The Role of the CIO in a Local Government IT Strategy: The Case of Merida, Yucatán, Mexico

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Abstract: Merida offers an exemplary case of the importance and strategic role of the CIO in a local government. Merida, like many other local governments, faces numerous problems in terms of adequate technical infrastructure, specialized IT staff, and support from public officials, among others. In addition, one of the main challenges of local eGovernment implementation is the lack of a central figure to promote progress, integrate decisions, and foster structural and procedural changes. In the case of Merida, the CIO played this role and created new regulations, homologated processes, and developed interactions among Merida's different city government stakeholders through websites and cell phones. Merida is now a leader in citizen-centered eGovernment services and provides fast and reliable responses to their daily needs. Based on the review of official documents and interviews with Merida's CIO and his IT staff, this article identifies and describes some of the early challenges and success lessons of this experience. It also proposes a set of elements to incorporate in an integrated local eGovernment strategy. The article is organized into five sections: Section one is an introduction of the CIO problem in local governments. Section two provides background information about the city of Merida and its IT organization and infrastructure. Section three describes the arrival of the new CIO, his main objectives and motivations, and the results of some of his initiatives. Section four proposes ideas about the future of CIOs in local governments and their role within an integrated IT strategy. Finally, section five offers some concluding remarks and suggests areas for future research in this field.

Keywords: CIO, local government, Mexico, IT organization

1. Introduction

Around the world, eGovernment initiatives are usually led by a chief information officer (CIO) or an individual in a similar position. However, in most Mexican local governments this person is not formally designated as a CIO and does not have the necessary decision-making power to achieve the initiative's goals. Most of the time, she or he is the director of the information systems (IS) department and has operational rather than strategic responsibilities (Nguyen, 2008, Campbell, 2003). Very few government agencies at all three levels (federal, state, and municipal) have appointed a specific person primarily dedicated to a government-wide information systems strategy (Lee and Kim, 2007, Luna-Reyes et al., 2007, Enns et al., 2001).

The individual responsible for the IS department is normally a mid-level staff member who does not have the necessary authority and access to the mayor to lead an eGovernment initiative. In addition, many IT offices only provide technical support to other government agencies (Chun and Mooney, 2009). This lack of power and absence of a real coordination role with other agencies negatively affects the implementation of eGovernment projects. However, things are beginning to change. Incrementally, IT offices are becoming involved in government decision-making processes and using a more strategic vision to guide the introduction of new technologies to government agencies. In some ways, they are becoming CIO offices (Luna-Reyes et al., 2008).

The role of CIOs in local governments is becoming increasingly important and more research about their actions and impacts is needed, not only from an academic perspective, but also for practical purposes. Currently, eGovernment initiatives require a high degree of specialization and knowledge about citizens' needs and government procedures (Janowski, 2010) A strong CIO, with well defined responsibilities, would help to make better decisions about the use of IT in government agencies (Reddick, 2008). However, there are also important challenges and problems that CIOs face when performing their daily jobs. These challenges are not only related to technology, but also to the context in which their organization is embedded. Organizational, institutional, political, and other factors greatly affect the CIO's capacity to implement eGovernment initiatives.

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This paper explores the role of the CIO in a local government and pays particular attention to the problems, challenges, and successful strategies found in the case of the city of Merida. We focus on the experience of Merida because it was one of the first local governments in Mexico to establish a CIO position at the executive level. The case reported here is based on the collection and analysis of formal documents, as well as interviews with the CIO of the city of Merida and his staff (Bowen, 2008). It highlights the problems and challenges that the CIO initially faced and describes the strategies that he used to successfully address them. It also provides some background information about the city of Merida and its IT infrastructure.

The article is organized in five sections, including the foregoing introduction. Section two provides background information about the city of Merida and its IT organization and infrastructure. Section three describes the introduction of the CIO, his main objectives and motivations, and the results of some of his initiatives. Section four proposes some ideas about the future of CIOs in local governments and their role within an integrated IT strategy. Finally, section five offers some concluding remarks and suggests areas for future research in this field.

2. Background

This section provides the general background about the Meridian CIO's intervention on IT policy and the municipal IT organization. It presents a very brief review of previous studies focusing on government IT projects at the local level and the role of CIOs. It also includes a description of Merida's IT background.

2.1 Local eGovernment and CIOs

There is limited research on the challenges that local government CIOs face in their daily activities, particularly in developing countries. Stephens and Loughman (1994) focus their research on the CIO's communication problems. Enns, Huff, and Goldman (2001) explore the barriers to commitment for IT projects among CIOs. However, these studies do not focus on local governments. Most previous research focuses on success factors of eGovernment more generally (Gil-García and Pardo, 2005). This section provides a very brief review of eGovernment studies at the local level.

The first international studies about local eGovernment were developed in the United States (Leenes and Svensson, 2002; Moon, 2002). Most of this research assesses the characteristics of electronic transactions or looks for best practices among local governments. Similarly, Criado and Ramilo (2003) evaluate web design from the citizens' perspective in Spain. In contrast, focusing on electronic services in Denmark, Siegfried's (2002) study is based on his role in a collaborative software project for a local government and includes multiple aspects of and perspectives on the initiative. Valimaki and colleagues (2005) explore the use of open source software in local governments, while other scholars have focused on the usability of local eGovernment information (De Jong and Lentz, 2006) and accessibility aspects of local eGovernment websites (Evans-Cowley, 2005).

Melitski and colleagues (2005) published the first worldwide assessment of local eGovernment. Taking that research a step further, Paivarinta and colleagues (2007) developed a study about the impact of IT investment in local governments. In Mexico, there have been several studies of the federal government, but there is only one preliminary evaluation of local eGovernment (*municipios*) that takes a sample of 90 local governments out of four thousand. This assessment considers web page characteristics and functionalities (Martínez-Vilchis and Sandoval-Almazán, 2008). However, the main results are not generalizable because the sample was intentionally, not randomly, selected.

