in order to identify the characteristics of those municipalities that are further advanced. While the results of the above example are not very surprising (it can be expected that a modernization project and e-government development go hand in hand), this kind of analysis may show some important and surprising results.

Another variable that can be correlated with the advancement index is the level of connectivity of the community's citizens. It might be expected that there would be a significant correlation between Internet penetration among citizens and the advancement of the municipality toward e-government. The data from Peru shows that the correlation is very significant ($p = 0.001$) and Spearman's rank correlation coefficient claims for a strongly positive correlation ($r = 0.577$). The result is the same for Internet penetration in Peruvian enterprises. Those communities where local enterprises show high Internet penetration rates also show significant advancement

toward a digital municipality, whereas in communities where enterprises have little access to Internet, also the municipality is lagging behind in its digitization efforts (correlation between 'Peruvian advancement index' and 'Internet penetration between enterprises in the community', Spearman's rank correlation coefficient $p = 0.007$; $r = 0.467$).

In many cases, no significant relation can be found. In Chile, for example, no significant relation can be found between the level of Internet access by citizens and the advancement index. From these results, one could assert that those municipalities where citizens have more Internet do not necessarily tend to have more advanced digital municipalities. There are a considerable number of communities in Chile where less connected citizens have more advanced digital municipalities (significance level $p = 0.467$, means not significant). The same accounts with regard to the connectivity of the community's enterprises in Chile ($p = 0.245$).

Associating the advancement index with the degree of urbanization of the community, results show a direct relationship in Peru, while municipalities that describe themselves as "*more rural*" are less advanced. Municipalities that describe themselves as "*more urbanized*" show a significant and positive correlation with the Peruvian advancement index ($p = 0.011$; Spearman's rank correlation coefficient $r = 0.332$), while Peruvian municipalities that describe themselves as "*more rural*" show a significant and negative correlation with the advancement index ($p = 0.024$; $r = - 0.316$). In Chile, both tests show that the "degree of urbanization" is not significantly related to the advancement of a municipality. This means that in Chile, rural and urban municipalities alike can be found in the "Leader" category of the advancement index, as well as in the "Laggard" category. In other words, a high degree of urbanization is a significant characteristic of advanced digital municipalities in Peru, while in Chile no such trend is visible.

Interestingly, direct relationships can also be found in relation to the kind of economic activity that prevails in the community. In Peru, communities with a high degree of 'commercial activities and service industry', show a significantly positive correlation with the advancement index ($p = 0.011$; $r = 0.324$), while those communities in which the economy mostly lives from 'agriculture, forest, fishing and mining' show a significant negative correlation with the advancement index ($p = 0.006$; $r = - 0.351$). In Chile, once again, the available statistics lead to no significant trend.

Another interesting area of testing is the correlation between the advancement of a municipality toward local e-government and the size of the municipality ('*number of employees*'), as well as the correlation between the advancement index and the size of the community ('*number of inhabitants'*). In Peruvian municipalities more advanced municipalities also tend to have more municipal employees ($p = 0.52$; Spearman $r = 0.254$), while the size of the community is not a significant characteristic for advanced municipalities ($p = 0.220$). In Chile, the opposite is true,[14] and municipalities with a small or large municipal staff can be found in all different stages of e-government advancement. On the other hand, highly populated communities tend to have more advanced digital municipalities in Chile, while in Peru the number of inhabitants is not a significant characteristic.

It is essential to remember that the advancement index is exclusively based on the existence of an ICT infrastructure. It does not measure adequately the usage of the technology. However, it is not the plain existence, but rather the efficient usage of the infrastructure that moves municipal organization and service delivery into the digital age as shown ahead.

[14] A significant and positive correlation can be found between the number of inhabitants and the advancement of Chilean municipalities toward local e-government ($p = 0.49$; Spearman $r = 0.205$), while the size of the municipality itself (number of employees) is not a significant characteristic of the advancement index ($p = 0.170$).

4. Generic Services

The Generic Service Layer consists of two basic components: the software in the "back office" and the Website in the "front office" of the e-government platform. One of the basic purposes behind the creation of an integrated government portal is the so-called "one-stop shop." The concept of a "one-stop government" refers to the integration of public services from a user's point of view (Wimmer and Krenner, 2001). For the provider, this implies the need to interconnect public authorities and to create platforms that bring together frequently interrelated matters of concern. If a request is made with one authority, the data is processed to and handled by all affected institutions. Also, municipalities and the various offices that constitute a municipality need to be integrated. The need for interconnection shows that the true challenge of the one-stop-government portal does not lie in *the 'front-end user interface'*, but rather in '*back-office*' processes, meaning the organization within the municipality. Using a metaphor, the process of modernization must not stop with the painting of the doors and outside walls of the city hall, but efforts need to be put forth to the renovation of rooms and workspaces inside the office building, accommodating the organizational structure and the functionality of the house according to new possibilities. Unfortunately, local e-government development often refers to a new look in the municipalities showcase window.

4.1. Front-end user-interface

There are some general concepts which characterize the outer appearance of the e-government presence. One concept, which has gained increasing popularity, is the "life-event metaphor." It organizes the Website along different necessities of the citizens (life-events) and necessities of companies (business situations) that trigger public services (e.g. birth, school, marriage, pension, house building, moving, death; or for the business sector respectively: start-up company, real estate, environment protection, M&A, insolvency, etc). The life-event organization facilitates the user to find required and interrelated procedures. Citizens and businesses will not be obliged to be aware of the fragmentation of the public sector, while in the back-office of the public sector similar services from a different aspect of the citizen's life, link up within the same department. (eGOV Consortium, 2001). It is a product-oriented form of organization, in contrast to the nowadays-common institution-oriented form of organization.

BOX 2
CITIZEN RELATIONSHIP MANAGEMENT FOR SUCCESSFUL E-GOVERNMENT

Alluding to the commonly known Customer-Relationship-Management (CRM) in the business sector, CRM applications in the e-government sector are often referred to as "Citizen-Relationship-Management." CRM systems are used to provide users with individualized services and support quickly and easily. The best-in-class CRM solutions encompasses all customer-facing front-end and enterprise-level back-office systems and processes – from the contact center that handles customer's orders to the inventory system, to tracking service/ product availability to the warehouse, to the fulfillment and delivery of orders. This concept from the private sector is being adopted increasingly by the public sector, in order to provide the citizen with a better and more complete service. On the municipal level in Brazil, CRM mechanisms are incipient, but are building up fast, as passwords and username systems start to individualize service delivery. The "Serviço de Atendimento ao Cidadão (SAC)" (Citizen attendance service, also known as 'Shopping Mall for Public Services') from municipalities in Brazil (see for example Belo Horizonte, Minas Gerais)[15] work through identification systems with a special citizen code, or simply through entering the complete name and residential number. Solicited services can then be monitored and accompanied step by step while they are completed, always being kept up to date as to where the service is and how long the completion of a petition will last.

Another particularity that has strategic importance for the appearance of the front-end user-interface is the decision about the implementation of a pull- or push concept. Demand-oriented pull-concepts are based on the idea of self-service potential (Saueressig, 1999). The objective is to offer high-quality services by involving the service recipient to a greater extent in the administrative process (e.g. calling off or triggering services and participation in the service production process (*'pull principle'*). In the case of supply-dominated push-concepts, the supplier takes over functions which have to be fulfilled usually by the buyer in single transaction steps as well as spanning multiple transactions over the whole customer life cycle. For example, the automatic completion of required fields (e.g. the automatic completion of the Zip code in the required field, etc.) reduces the risk of syntax errors and form errors through plausibility tests. It also provides additional value to the user, as "pushed services" give better support of interactive petitions or requests than paper-based forms. Online forms can be enriched with support texts, for example, and fill-in alternatives through emerging menus and other multimedia support per "mouse-click." Even laws and other administrative regulations can "pop-up" to complement and explain the required procedures. The *'push principle'* is also deployed for reminder services such as to inform the citizen about the deadline for tax declaration through mobile SMS services, etc.

Summing up, it can be claimed that the 'pull-principle' is very easy for the supply side of the service, while the 'push-principle' requires a more complex online application for the service supplier. However, the 'push-principle' is surely more beneficial for the citizen as it can reduce error rates and help to e-capacitate the user. Every single online service requires a specific analysis about which of both concepts (push- or pull) is the more adequate, considering all of the given circumstances (such as the nature of the service, the financial situation of the municipality, the current regulatory framework and the e-capacity of the users).

As already stated above, more than twice as many municipalities in Chile have a Website, compared with Peru (44% vs. 20%). Chilean municipalities are also updating their Websites more frequently. While in Peru half of the municipalities update their Website less than once a month, in Chile half of the municipality's Websites are updated more often than once a week. 21 percent of the Chilean municipality's Websites are even updated daily. Nevertheless, as the plain existence of a Website does not automatically imply the existence of a functioning digital municipality, Websites of the municipalities from Peruvian and Chilean sample were classified by a methodology borrowed from the European Commission (eEurope, 2001). The level of online sophistication of the services is measured with the help of a four-stage framework:

- Stage 1 = Information: online information about the public service

[15] http://sacnet.pbh.gov.br/index.htm

- Stage 2 = Unidirectional interaction: one party acts online, e.g. downloading and printing of forms and documents.[16]
- Stage 3 = Bi-directional interaction: two parties act online, e.g. the user fills in and hands over forms, including authentification
- Stage 4 = Complete transactions: the municipality completes and responds to the online procedures, including payment, and accepting digital signature

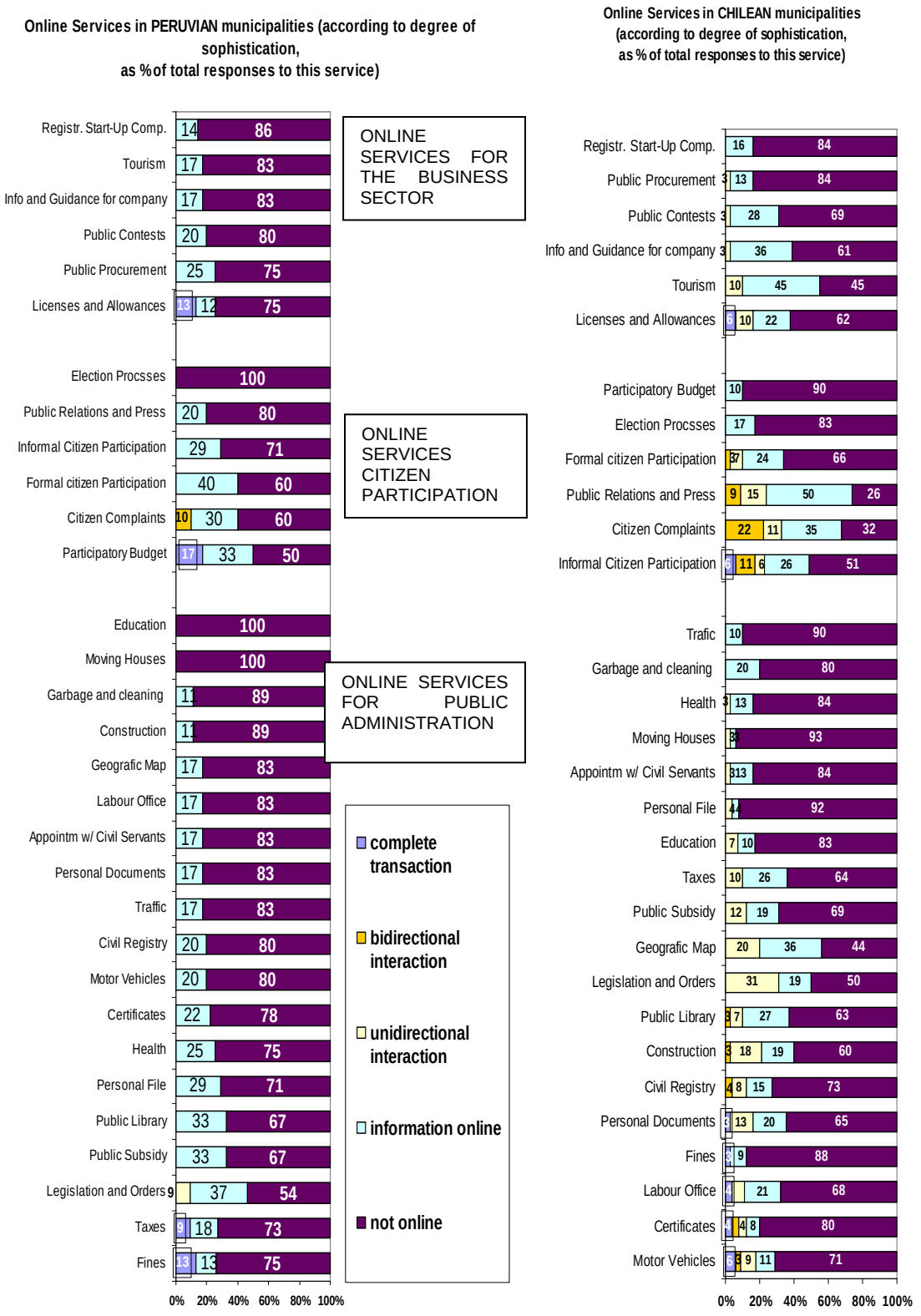
In general, the vast majority of online services in Peruvian and Chilean municipalities are still in Stage 1 (see Figure 12).[17] The most sophisticated applications in Peru are [1] 'Participatory Budget' processes, as 17% of the municipalities already offer participation possibilities at Stage 4 (see also Box "Participatory budgets for local participation), [2] the payment of 'Fines' (13% of the municipalities that have a Website offer transaction mechanisms for the payment of fines online); [3] 'Licenses and Allowances' (13% reach Stage4); [4] 'Tax Payment' (9% of the municipalities with Website already provide online tax payment transaction mechanisms); and [5] 'Citizen Complaints.' In Chile, the most sophisticated online applications include [1] 'Informal Citizen Participation,' [2] 'Motor Vehicles' and [3] 'Licenses and Allowances' (in all three cases, 6% of the municipalities with Websites already offer complete transactions for this application), [4] the online provision of 'Certificates,' and [5] 'Labor Office.'

[16] The difference between Stage 1 and Stage 2 is also for institutional and legislative reasons. The information that is offered to the user can be presented in different data formats. In case that information is presented (Stage 1) only in browser, pure HTML is suitable. However, the concrete appearance on the screen can only be defined inaccurately and depends strongly on the browser. In cases where a ready-to-print edition of information is required –like it is the case with official forms for example— proprietary solutions like PDF Acrobat are often used (Stage 2) (Spahni, 2001). Since the installation of the required software is free of charge in the case of Acrobat, the user does not have any additional costs with this alternative. A third alternative (Stage 3) would be to make the official form interactive online (fill-in form).

[17] However, compared with a similar study that was carried out in Germany in 2000 (Grabow, 2000; Media@Komm, 2001), it has to be recognized that neither Chilean nor Peruvian municipality Websites are far behind their counterparts from the developed world. For example, such a sophisticated application as the "Payment of Fines", has only been realized completely online (Stage 4) in 1% of the German municipalities in the year 2000, while in Peru two years later, already 13% of the municipalities offer complete online transactions and in Chile 3%. While Germany's "Motor Vehicle" applications only 1% reached Stage 4 and another 10% reached the Stages 3, 2, and 1, in Chile two years later already 6% offer complete transactions online (Stage 4), 3% offer bi-directional (Stage 3) and 9% unidirectional services (Stage 2) and 11% post at least information about Motor vehicle services online (Stage 1). Notwithstanding, in some applications (such as with Education, Public Libraries and Moving Houses) Latin American municipalities are still lagging far behind their European counterparts.

FIGURE 12

ONLINE SERVICES IN MUNICIPALITIES ACCORDING TO DEGREE OF SOPHISTICATION AS % OF TOTAL RESPONSE TO THIS SERVICE



In general, the most sophisticated online application for private enterprises is 'Licenses and Allowances,' the most advanced application for citizen participation is 'Citizen Complaints,' and for citizens services the payment of 'Fines' receives the most attention. Ranking the 33 applications of each country according to their "degree of sophistication" and making a significance test between the rankings of the two countries, shows that both countries pursue more or less the same priorities in their choice of which application to digitize. There is a very significant and strong correlation between the sophistication rankings of online applications in Chile and Peru (Spearman $p = 0.002$, $r = 0.517$). This means that municipalities in both countries, as different as the focus of their daily tasks might be, tend to implement the same kind of applications. This begs the question: Is the force behind digitization the need for a particular online service (demand driven), or is it because of the availability of the technological solution to digitize this specific service (supply driven)?

BOX 3
PARTICIPATORY BUDGETS FOR LOCAL PARTICIPATION

Participatory Budget (or "Orçamento Participativo" in Portuguese) is a model of citizens' participation which has been implemented in Brazil since the late 1980's for the allocation of resources and definition of annual investments of the municipality. The model has been constituted in a reference to a program of democratic management (CEPAL/ GTZ, 2000). For example, in the municipality of Santa Maria in Rio Grande do Sul/ Brazil (243.000 inhabitants with about US$ 2000 GDP/capita), 11.000 citizens participated in the allocation of the US$ 1.2 million budget in 2002. The citizens decided to allocate 21% of the budget to eleven separate services in the educational sector, 19% to nine different health-related projects, 17% for pavement of streets, 9% of the budget for environmental services and the rest into several projects for habitations, economic development, social assistance, culture, sports and agriculture. The increasing use of Information and Communication Technologies to implement the established processes of participatory budget, aims at extending and facilitating the collective decision taking process.

Source: CEPAL/GTZ; http://www.santamaria.rs.gov.br

The most sophisticated online applications are not necessarily the most utilized ones (the ones that receive the most "clicks"). When asked about the most utilized online services, Peruvian municipalities named [1] 'Taxes', [2] 'Tourism', [3] 'Public Relations and Press', [4] 'Participatory Budget', and [5] 'Licenses and Allowances.' In Chile, the most used local e-government Web services are [1] 'Citizen Complaints,' [2] 'Public Relations and Press,' [3] 'Licenses and Allowances,' [4] 'Tourism' and [5] 'Formal and Informal Citizen Participation.' Ranking the 33 applications according to their "degree of utilization" and making a significance test between the "utilization ranking of Chilean applications" and a "utilization ranking of Peruvian applications" shows that there is no significant relation between the most popular applications in Chile and those in Peru ($p = 0.292$). In other words, even though in both countries municipalities put more or less the same applications online, e-government users, be it citizens or private companies, have different demands for e-government services.

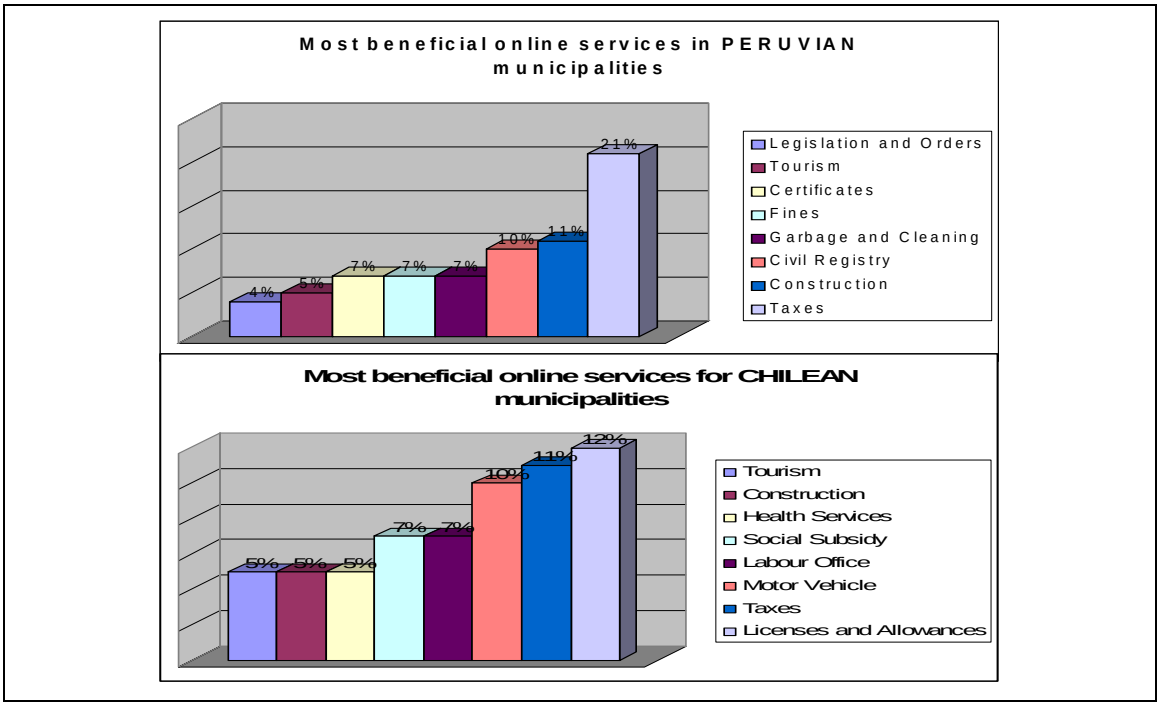
A common misconception in ICT applications is that implementation is supply driven and not demand driven. This is partly due to the lack of knowledge about the full scale of available solutions, partly due to the marketing power of transnational vendors. Often municipalities buy and implement what is offered on the market and what is promoted as an international best-practice, not what would be the most urgent and demanded. Since the available online solutions are often offered by transnational companies, which offer the same kind of "packages" in Peru as in Chile, municipalities end up with the same kind of online applications, even though the "clients" of the respective municipalities in both countries show very different demand patterns.

As a next step, a correlation between the listing of the 33 applications according to their degree of sophistication and according to their utilization was carried out. It is interesting to note that in Peru the relation between the most sophisticated applications and the most utilized applications is stronger than in Chile. The significance test between the two rankings in Peru

turns out to be very significant and strongly correlated (Spearman: p = 0.001; r = 0,561) and in the Chilean case it shows a medium correlation (p = 0.053, r = 0.339). It is indeed remarkable that in Chile some low functional "citizens participation applications" (such as 'Citizens Complaints', 'Public Relations' and 'Formal and Informal Citizen Participation') are more popular than many already relatively sophisticated "citizen service applications" (such as 'Fines' and 'Certificates'). This may stem from the fact that online payment of fines or online certification requires trust and confidence of the user, while participatory applications may be rather used as "nice additional toys" to gain citizens' interest and support of the e-government project.

Municipalities were also asked about the applications that would "potentially bring the greatest benefits to the municipality, ignoring present implementation obstacles." Some similarities become visible between both countries, such as in both cases municipalities agree that 'Tax' applications, applications for 'Construction,' as well as 'Tourism' applications would be beneficial in Chile as well as in Peru (Figure 13). However, the structural differences between Chile and Peru become also obvious, as 'Licenses and Allowances' and 'Motor Vehicles' (both major income generators for Chilean municipalities) are thought of as very beneficial in Chile, but not in Peru. Consistent with the State structure in both countries, Figure 13 also shows that 'Health services' are of greater interest for Chilean municipalities, while 'Civil Registration' would be an application with high potential in Peru.[18]

FIGURE 13
LOCAL E-GOVERNMENT ONLINE APPLICATIONS WITH THE HIGHEST POTENTIAL FOR BENEFIT IN PERU AND CHILE (IN % OF TOTAL NOMINATION OF THE APPLICATION)



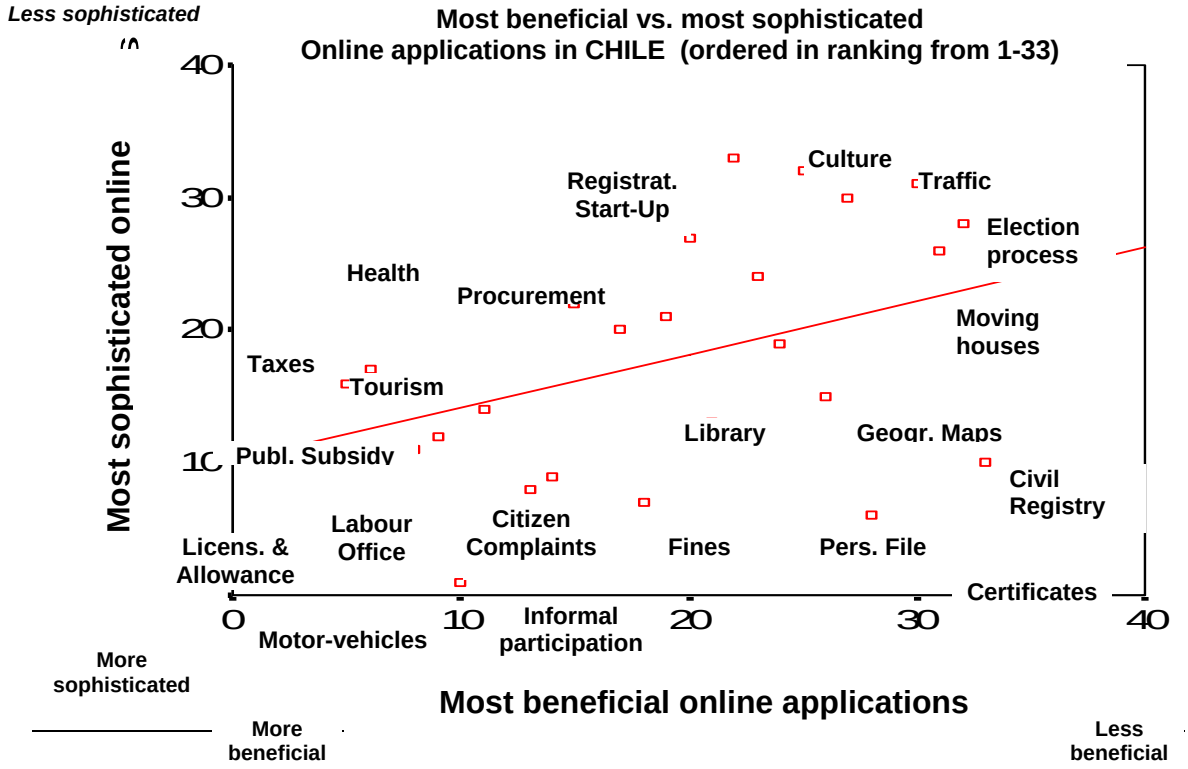
Source: Prepared by author

The next question is whether the most sophisticated online services would potentially also bring the greatest benefits to the municipality. A significance-test shows that in Chile, as

[18] Remember that health services are not of direct interest in Peru, given the leading role of the national government in this field, the same as civil registry is not as important for Chilean municipalities, given that such offices (although often placed inside the city-hall) are coordinated by the national government.

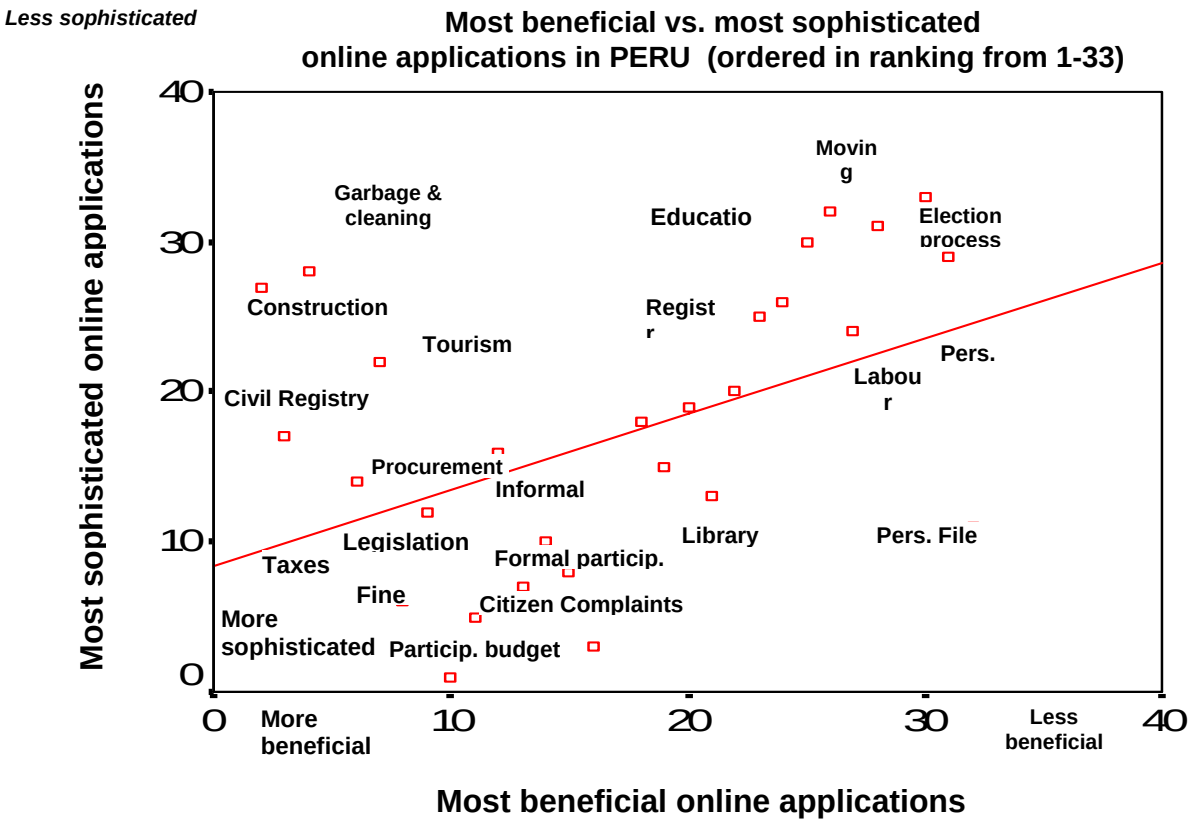
well as in Peru, there is a positive relation between the most sophisticated and the most beneficial online applications, while the adjustment between those two variables has been accomplished more successfully in Peru than in Chile[19]. However, in neither case was a very strong correlation found, meaning that there must be a number of cases where less beneficial applications receive a lot of attention from the e-government initiative, while some very beneficial digital applications are still "off-line." Taking a closer look at the Figure 14 shows that there is a significant number of cases in which applications with a high potential to make beneficial contributions to the municipality are very poorly developed (such as 'Health', 'Procurement', 'Taxes', 'Tourism,' or 'Public Subsidies' in Chile and 'Garbage and Cleaning,' 'Construction,' 'Tourism' and 'Civil Registry' in Peru). On the other hand, a significant number of applications are already very sophisticated, even though the benefit of their digitization for the municipality is very limited (such as 'Civil Registry,' 'Personal Files' and 'Certificates' in Chile and the bulk of citizen participation application in Peru: 'Participative Budget,' 'Citizen Complaints,' 'Formal' and 'Informal Citizen Participation').

FIGURE 14



Source: Prepared by author

[19] There is a medium correlation in Chile (Spearman's test for Chile: p = 0.020, r = 0.402) and a high correlation in Peru (Spearman's test for Peru p = 0.003, p = 0.503).



Source: Prepared by author

To understand this mismatch, particular environment and circumstances regarding Chilean and Peruvian digital municipalities must be considered. In the questionnaire, Chilean municipalities state that the digitization of 'Civil Registration' and related services, such as insight into 'Personal Files' and 'Certificates,' are not very beneficial for the municipality itself. This makes sense, considering that the municipality is not directly in charge of these services as they are assigned to a national civil registration authority. The national civil registry authority in Chile is already very advanced in digitizing its services.[20] Birth- and marriage certificates, for example, can be obtained through the national civil registry Website since 2001. The citizen can pay the required fee online, and print the demanded certificate on a home PC. Given this advancement of the national civil registry authority, it is not a very exhaustive effort for the Chilean municipalities to offer those services in their community. However, such applications do not improve the efficiency of the Chilean municipality itself, they are rather additional services that the municipality might offer with the help of the applications from the national authority. The core-tasks of the Chilean municipalities, such as health services, are not very digitized, while their digitization would be beneficial for the functionality of the municipality. In Peru, a similar explanation can be found. 'Civil Registration' is one of the core activities of the municipality, but it is one of the least digitized applications. Municipalities recognize that bringing civil registration online would be very beneficial for them; however, every single one of them will still have to run through the learning process through which the Chilean national authority already did. Peruvian municipalities will also need to run through a similar learning process in order to digitize applications related to 'Construction' (which requires complex databases about geographic information and electronic certificates in the back-office) and interactive applications related to 'Cleaning and Garbage' (which would require coordination

[20] See: http://www.registrocivil.cl/registro .

with the cleaning staff of the community). On the other hand, applications that are less beneficial for Peruvian municipalities but are rather easy to digitize are further advanced in the digitization process. This accounts for, amongst other things, a bulk of citizen participation applications such as 'Participatory budget', 'Citizen Complaints', 'Formal' and 'Informal Participation.'

Two basic conclusions can be drawn from this statistical analysis that open up two different development trajectories toward e-government implementation in the front-end of a digital municipality: First of all, it needs to be recognized that in the majority of the cases municipalities tend to prioritize those applications that are most beneficial to them. In some cases, however, municipalities seem to be unable to advance in these applications. A lack of decentralized know-how and other restraints (such as discussed in the following Sections on "Financing", "Human Capital" and "Regulatory Frameworks"), seem to impede rapid advances in those areas. Therefore, municipalities opt for the digitization of services that are not necessarily the most beneficial for them, but are relatively easy to implement. They decide to start their "e-government learning process" with the provision of applications that are borrowed from other institutions (such as in the case of civil registration in Chile) or with applications that are easy to implement, but do not really contribute to the efficiency of the municipal functionality since they are rather non-essential services (such as in the case of citizen participations applications in Peru). This then often leads to a situation where the real benefits of online applications do not become effective in a municipality. Such projects fall then into the "*nice-to-have*" category and are quick to gain the mark of "*not really making a difference*" in the functionality and organization of the municipality. This bears the risk that e-government projects quickly lose the required political and financial support to continue in the complex reorganization process required by the transition toward e-government.

Notwithstanding, in many cases it is quite useful to implement some uncomplicated and cheap online services first, in order to demonstrate the technology and then to move on to those applications that bring the real benefits to the municipality. Overly ambitious ICT projects often do not fulfill expectations and quickly lose political and financial backing. From this point of view, it is wise not to start with the most beneficial and complex application, since the painful learning process of trial-and-error could lead to failure and frustration, which will then slow down overall e-government development.

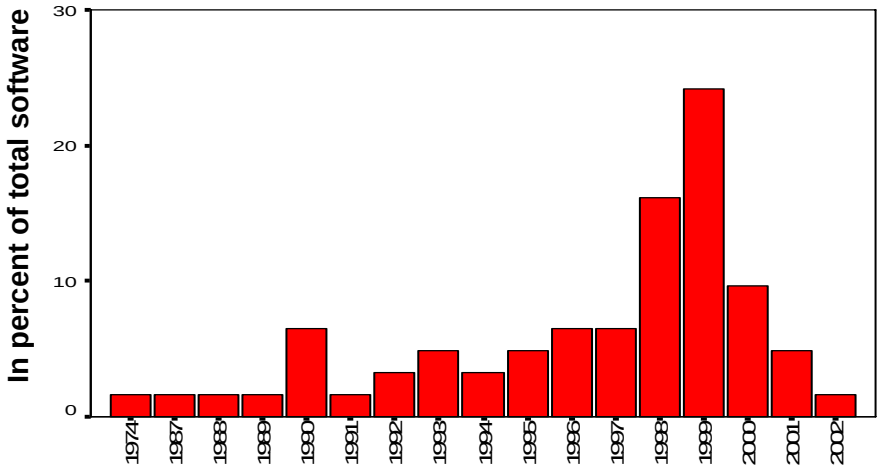
This trade-off between the quick and easy implementation of less beneficial online services and the often-complicated implementation of more beneficial services requires close consideration. Municipalities seem to look for niches in which some specific applications can meet urgent needs in order to demonstrate the potential of the technological solution and to gain political and financial support for the extension of the ICT project. In the Chilean case, the applications '*Licenses and Allowances*', '*Motor Vehicles*' and '*Labor Office*' seem to be used in such a way. In the Peruvian cases of '*Taxes*' and '*Fines,*' the same idea is present. Of course, in the particular case the selection of these "pilot applications" needs to be done with close attention paid to the particularities and needs of the municipality. In other words, the general wisdom: "think big, start small, and scale fast" also applies to the successful implementation of a local e-government project.

Thus, a careful consideration of three factors is required before starting a local e-government project: (1) the different tasks carried out by the municipality; (2) the potential benefit to the municipality when digitizing them; and (3) the requirements for bringing them online. The creation of a "product and service catalogue" that is listing and weighing all three factors has therefore proven to be a good starting-point for the local e-government project.

4.2. Back-office digitization

The "ICT- and New Economy boom" of the years 1998 and 1999 and the consecutive "high-tech crash" in the year 2000 clearly left its marks in Peru and Chile. 40.3 % of the software, which is currently being used in Peru, was purchased in the years of the ICT-boom, as shown in Figure 15. After the "New Economy hype" was over in the Spring of 2000, software acquisitions of municipalities in Peru slowed down considerably.

FIGURE 15
START YEAR OF ADMINISTRATIVE SOFTWARE IN PERU



Source: Prepared by author.

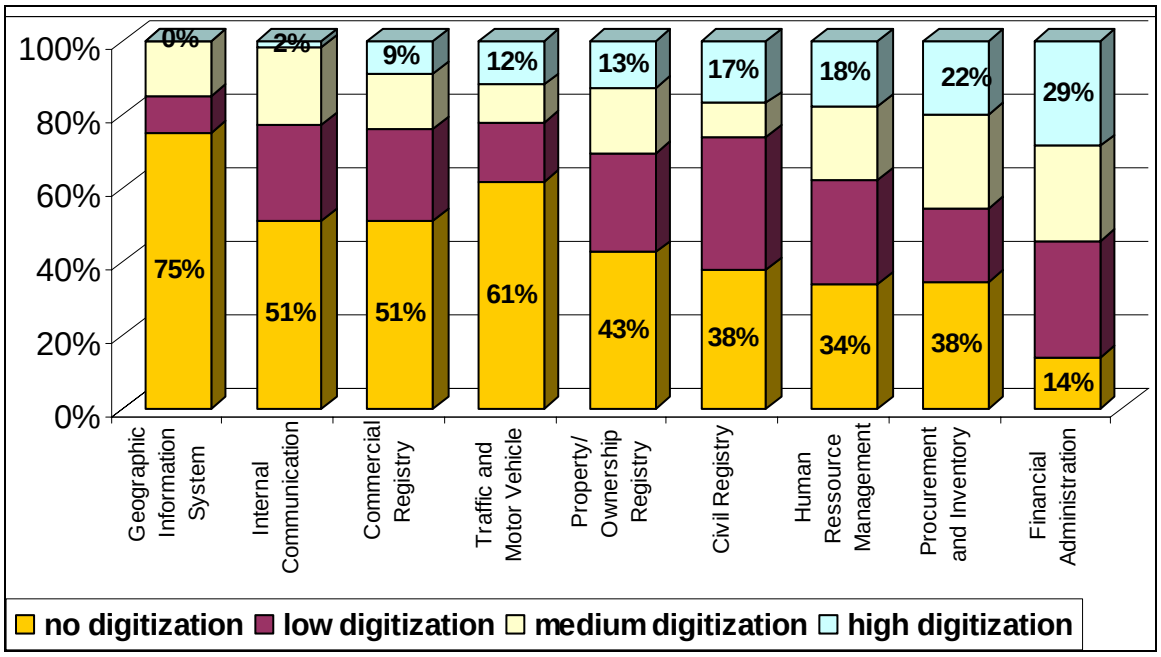
Regarding the specific purposes for software usage, municipalities with some kind of software application were asked which percentage of the information and communication flow in the specific area of application is taking place through digital networks (see Figure 6). Answers were classified as 0 % (no digitization), 1-33% of the information and communication process involved (low digitization), 34 – 66% (medium digitization or more than 67%, including complete realization through digital channels (high digitization).

The digitization of the financial administration in the back-office of a municipality is a priority area in Peru (Figure 13). 29 % of municipalities that work with some kind of administrative software claim to have 67%-100% of information flows and communication processes related to '*financial administration*' digitized. Another popular area for software implementation is in keeping track of the municipality's '*procurement and inventory*'. 22 percent of the software in experienced Peruvian municipalities have more than two-thirds of their acquisitions and inventory management processes digitized. The digital administration of incomes and salaries in Peruvian municipalities is also very advanced. Additionally, several other municipalities explicitly stated their goal to work with an electronic system to manage studies and projects.

On the other hand, the digitization of '*internal communication*' is still very low in Peruvian municipalities. Even for those municipalities that have computers interconnected (i.e. those that use some kind of LAN) and are used to working with some kind of administrative software, 36% do not have any kind of digital inner-municipal communication networking. That means that the infrastructure is ready to work with internal email or groupware material, but in practice, the organizational information and communication process is done by walking around the building or by talking on the telephone.

Some other crucial application, such as the '*civil registry*' or '*geographic information systems (GIS),*' which constitute the heart of many different public services, especially when interconnected, still has some room for improvement. However, it is recognizable that 62% of the Peruvian municipalities with software experience already started to digitize back-office processes involved in their '*civil registry*' system. However, as seen in the previous section, only 20% of the Peruvian municipalities started to put some kind of civil registry information online (see graph above "Online Services in Peruvian municipalities"). This is an example of a complex application that first requires back-office digitization, in order to be connected to the front office later on. Without the first step, the second cannot be realized.

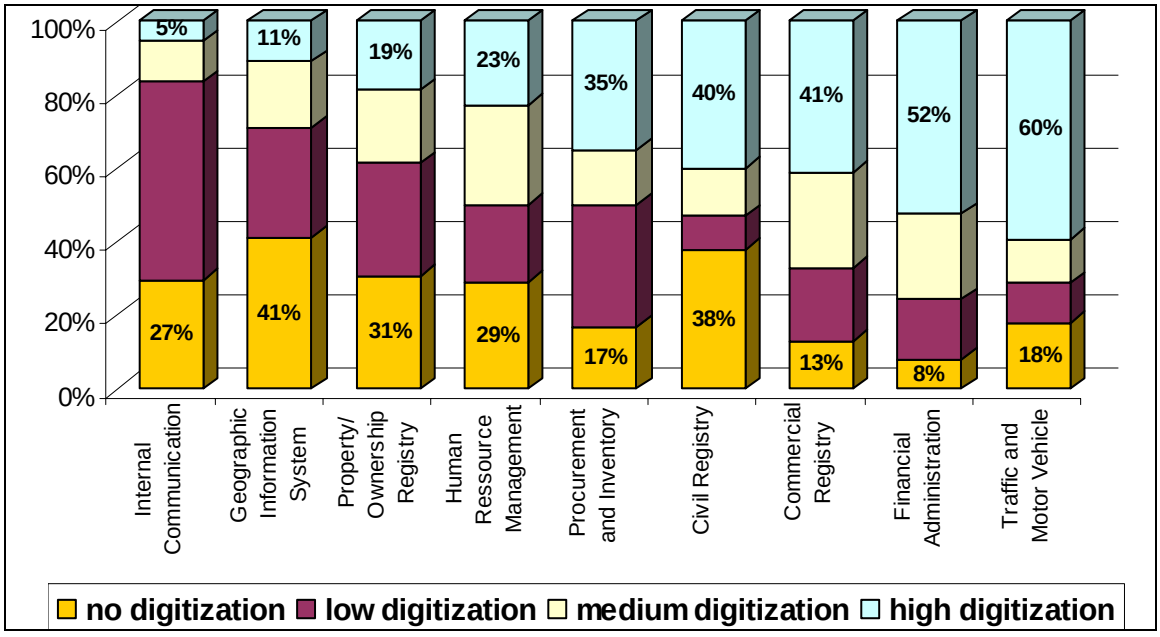
FIGURE 16
DEGREE OF DIGITIZATION PER AREA OF SOFTWARE APPLICATION IN PERU: ALL MUNICIPALITIES WITH SOFTWARE EXPERIENCE



Source: Prepared by author.

In Chile the digitization of the analyzed internal administration processes is more advanced (Figure 17). 52% of the software-experienced municipalities already have more than two-thirds of their '*financial administration*' digitized. It is also interesting that the digitization of '*traffic and motor vehicle*' registration and processes is far more advanced in Chile. 60% of the software-experienced municipalities manage more than two-thirds of such processes electronically. Also the '*civil registry*' and the '*commercial registry*' are already very advanced (40% and 41% of the software experienced municipalities are found in the 67%-100% segment). In '*civil registry,*' however, a large gap between those municipalities that are already very advanced in digitizing their civil registration databases and those lacking any initiative in this direction is noticeable. For '*commercial registry*' on the other hand, the gap is not as large. This seems to suggest that '*commercial registration*' is a priority for a wider range of municipalities, while '*civil registration*' is only of interest for some few municipalities and for others it is not a priority yet.

FIGURE 17
DEGREE OF DIGITIZATION PER AREA OF SOFTWARE APPLICATION IN CHILE, SAMPLE: ALL MUNICIPALITIES WITH SOFTWARE EXPERIENCE



Source: Prepared by author.

Given existing implementation problems (see box below "Digitizing Geographical Information"), the digitization of '*geographical information systems (GIS)*' is still lagging behind in Chile. 40% of the Chilean municipalities, which already use some kind of administrative software, have not yet started implementing GIS. However, as the two graphs above and the example in the following box are showing, GIS is undoubtedly one of the most complex software systems for a municipality to implement.

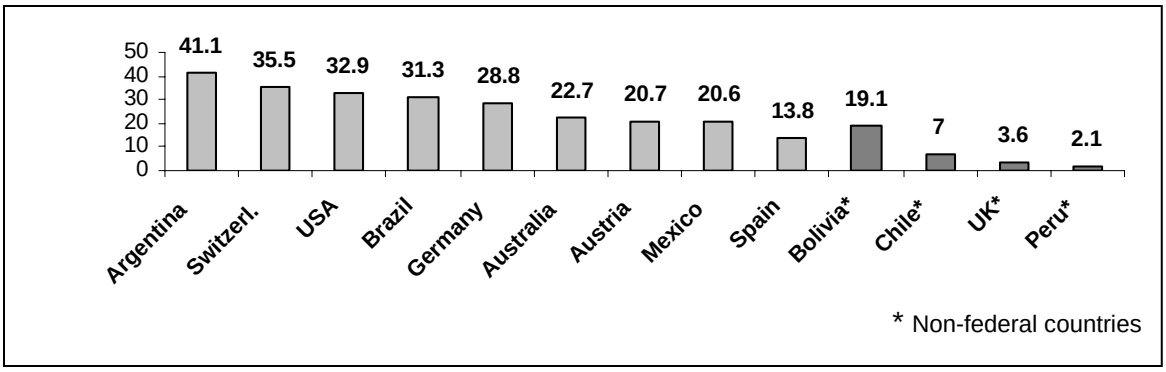
5. Enabling environment

The process of digitization must be supported by an enabling environment, which might otherwise bottleneck the digitization process. This enabling environment includes financing mechanisms that support investments and maintenance of technologies; human capital as the driving force behind the technology, and a regulatory framework to foster digital interaction.

5.1. Financing

The income of a municipality varies widely among municipalities of different countries and between different municipalities inside one country. Compared internationally, Chilean and Peruvian municipalities have relatively small budgets. While on the international average municipalities have 22% of the total public sector income, Chilean municipalities appropriate only 7% of the total public income and Peruvian municipalities only 2.1% (Figure 18). Generally speaking, non-federal states (in all Latin America besides Argentina, Brazil and Mexico) have a limited budget in comparison with the national government, given their limited spectrum of duties and responsibilities. Budget distributions, the same as tasks and duties between local, regional and national government in different countries vary widely. This requires consideration when evaluating local e-government development, especially when drawing conclusions in international comparisons.

FIGURE 18
INCOME OF LOCAL GOVERNMENTS AS PERCENTAGE OF TOTAL PUBLIC SECTOR INCOME (1997)



Source: IMF, 1997, cited in 'propuestas técnicas financiamiento y automonía municipal.

Furthermore, not all municipalities in the same country have the same amount of budget at their disposal. Municipalities in both Peru and Chile finance themselves through local taxes and tariffs (e.g. territorial rates), license plate and other transportation permits, commercial and professional permits, fines and rent, among others. Therefore, the income of a municipality depends heavily on the income-level of a community. National inter-municipal compensation funds exist in Peru and Chile, but they are not far enough to lead to effective income redistribution. The fact that Latin America is the region with the greatest income inequality in the world (ECLAC, 2002) is reflected in income distribution between municipalities. Data from the Peruvian "Encuesta Nacional de Infraestuctura Social y Económica Distrital" of the year 1999 shows that (INEI, 1999) the income distribution among 77 Peruvian municipalities is extremely unequal. The "poorest" ten percent of the municipalities in the sample have on average less than 898,000 soles budget per year (around US$ 256,600), while the ten "richest" percent have more than 6,255,939 soles (around US$ 1,787,411). In other words, the ten richest percent of the surveyed municipalities have almost 7,000 times more income as the poorest ten percent.

Absolute numbers have to be set in relation to the size of the municipal district/province. However, as Table X shows, even balanced with the number of inhabitants of the community or balanced with the number of employees of a municipality, the gap remains large. Adjusted to the number of inhabitants of the community the richest ten percent of the municipalities have 1,500 times more budget for each inhabitant available than the poorest ten percent. Adjusting the available budget to the number of employees of a municipality, the rich ones have 3,190 times more.

FIGURE 19
INCOME DISTRIBUTION IN PERUVIAN MUNICIPALITIES (PERCENTILES OF THE SAMPLE; US$1 = 3.5 SOLES)

PERCENTILE of municipalities from the sample	0% - 10%	10% - 20%	20% - 30%	30% - 40%	40% - 50%	50% - 60%	60% - 70%	80% - 90%	90% - 100%	MEAN
Income per habitant US$	15	20	25	58	75	106	227	3 253	22 551	6 314
Income per employee (in thsnd US$)	6	13	15	24	29	35	121	1 219	19 143	4 286

Source: based on INEI Peru, 1999.

The logical question is how much the resources of a municipality contribute to its advancement towards an "e-government." Given the high cost of the technology, the theory of the "digital divide" suggests that there is a highly positive correlation between income and technology adoption. Surprisingly, no significant relationship between municipal income and "advancement indicator" exists. The significance test between the absolute budget of a municipality in Peru and the advancement indicator is $p = 0.701$, while the significance test between the available income per inhabitant and the advancement index $p = 0.928$ and between the income per employee of a municipality and the advancement index $p = 0.625$.[21]

Some municipalities that are characterized as "Advanced" in Peru have as little as US$12 per inhabitant yearly (falling into the poorest percentile of Peruvian municipalities), while others have as much as US$97,500 (falling into the richest percentile). Peruvian municipalities characterized as "Laggard" also have as little as US$12 per inhabitant (poorest percentile) or as much as US$54,500 (richest percentile). No relation could be found. On average, advanced municipalities have US$7432 per inhabitant. Ironically, the "lagging" municipalities earn a higher income per inhabitant on average than the advanced municipalities (US$ 9667). In other words, in many cases poor municipalities are more advanced than rich ones in Peru, while some rich municipalities do not invest their budget in ICT. Therefore, income does not seem to be a decisive factor for ICT diffusion in Peru.

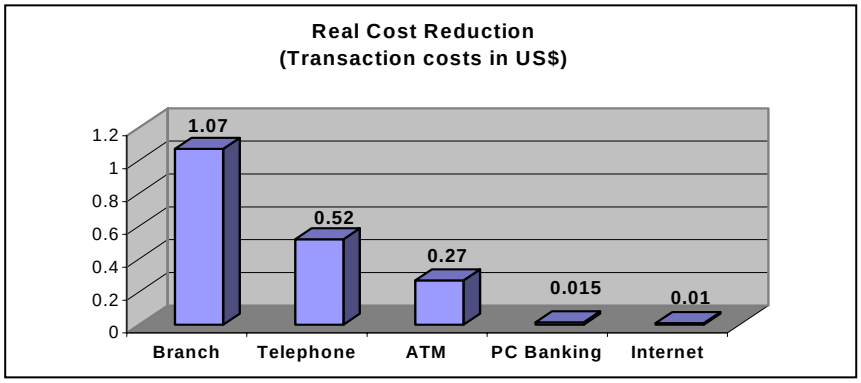
Questionnaire results show that 80% of the richest 40% of the Peruvian municipalities see "*the lack of funds for the necessary investments*" as a "*very significant obstacle*" to e-government implementation. 95% of them see the "*lack of funds for maintenance of e-government*" as a "*very significant obstacle*". Ironically, the poorest 40% of the Peruvian municipalities do not consider the lack of funds as such a significant obstacle, as only 75% of them consider investments and 73% consider maintenance cost as very significant obstacles. This first finding shows that poor municipalities in Peru do not consider the lack of funding as problematic as rich municipalities do. Knowing that there is a very significant and strong correlation between the "*existence of a budget for e-government activities*" and the advancement indicator (Spearman: $p = 0.001$ with $r = 0.418$) the final question is: Which municipalities have set up such a budget? Asked concretely about the existence of an e-government budget, it is remarkable to find that 28% of the 40% richest municipalities in Peru do not have such a budget, while only 13% of the 40% poorest municipalities did not establish an extra e-government budget. The reason for these findings is that many more poor municipalities in Peru have set up an extra budget for e-government initiatives, while many rich municipalities have never separated any money for this purpose. One possible hypothesis then would be not if funds are available, but rather if there is sufficient political will to spend those funds on ICT and e-government.

Considering those cases where municipalities have set up such budgets, one of the primary reasons for efficient e-government investments is the resulting cost savings that seem to introduce some kind of self-finance mechanism. Experience from the private sector shows the tremendous potential for real cost reduction when digitizing transactions. The banking sector has benefited greatly from digitizing their clerk-client relationship. A bank transaction which is

[21] It is interesting to note that there is neither a significant relationship between income and each one of the different variables, constituting the "advancement indicator". Person's R significance test for two scale variables give the following results: income per inhabitant and the municipality's computer penetration: $p = 0.819$; income per inhabitant and the municipality's email penetration: $p = 0.358$; income per inhabitant and the municipality's Internet penetration: $p = 0.442$. Person's Chi-Square significance test for a nominal variable gives $p = 0.398$ for a test between the income per inhabitant and the existence of an administrative software; and also $p = 0.398$ for a test between the income per inhabitant of a municipality and the existence of a Website.

carried out at the branch costs the bank US$1.07 on average, while the same transaction over the Internet only costs US$0.01 (Figure 20).

FIGURE 20
EXPERIENCE FROM THE BANKING SECTOR SHOWS THE POTENTIAL FOR COST SAVINGS IN PUBLIC SERVICES

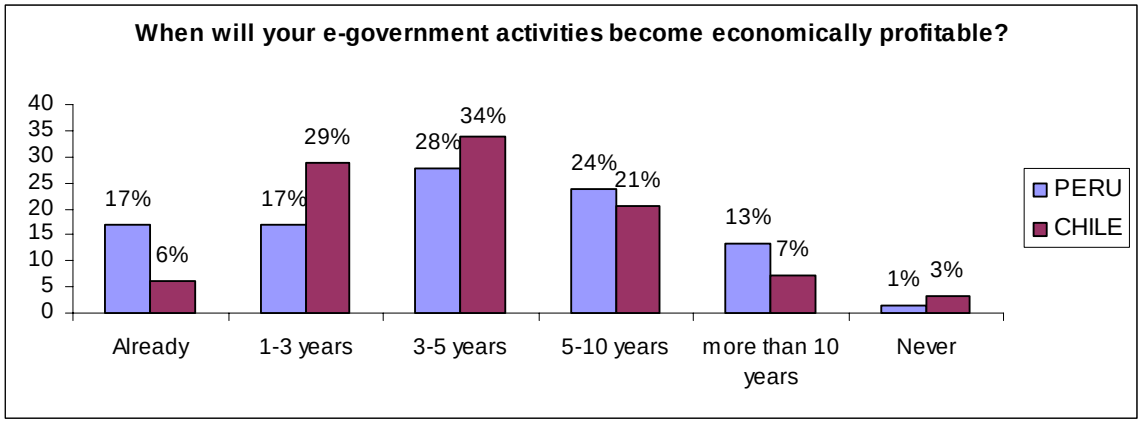


Source: Booz-Allen Hamilton, sited from U.S. Dept. of Commerce, 1999.

Municipalities can benefit from ICT cost reduction potential by bringing civil servant-client relationship online. In most cases cost savings cannot be felt immediately and will only become visible in the medium term. Some e-government applications will never lead to cost-savings, since the nature of the digitization in those cases does not have a quantitative effect for the municipality, but rather contributes to social and political goals, such as democratic participation and user convenience or provide cost savings for the citizens through reduced travel expenses and timesaving.

Nevertheless, municipalities in Peru and Chile alike are positive about getting an early return back from ICT investments, as shown in Figure 21. Two thirds of municipalities in both countries expect an economic benefit out of their e-government activities in less than 5 years. Only a very small number of municipalities believe investments will "never" become profitable.

FIGURE 21
RETURN OF INVESTMENT FOR LOCAL E-GOVERNMENT

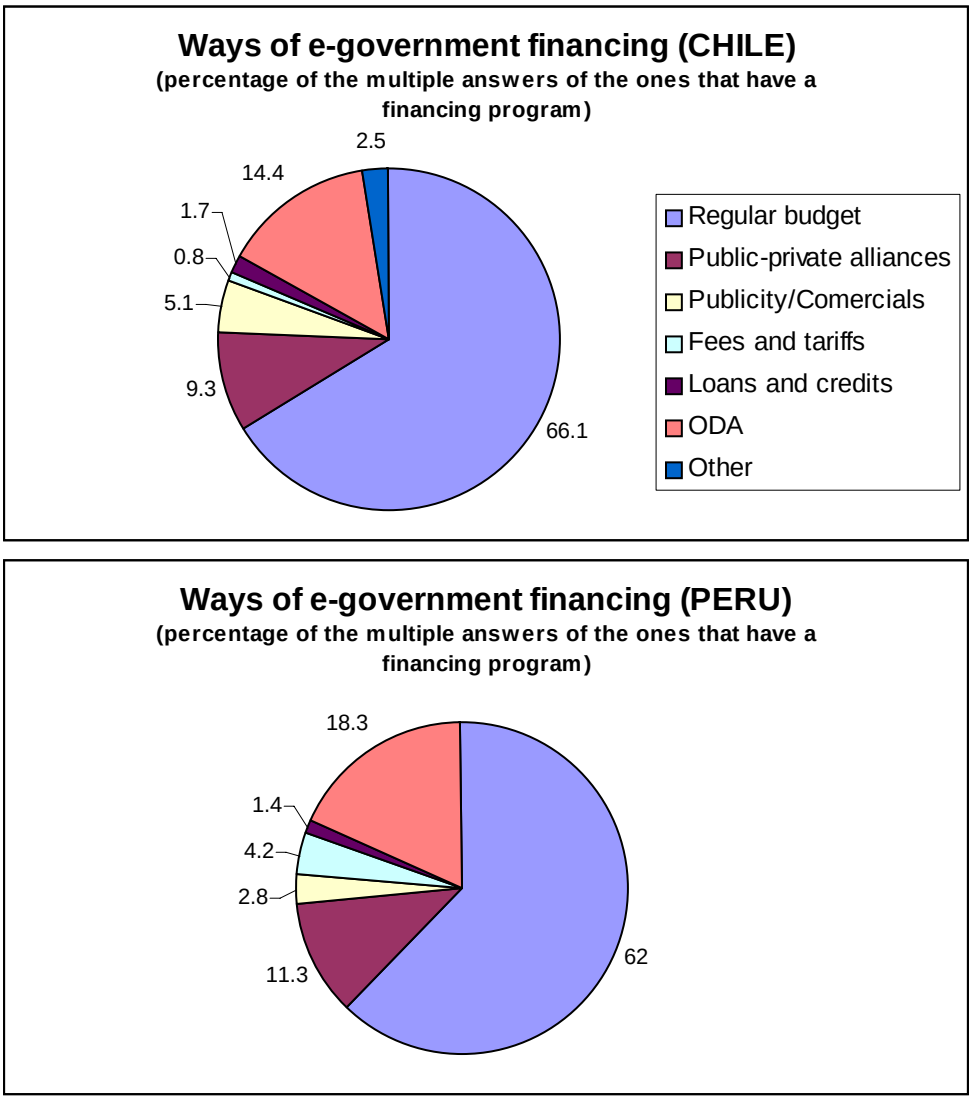


Source: Prepared by author.

Municipalities expectations on return on investment imply an ICT project might require a planning horizon that goes beyond five years. Five years is a short horizon regarding technology investments, but can be too long with respect to the political period on the municipal level. In case of one four year period, the mayor's successor will receive all benefits of e-government efforts from the former mayor. This might be a serious discouragement for an ongoing authority to invest in e-government. Incentive systems and finance compensations need to be found in order to encourage a mayor to invest regardless of short-term political consideration. The national government might have to step in here in order to distribute investment burdens and return of investment benefits between the political periods of various municipalities' administration terms.

Regarding financing sources in Peru, as shown in Figure 22, 19.5 % of the municipalities have explicitly stated that they actually do not have any kind of budget explicitly available for e-government activities. Of the ones that have some kind of financing, the regular budget is the most important source: 62 % of the Peruvian municipalities in the sample use it for their e-government activity. It is noticeable that high-income municipalities use regular budget more frequently than low-income municipalities, which are forced to search for alternative sources of financing. Official Development Assistance (ODA) make up an important source, while it is remarkable that 11.3 % make use of innovative public-private partnership models in order to finance e-government programs. In Chile the situation is similar, in which less ODA and more publicity/commercial-based models and stronger regular budgets constitute the main differences with Peru.

FIGURE 22
WHERE TO TAKE THE MONEY FROM?



Source: Prepared by author.

5.2. Human capital

Every e-government project depends on an effective and dedicated team of project managers, technicians, programmers, Web-designers, and engineers. Not surprisingly, the relationship between the "*existence of an e-government team*" and the "*advancement indicator*" in Chile is very significant (Spearman: p = 0.005, r = 0.289).[22] Looking at the different components of the "advancement index," the relations between "*computer penetration in the municipality*" and "*existence of a team*" is not significant (p = 0.656). In other words, it is not necessary to have a team in order to have many computers and vice versa. A similar relationship can be found for the overall average usage of email in Chilean municipalities, even though the relationship is a bit stronger here (p = 0.262). The correlation between the existence of a team and the usage of an administrative software program is hardly significant (p = 0.100). However, the existence of a

[22] In Peru, however, the relationship is not significant (p = 0.489). This might be due to the incipient development of e-government projects in the country.

team is very significant for intensive Internet usage in a municipality ($p = 0.010$) and the relationship between the "*existence of a team*" and the "*existence of a municipality Website*" is extremely significant ($p = 0.000$). In other words, in order to have less sophisticated digital applications, such as computers, email usage or software programs, the existence of a team is not as important. Even municipalities, which do not have a team, have advanced to such stages. Nevertheless, municipalities that evolved from using the Internet and setting up Websites make significantly use of an e-government project team.

This leads to the question of the constitution of such a team, first of all, and, secondly, if it is necessary that a municipality builds up those required skills itself, or whether it should outsource e-government activities to a professional organization. In this respect it seems that a minimum set of capabilities is indispensable even if the majority of technological and project-management part of e-government activities is outsourced to an external partner (Göldi, 2001). On the other hand, its fast cycle times in the ICT sector and changes associated with its applications may require the contracting of external experts, in order to reduce uncertainty and complexity, and to accelerate internal learning processes.

In Chile 28.3% of the municipalities have a local team. In those cases, such teams make up between 2 – 18 % of the municipality staff, between one and 23 team members. The large majority of municipal e-government teams are internal staff members. 93.3 % of the municipalities that have a team rely on internal staff members, while only the remaining 6.7 % exclusively outsource their e-government project. Nevertheless, more than one third of teams composed of internal staff members also rely on external consultants (39.9 %). Such external assistance is in 91 % of the cases limited to the consultation of one or two external experts. In no case are there more than 3 external experts involved in a municipal e-government team.

In Peru the situation is similar. Of the 20.3 % of municipalities that have a team, members make up between 1 % and (in one case even) 28 % of total municipality staff. Not a single municipality of the Peruvian sample outsourced its e-government activities completely; however, 42.8 percent of them rely on external assistance. Once again, never were there more than 3 external consultants on the team.

A well functioning e-government project does not only require Human Capital on the supply side of the system, but also users of e-government require training in order to benefit from technological solutions. Employees of 31.6 % of Peruvian municipalities can rely on some kind of support system when they have questions about topics related to the e-government system or the usage of ICT in general. The staff members of Chilean municipalities have access to such systems in 44.1 % of the cases. Regarding user-end support the numbers are a little lower. Only 14.9 % of Peruvian municipalities offer such a support system to e-government users, compared to Chile's 23 %.

It is remarkable that "Leader" municipalities in both cases place a higher emphasis on the training of employees than on user-end training, meaning training for citizens or companies that use e-government services. Of the municipalities that possess a Website and some kind of administrative software, 70% of the leading municipalities in Chile have employee training mechanisms, while only 43% of them have user training programmes. In Peru it becomes even more obvious, as all of the leading municipalities have set up employee training mechanisms, but none of them offers support systems for users. This underscores the findings of studies in other fields of ICT usage, such as with ICT in schools (e-learning) or ICT in hospitals and clinics (e-health), in which usually the user-end of the technology is not the obstacle to usage (the citizen, student or patient), but rather the supplier of the electronic services, meaning the civil servant in e-government, the teacher in e-learning and the doctor and nurses in e-health. PcoIP (2002) claims that mistrust and resistance to change by civil servants is often even a greater problem in

developing countries, given the lack of training resources and the limited alternatives for equal job opportunities in the labor market. The intent to hold on to existing power structures and to established rules of procedure is a logical consequence. Therefore, it is far more important to enable such "key users," while it is expected that the user-end seem to have a greater autodidactic capacity.

A "brain drain" between the public sector and the industry is a typical consequence of large training possibilities. As officials gain new skills through ICT training, they are often in high demand for private sector jobs, which can be damaging for the e-government project. Such public-private sector "brain-drain" can be reduced by including contract clauses, which prevents staff from leaving their jobs over a given period after receiving extra training.

5.3. Regulatory framework

With regard to the regulatory framework the municipality largely depends on national legislation. Concerns about legislative obstacles with Chilean and Peruvian municipalities are not as large as in Europe, (Media@Komm, 2001; 2002). Privacy issues, for example, which are a major point of concern in Europe, is not a priority in local e-government initiatives. Only 15.3% of the Peruvian municipalities consider privacy issues as a 'very significant obstacle', compared to Chile, where that number is 29.5%. 'Data security and confidentiality' is considered to be a more worrisome obstacle. 59% of the Peruvian municipalities classify the concern as 'very significant.' Almost every second Chilean municipality worries about data security.

The resulting actions to address those problems however are very incipient. Only 4% of the Peruvian municipalities elaborated or published some kind of policy and declaration about privacy and the security of digital data treatment. In Chile the situation is similar, with 6% of the municipalities having done so.

Digital signature legislation is of increasing importance, as services move toward the model of media-frictionless online transactions. In Latin America, many countries already introduced digital signature legislation. Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Peru and Venezuela have such legislature and other countries are about to follow. However, as with similar legislation all over the world, the real bottleneck is not in the legislation, but rather in its implementation. Elevated implementation costs, including identification cards and the required hardware [card reading machines], are the main obstacles.[23] Usually, only companies or other business entities (lawyers, architects, etc.) that have frequent contact with the municipality make the investment to obtain the required hardware components. Experience from Europe shows that the cooperation with banks (to integrate digital signature into credit cards) or the integration of the digital signature chip into ID cards,[24] supports the process of diffusion, but until now cannot claim to provide the solution for this urgent task. In accordance with international experiences, problems with digital signature legislation are a matter of concern with Chilean and Peruvian municipalities. 43% of the Chilean and 45% of the Peruvian municipalities see the issue as a very significant obstacle.

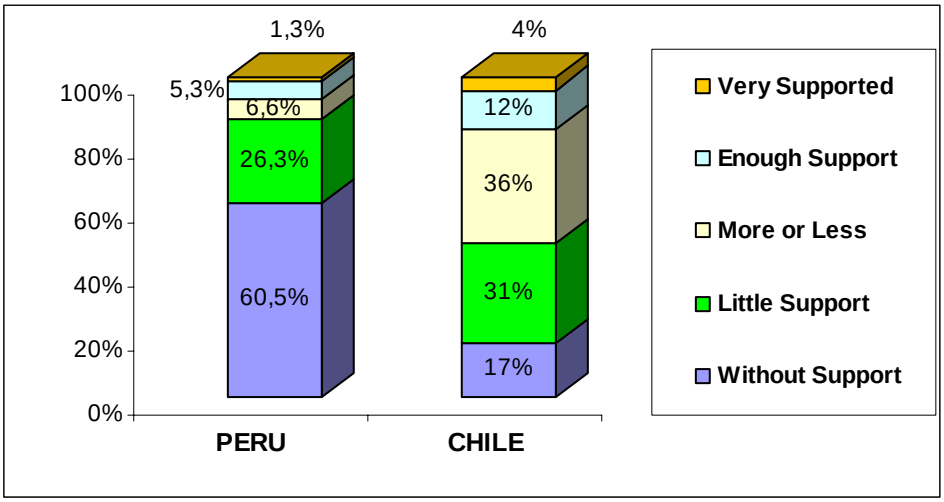
[23] In order to share the high cost of digital signature card reading machines, in Germany, the introduction of public access points that are equipped with digital signature infrastructure (hardware), turned out to be a price-effective alternative to increase the assimilation of the new method and to demonstrate the benefits of signing digitally (esip, 2001).

[24] Finland was the first country that tried to deal with this problem by the introduction of the electronic ID card. However, until now it did not find the desired acceptance with Finnish citizens (Hans-Bredow-Institut, 2002).

6. Obstacles

A significant determinant for the success or failure of local e-government initiatives is the support and the framework in which the national e-government strategy embeds local initiatives. A national strategy and incentive system can have a decisive, accelerating effect on the transition toward local e-government and few countries in Latin America have already set up some first initiatives in this direction.[25] As Figures 23 and 24 show, Peruvian municipalities would like more help from their national government. 60.5% of the Peruvian municipalities feel they lack support from their national government. In Chile more than two thirds feel at least "*little*" or "*more or less*" supported. In both cases, however, only a small percentage of municipalities are satisfied with the support they receive.

FIGURE 23
PERCEIVED SUPPORT BY NATIONAL (OR REGIONAL) GOVERNMENTS IN INTRODUCING E-GOVERNMENT IN PERU AND CHILE



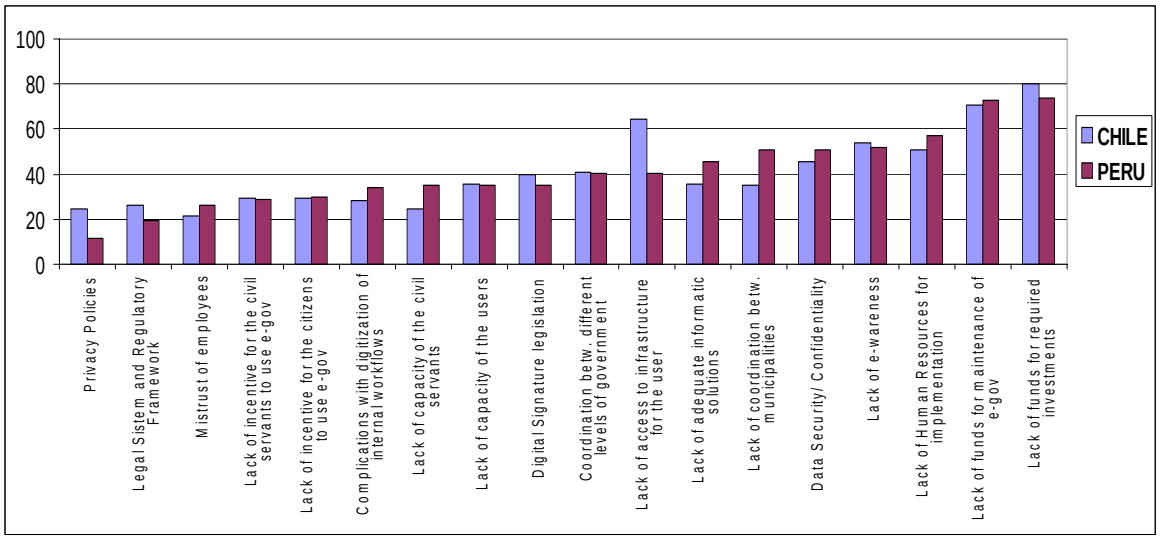
Source: Prepared by author.

Asked about specific obstacles for the implementation of e-government in the municipality, the majority agreed that the lack of funding was the most significant one. Funding for investments as well as for maintenance is the most significant obstacle that is subjectively according to municipal leaders[26].

[25] For example the extensive initiative "e-Local: Internet en todos los municipios" of the "e-Mexico" program: http://www.e-local.gob.mx Or the Working Group "Digital Cities" of the Brazilian Information Society Program: http://www.socinfo.org.br/grupos/acoes_concretas/cidades_digitais/index.htm . Also see the Chilean initiative "Minuta: El gobierno electrónico local, definición y areas de trabajo".

[26] It should be kept in mind that (as shown above in the section about 'Financing') the "rich municipalities" are even more likely to consider "funding of the e-government project" as a significant obstacle than the "poor municipalities." This suggests that the subjective perception of an obstacle (as shown in the graph) might not always reflect the reality.

FIGURE 24
E-GOVERNMENT OBSTACLES IN CHILE AND PERU

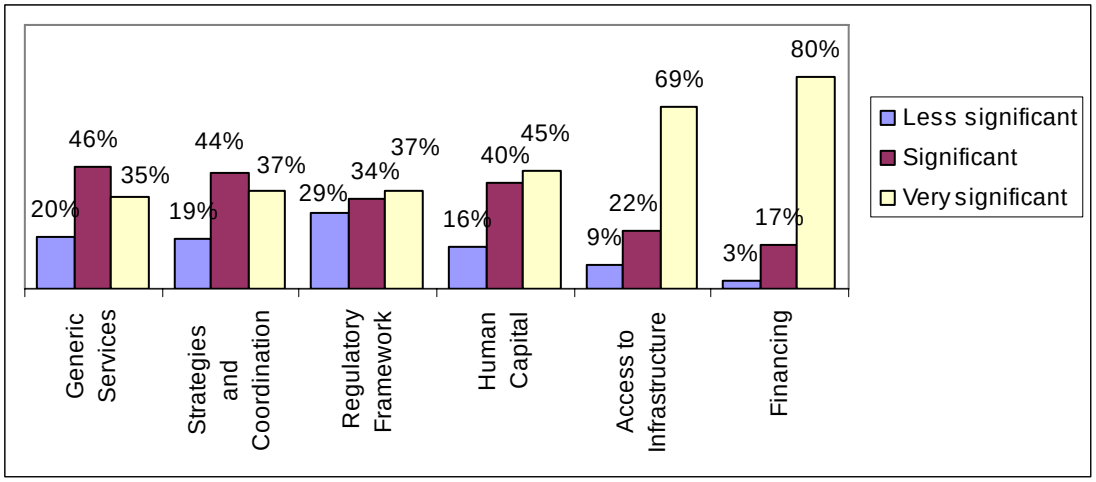


Source: Prepared by author.

A main difference between Chile and Peru is user access. Chilean municipalities worry a lot more about citizen access, while Peruvian municipalities have had positive experiences with public access booths. Citizen access is a very important point, especially with regard to e-democracy. The digital divide can have disastrous socioeconomic effects on equality, which can be perceived very intensively at the local level inside a community, which is a subject for further research. This aspect will require further investigation. Chilean municipalities are also more worried about the legal framework, such as privacy policies, and the digital signature. Peruvian municipalities, on the other hand, are more intensively confronted with the lack of human capital, especially civil servants directly involved with e-government to municipalities. Peruvian municipalities believe that a better coordination between local governments could significantly contribute to the diffusion of technological solutions.

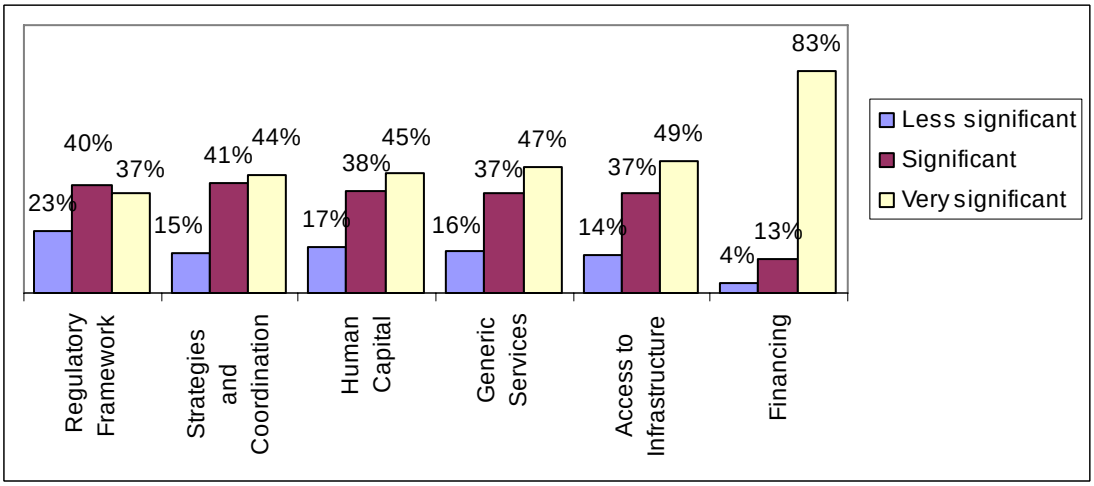
Figures 25 and 26 below group the above listed obstacles into the different focal issues of this study, namely infrastructure, generic services, financing, human capital, regulatory frameworks and an extra area called “strategies and coordination,” related to barriers posed by the lack of coordination of and between different actors in the public sector.

FIGURE 25
E-GOVERNMENT OBSTACLES IN CHILE, ACCORDING TO THE "BUILDING BLOCKS" OF E-GOVERNMENT (IN % OF THE TOTAL OBSTACLE DIMENSION)



Source: Prepared by author.

FIGURE 26
E-GOVERNMENT OBSTACLES IN PERU, ACCORDING TO THE "BUILDING BLOCKS" OF E-GOVERNMENT



Source: Prepared by author.

Municipalities perceive '*Financing*' and '*Infrastructure*' as the largest and most pressing obstacles. Chilean software markets also seem to provide more adequate solutions for the needs of municipalities than Peruvian ones, as the provision and introduction of digital Generic Services seems not to be a problem in Chile. Additionally to the presence of transnational software houses, at least two local Application Service Providers (ASP's) have specialized on software for Chilean municipalities by the end of 2002. Among Peruvian municipalities, the provision and introduction of adequate software is still perceived as a major problem. Regulatory issues are not an aspect of concern in Peru, while the provision of human capital is considered to be a problem of medium priority in both cases.

III. Summary, conclusions, and policy implications

Local e-government can be a powerful tool for improving the quality of life of citizens. It can introduce and demonstrate the benefits of the information society to the daily life of people and may be an important component of a sustainable development agenda increasingly becoming a priority on the development agenda. Local governments in the region are becoming aware of the benefits of e-government systems and are starting to implement such systems, pursuing the benefits of service improvements for their citizens and enterprises, better internal administration, transparency, and citizen participation.

Even though e-government initiatives can benefit from the experiences and the knowledge that has been gathered in the e-business sector, the nature of the public sector can hardly be compared with that of the business sector. A municipality, as is the case with all public institutions, leaves the people bound by laws and a bureaucratic order. E-government systems must respect institutional frameworks and State structures. Among countries and regions, each municipality is unique. Tasks, authorizations, institutional structures, and rules of procedure vary widely. Nevertheless, technological solutions, such as the suggested framework component model software solution, should be oriented to (a) make use of economies of scale and scope and (b) respect the existing (often irrational and historically determined) institutional regulations and procedures. Such economies of scale can also be exploited for the creation of content for municipal front-end user-interfaces (see box).

BOX 4
ECONOMIES OF SCALE FOR THE CREATION OF EFFECTIVE LOCAL E-GOVERNMENT WEBSITES

The diffusion of e-government can be accelerated through the use of economies of scale in the front-end of the e-government system. Digital products have almost infinite economies of scale, since their fixed-cost might be very large, but the cost of duplication is basically zero. Therefore, the largest possible scale in usage reduces prices constantly. The federal state of Baden-Württemberg in Germany set up a central server with pre-prints of official documents and forms. Through the service "eFormular" (http://www.virtuelles-rathaus.de), every interested municipality (or every other interested user) can order a selection of 709 ready to fill-out forms related to national legislation and 240 fill-out forms from the federal state of Baden-Württemberg. The prepared forms cover a wide range of areas and subjects, from "traffic" and "child-support," to "hunting" and "fire department." The majority of documents are in PDF format (Acrobat Reader) and can be used directly by the municipality for the integration into the local Website of their municipality. Using this technology, the municipality does not need to make large investments in the digitization of required forms. The municipality only needs to decide which forms are most effective for its particular need and to post them on their municipal Website. The price for the adoption of the forms depends on the number of inhabitants of the municipality.

As this study has shown, the learning process in the evolution toward e-government at the local level is central, involving structure, functionality, and leadership within a municipality. Currently, the driving force behind current local e-government initiatives is the improvement of citizen services and efficiency gains in the internal administration. While it can be expected that the improvement of citizen services bring a "*political return of investment*" through greater citizen satisfaction, improvements in the administrative efficiency and the reduction of error rates might bring a "*financial return of investment.*" In general, municipalities expect that their e-government activities will become economically profitable in less than five years.

In this sense, *e-administration* bears high potential for socio-economic developments of the communities. There is much room for improvement and an urgent need for public administration's modernization. The fact that it can take up to 20 procedures (worldwide average 10) and up to 171 working days (worldwide average 63) to accomplish such an important and pressing task as obtaining the right to start a new enterprise in Latin American countries (NBER, 2000) shows the necessity for fast and effective modernization of public procedures to keep the region competitive. The digitization of public procedures can bring such improvements faster than any legislative reform. However, the introduction of e-administration does not entirely replace the need for legislative reforms. Instead, they should mutually contribute to public sector modernization. While the introduction of e-government can pave the way for administrative reforms, new technological solutions can also help to complete legislative modernization processes already underway. For example, the introduction of ICT systems may contribute to current decentralization efforts in many Latin American public sectors. The decentralization of the public sector and the creation of new local and regional authorities might pose an institutional challenge rather than a technological one. Adequate legislation needs to be found, tasks and responsibility need to be distributed efficiently, and finance mechanisms need to be assured. Digital organization over large distances in real time has a very real chance to create new and innovative forms of local government. The use of ICT can strengthen coordination among different local authorities and between national and local authorities. In this sense, it can also contribute decisively to improve capabilities of local authorities. E-administration can contribute to a new, efficient, effective, accountable, transparent, and participatory form of public administration right from the start of the institution building process and therefore has the potential to strengthen current decentralization efforts.

ICT's are also increasingly used to strengthen democratic processes as it contributes to increase transparency in the administration and in political decision making processes as well as

through formal and informal citizen participation. Citizen participation applications are not the main motivation for municipalities to "go online." But, in many cases *e-democracy* is a central element in e-government strategies from the very start. Citizen applications are often comparatively easy to implement. Citizen's complaints applications can be set up by a simple email application or through a chat room. Citizens are also very receptive to e-democracy applications, since they are straightforward in their use. In their simple form (except of more advanced formal participations applications, such as e-voting), they do not require sophisticated security features and, in contrast to many public service applications such as electronic payment or digital signature, there is almost no risk involved. Citizen participation applications can help to win popularity for an e-government initiative and contribute to lessen the initial fears and doubts toward this new form of public service. One of the main constraints for e-democracy implementation is the difficulty to justify investments in participatory applications, as their effects can not always be measured in terms of return on investment. They are not cost-saving applications, but rather tend to inflate the bureaucratic apparatus of the municipality. Anecdotal evidence, such as 'participatory budget' mechanisms in Brazil and Peru or 'citizen complaints' applications in Chile, show that in some cases citizens have a direct "return on involvement," meaning that they perceive their voices are heard and their input is taken into account. This has a great impact on citizens' satisfaction and through this indirect impact on the municipality. Thus, e-democracy is becoming a driving force in many e-government projects.

Summing up, e-democracy applications are often easy to implement and therefore provide an interesting motivation for citizens, as well as the political support for civil servants to continue their e-government efforts. On the other hand, many decision-makers in the political and administrative domains still primarily regard participation as an unnecessary complexity and cost factor.The contributors to e-government advances of a municipality depend on all of the different "building blocks" of the conceptual framework presented.

Peruvian digital municipalities can be described as municipalities with a large staff and are located in urban centers, while the economy of the community is mostly concentrated on commercial activities and the service industry. A high Internet penetration with the population and enterprises of the community is also characteristic of more advanced digital municipalities in Peru. Rural communities maintain a heavy focus on agriculture, forest, fishing, and mining, in which neither citizens nor enterprises have easy Internet access. Thus, very little advancement toward e-government can be found in Peruvian rural communities. Even though Peruvian municipalities complain that the "*lack of funding*" is the largest obstacle in their evolution toward e-government, the study shows very clearly that the size of the budget of a municipality is not a significant factor behind more or less advanced municipalities in Peru. Rich and poor municipalities alike make progress at varying speeds. Many rich municipalities in Peru have not set up a particular budget for e-government activities, while many poor municipalities have done so. Those poor municipalities frequently look for innovative finance mechanisms such as public-private partnerships, or rely on Official Development Assistance in order to finance their initiatives. This seems to suggest that the political will and the vision and leadership of the mayor and his or her team may be a decisive ingredient for the successful creation of a digital municipality.

Leadership is pertinent to the development of e-government. Citizens cannot choose governments that do a better job with e-government like they can choose between competing commercial Websites. The government is not subject to competitiveness and therefore naturally is not driven toward rapid innovations, as are private companies in markets. Top-level political support is essential to move government organizations and their democratic processes into the digital age.

The characteristics of *Chilean digital municipalities* are less discriminative. Chilean digital municipalities might have a large or small staff, they might be located in urban or rural areas, their economy might be more commercial and service-oriented, or they might rely upon agriculture, forest, fishing and mining. None of these features discriminate towards a high Internet penetration. Interestingly, the only significant characteristic found is the number of inhabitants of a community. Large communities tend to be further advanced. However, the Chilean case demonstrates that the existence of a specialized e-government team is important. The lack of human resources for the implementation of e-government is considered to be the greatest obstacle in the evolution toward e-government, after financing. The deployment of such teams becomes especially essential when municipalities move from less sophisticated ICT's, such as computers and email, to technological solutions, such as administrative software, Internet usage or a municipal Website. Such teams can make up as much as one fifth of the municipality's staff and mostly consist of internal staff members. The complete outsourcing of this task hardly exists. However, almost every other team relies on the support of an external consultant. Such teams also have the challenging task of enabling the rest of the municipal staff. In general, it can be observed that municipalities are twice as concerned with the training of those users of e-government (citizens and enterprises), suggesting that municipalities suppose a certain degree of auto-capacitation of the e-government user, while the adaptation of the internal staff to a new form of organization seems to cause a major bottleneck.

Regarding the technological infrastructure of Chilean and Peruvian municipalities, a large gap can be found between very advanced e-government projects (less then 10 % of municipalities) and those that basically do not employ any kind of ICT (around one third of municipalities). The most frequently used technology is administrative software, while the penetration of personal computers and Internet usage for the municipal staff is still relatively low. The largest part of e-government does not consist of setting up a simple Website (the so-called *'front-end user interface'*), but rather in the digitization of the information flows and communication processes that take place in the *'back-office'* of a municipality. The introduction of administrative software in the back-office entails the re-organization in the functionality of the municipality, which is a structural and process-related problem rather than a technological one. Digitizing information flows, communication processes and coordination mechanisms can support organizational and functional reforms.

With regard to the digitization of back-office processes, it is recognizable that the least digitized areas are those that require a major adjustment of the habits and customs of municipal staff (such as the digitization of '*internal communication'*) or those areas that require staff to obtain and create adequate information (such as geographical data and maps to fill out digital '*Geographic Information Systems'*). The problem in the first case consists in digitizing communication and coordination mechanisms. It is a learning process and a change through which civil servants need to know how to exploit new technological channels adequately. Incentives can make a major difference in this regard. In the second case, the problem is not so much to digitize information, but rather to obtain this information. Many municipalities simply do not have the required data about geographic features of their community that is required to fill a GIS. In such areas, where the required information is already available and where habitual changes are minimal (such as with the digitization of '*Financial Administration'* or '*Civil Registry'* data), the process of digitization is already very advanced.

A second step toward a digital municipality is connecting the back-office processes to the front-end user interface, meaning the municipal Website. The learning process involves a clear trajectory, starting with the presentation of information online (Stage1), unidirectional interaction online (e.g. downloading of documents; Stage2), bi-directional online interaction, in which the municipality responds to the user's demand online (Stage3), and finally complete online

transactions, such as online payment and case handling (Stage4). The vast majority of current online applications can be found in Stage1, while still some other specific applications are very advanced already (Stage3 and 4).

Municipalities are picking specific online applications and developing them almost completely, while the vast majority of applications are left behind. One might expect that the selected applications are also the ones that can potentially bring the greatest benefits to the municipality. While in the majority of cases this tends to be correct, there are some notable exceptions. In these cases, the e-government system does not tackle the real and urgent needs of the particular municipality. In Chile, for example, e-health services, tax payment, and tourism applications would be very beneficial for the municipality, but are very early in their digitization process. The same accounts for civil registry and garbage and cleaning applications in Peru. This is partly because such potentially beneficial applications require a considerable amount of know-how and sophisticated technology for successful implementation. Therefore, some municipalities do not choose to start with online applications that can benefit the most from digitization, but rather with the ones that are less complicated and cheaper to implement. The latter, however, are often additional services, which usually do not have efficiency effects, but rather tend to inflate the bureaucratic apparatus of the municipality. Typical examples are *'Citizens Participation applications'*, such as *'Citizens Complains,' 'Public Relations and Press,'* and other forms of *'Informal Participation'* (Chat rooms, etc). On the one hand, applications are relatively cheap and fast to bring online. Informal citizen participation applications are easy to implement (e.g. through email) and to make popular with the first e-government users. On the other hand, while such applications do not require major readjustments in the established functionality of the municipality, nor do they bring any efficiency results or cost savings to the administrative apparatus (if anything, the opposite is true). As a result, these applications are seen as "nice additional toys" that "do not really make a difference" and can become an additional burden to the municipality.

In order to obtain visible benefits from online services, municipalities would need to take on the digitization of more complex applications, such as tax-payment mechanisms, the online provision of licenses and permissions, and the payment of fines, among others. However, the lack of know-how for the implementation of such "advanced" applications leads to a high possibility of failure and frustration, which can lead to the loss of the political and financial back-up and therefore slow down the entire e-government initiative. This risk seems to be too high for some municipalities and therefore they start their learning curve with rather simple applications. The result is a large amount of low-functional Websites that make it difficult to show the real potential and possible efficiency gains of the technology, potentially leading to the loss of political and financial support, since the urgent needs in municipalities of developing countries do not permit their local governments to waste energy on such "nice toys." A veritable "catch-22" is formed around the decision as to which applications to prioritize in a e-government project on the local level: should the digitization of the "really beneficial" applications go first in order to demonstrate the potential of the technology (bearing the risk of failure or the disadvantage to only being able to focus the limited resources on one or two selected applications), or should some "less beneficial" and "easy to implement" applications pave the way for the more sophisticated applications? Niches need to be found that can partly satisfy both aspects and a considerable amount of visionary leadership and strategic planning are required to successfully tackle this dilemma.

It has also been shown that the decision as to which applications to digitize first is often supply driven and does not necessarily fit the specific demands of its users. Municipalities buy and implement solutions that are readily available on the market or those that are promoted as best practices in other communities and countries, rather than focusing on the specific demands of

the users in their community. To prevent this from happening, two steps need to be taken: (1) the municipality needs to decide what is important and beneficial for itself. A good starting-point seems to be the creation of a "product and service catalogue" that lists all different tasks carried out by the municipality, weighing them according to their potential benefit from digitization and evaluating the requirements for bringing them online. (2) Citizens should be consulted to find out what they expect from a digital municipality. Both practices can reduce the mismatch between the demand and the supply of specific online applications decisively.

An issue where municipalities seem to be have little control is the regulatory framework, as they depend heavily on policies from the national government. There are, however, parts of the regulatory environment that can be assured by the municipality, such as privacy and confidentiality issues and the rules and procedures of data treatment. The collected data must not be misused for private business purposes. The municipality needs to set up strict, understandable, and broad privacy and security policies that are binding and that will dispel any kind of doubts about the misuse of data by the authority right from the start. Valuable lessons can be learned from the privacy policies of e-commerce companies in this process.

In conclusion, (1) local e-government is not only an ambition of developed countries, and (2) Latin American municipalities are making a visible effort to modernize their internal administrative apparatus, their performance in public service delivery, and the form of citizen participation in their communities. However, this study also shows that there is still a long way to go until we reach the stage of having truly "digital municipalities."

Annexes

Annex I

Besides **CONCYTEC (Consejo Nacion**

l de Ciencia y Tecnoloía) and **INEI (Instituto Nacional de Estatistica e Informatica)** the gratitude of the author also goes to the following municipalities which participated in the questionnaire:

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- Municipalidad Provincial de Chachapoyas
- Municipalidad Provincial de Luya (Lamud)
- Municipalidad Provincial de Utcubamba
- Municipalidad Distrital de Inguilpata
- Municipalidad Distrital de Luya
- Municipalidad Distrital de San Isidro de Mayno

Ancash (4)
- Municipalidad Provincial de Huaraz
- Municipalidad Provincial de Santa
- Municipalidad Provincial de Carhuaz
- Municipalidad Distrital de Independencia

Apurímac (2)
- Municipalidad Provincial de Abancay
- Municipalidad Distrital de Tamburco

Arequipa (5)
- Municipalidad Provincial de Arequipa
- Municipalidad Distrital de José Luis Bustamante y Rivero
- Municipalidad Distrital de Cayma
- Municipalidad Distrital de Mariano Melgar
- Municipalidad Distrital de Miraflores

Ayacucho (3)
- Municipalidad Provincial de Huamanga
- Municipalidad Distrital de Carmen Alto
- Municipalidad Distrital de San Juan Bautista

Cajamarca (4)
- Municipalidad Provincial de Celendín
- Municipalidad Provincial de Cajamarca
- Municipalidad Provincial de Hualgayoc
- Municipalidad Distrital de Baños del Inca

Cusco (5)
- Municipalidad Provincial de Cusco
- Municipalidad Distrital de Wanchaq
- Municipalidad Distrital de San Jerónimo
- Municipalidad Distrital de San Sebastián
- Municipalidad Distrital de Santiago

Huancavelica (1)
- Municipalidad Provincial de Huancavelica

Huánuco (2)
- Municipalidad Provincial de Huánuco
- Municipalidad Distrital de Kichki

Ica (1)
- Municipalidad Provincial de Ica

Junín (10)
- Municipalidad Provincial de Huancayo
- Municipalidad Provincial de Concepción
- Municipalidad Provincial de Chupaca
- Municipalidad Distrital de El Tambo
- Municipalidad Distrital de Chilca
- Municipalidad Distrital de Pilcomayo
- Municipalidad Distrital de Sapallanga
- Municipalidad Distrital de Pucara
- Municipalidad Distrital de San Jerónimo de Tunán
- Municipalidad Distrital de Tres de Diciembre

La Libertad (6)
- Municipalidad Provincial de Trujillo
- Municipalidad Distrital de La Esperanza
- Municipalidad Distrital de Víctor Larco Herrera
- Municipalidad Distrital de Laredo
- Municipalidad Distrital de Florencia de Mora
- Municipalidad Distrital de Moche

Lambayeque (2)
- Municipalidad Provincial de Chiclayo
- Municipalidad Distrital de Jayanca

Lima (1)
- Municipalidad Distrital de Jesús María

Loreto (1)
- Municipalidad Provincial de Maynas

Madre de Dios (1)
- Municipalidad Provincial de Tambopata

Moquegua (1)
- Municipalidad Provincial Mariscal Nieto(Moquegua)

Pasco (1)
- Municipalidad Provincial de Pasco

Piura (5)
- Municipalidad Provincial de Sechura
- Municipalidad Provincial de Piura
- Municipalidad Distrital de La Arena
- Municipalidad Distrital de La Unión
- Municipalidad Distrital de Catacaos

Puno (1)
- Municipalidad Provincial de Puno

San Martín (6)
- Municipalidad Provincial de Tarapoto
- Municipalidad Provincial de Moyobamba
- Municipalidad Distrital de Juan Guerra
- Municipalidad Distrital de Cacatachi
- Municipalidad Distrital de La Banda de Shilcayo
- Municipalidad Distrital de Morales

Tacna (1)
- Municipalidad Provincial de Tacna

Tumbes (1)
- Municipalidad Distrital de Corrales

Ucayali (4)
- Municipalidad Provincial de Coronel Portillo
- Municipalidad Distrital de Yarinacocha
- Municipalidad Distrital de Campo Verde
- Municipalidad Distrital de Curimana

Annex II

Besides **AHCIET** and **SUBTEL (Subsecretaría de Telecomunicaciones de Chile)** the gratitude of the author also goes to the following municipalities which participated in the questionnaire:

Antofagasta
Arauco
Cabildo
CaboDeHornos
Calama
Calbuco
Castro
ChillánViejo
Chumbarongo
Cisnes
Cobquecura
Colbún
Coltauco
Conchali
Conchalí
cunco
Curacautin
Dalcahue
De Coronel
El Carmen
EL QUISCO
ElBosque
Empedrado
Futrono
Gorbea
Huasco
I. Municipalidad de Aysen
I. Municipalidad de Chanco
I. Municipalidad de Lanco
I.Municipalidad de Ovalle
Ilustre Municipalidad de Alto del Carmen
Ilustre Municipalidad Porvenir
Juan Fernández
La Calera
La Cisterna
La Reina
La Serena
LaCruz
Lago Verde
Lampa
LaPintana
Las Cabras
Las Condes
Linares
Llanquihue
Llanquihue
Llanquihue
Loncoche
Los Muermos
LosAngeles
Maule
Melipilla
Mostazal
Ñuñoa
Osorno
Padre Las Casas
Panguipulli
Panguipulli
Parral
Peñaflor
Peñalolén
Petorca
Pichilemu
Pinto
Pitrufquén
Providencia
Pucón
Puente Alto
Puerto Montt
Puerto Natales
Puerto Varas
PuertoOctay
PuntaArenas
Purén
Purranque
Quilaco
Quilicura
quinchao
Quintero
Rancagua
Rauco
Recoleta
Rio Claro
Salamanca
San Esteban
San felipe
San Gregorio
San Javier
San José de Maipo
San Miguel
San Ramón
SanJoaquín
Santiago
Santo Domingo
Talcahuano
Til Til
Tomé
Torres del Paine
Tucapel
Valdivia
Valparaiso
Vilcún
VillaAlemana
Vitacura
Vitacura
Zapallar

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