CIOs must have a broad skill set in order to be successful in their role as leaders of eGovernment initiatives. According to Brown (1993): "1) The CIO is responsible for the information and IT infrastructure, but application development and technical support responsibilities will be decentralized to divisions and departments; 2) The CIO will have a people orientation and will utilize communication, education, standards, and other indirect controls to perform the role of integrator and gatekeeper for new technologies; 3) The CIO will become an integral member of the top management team and have the corporate-wide responsibility for the information resources policy and strategy." In the case of Merida, the CIO had many of these characteristics. This section describes the main motivations for the creation of the CIO office, highlights some of the implementation challenges and achievements, and provides some lessons about local government CIOs.

A review of the literature on CIO leadership reveals that communication with the people of the municipality is important (Stephens and Loughman, 1994) because it creates commitment across all stakeholders (Enns et al., 2001). Most innovations will be conducted by personnel from the IT department, but under the direction of the CIO (Hinde, 2005); some research establishes that this kind of leadership must take into account the perceptions of the government and the citizens (Lee and Kim, 2007). Finally, Chun and Mooney (2009) describe the evolution of the CIO's roles and responsibilities of a CIO over the last 25 years. The findings and main arguments from previous authors guide this research and contribute to developing an understanding of the CIO's impact on the IT challenges in Merida.

2.2 IT Background of the City of Merida

This section describes the IT infrastructure and the main challenges within the city of Merida. We start with a brief introduction to the city of Merida, followed by a review of its IT infrastructure, processes, personnel, and budget, as well as some data about the digital divide in the city. Merida is the capital of the state of Yucatan. Yucatan is in Southeast Mexico and its population is 1,955,577. It is divided into 106 municipalities (similar to counties and cities in the United States). Yucatan's main economic activities are commerce and tourism (restaurants, hotels, and other tourism-related activities). Merida is the state's most populated city with 830,732 inhabitants.

IT Infrastructure, Staff, and Budget

In terms of IT, Merida has been continuously expanding its technological infrastructure since 1994. Simultaneously, there has been an important evolution in systems development. Local government agencies started with a more generalized use of certain computer packages, such as spreadsheets and word processors, and then progressed toward the development of more specialized applications, including database systems, intranets for employees, and extranets for clients and suppliers. Despite significant growth in terms of the IT infrastructure, the availability of specialized personnel and a dedicated IT budget were still challenges for the city (see Table 2). The IT staff and budget have grown in the last few years, but they are not great enough to satisfy both the previous and emergent needs of citizens, businesses, and other stakeholders. In addition, the IT staff lacks expertise in certain strategic areas, which has limited the city's ability to pursue new developments and preserve the existing systems and databases.

From 2001 to 2007, there was a one hundred percent (100%) increase in the availability of PCs for local government agencies and four times more servers to keep them connected to the Internet and provide other services (see Table 1). In the same period, the IT staff almost doubled and the budget increased one hundred percent (100%). One of the main factors that resulted in this significant change was the creation of the CIO position, which promoted the IT function to a strategic level. The creation of a CIO also enabled an integrated vision of not only the delivery of products and services directly to citizens, businesses, and other local government stakeholders, but also their desired results.

Internet Presence, Digital Divide, and Internal Processes

Merida's Web page was created in 1996; in 1998, it became the official website of the city government (see Table 3). The automation of the city's main processes, such as online transactions, government information requests, information updates from the mayor's office and city council members, and online registration of property taxes, started in 1994. In 2002 the Law of Transparency and Public Information Access – Open Government Act - forced local and federal authorities to have a web page with updated public information about government actions, processes, and resources. There has been an increase not only in online services, but also in online customers, at least in part because more people are getting Internet access at government tele-centers (Gómez-Diaz and Almazan, 2009). This development is particularly important in a country like Mexico, in which only about 30 percent of the population has Internet access at home (AMIPCI, 2010).

A recent initiative of the Merida IT department was to offer free wireless Internet access in public parks around the city. The expected outcomes were that more people would have Internet access and would be more willing to use online services in general and online government services in particular (Merida IT department, 2008). The combination of improved processes and initiatives to reduce the

digital divide has produced greater demand for online services and an important transformation of the city's bureaucracy. The CIO was a key actor in this process by promoting the use of international certifications such as ISO 9001 to standardize processes and the development of additional online services.

Table 1: Merida's IT infrastructure (1994-2007)

CONCEPTS	Before 1987	1987 to 1994	1994 to 2001	2001 to 2007
SYSTEMS DEVELOPMENT	Total absence.	Development of central systems for accounting and income processes, but without integration. The city begins to use spreadsheets, word processors, and databases.	The use of general systems is common across accounting systems, government income, expenses, maintenance shop vehicles, supply, budgetary control, payroll, and service orders. The first system focused on the citizens' needs, "Ayuntatel," is created.	The city builds its first comprehensive system for financial administration. Database design. New systems are developed for internal and external users. Development of new technologies, e.g., Attention Unit is accessible by cellular phone and deployment of Geographic Information Systems.
COMPUTER EQUIPMENT	Total absence.	50 computers and 18 dummy computer terminals.	550 computers. Technology farm with 5 data servers.	1,300 computers. Technology farm with 20 servers.
INFRASTRUCTURE OF NETWORKS AND CONNECTIVITY	There was no network infrastructure.	The first local area network is created, which increased in size over the next few years.	The first metropolitan area network is deployed.	First municipal voice and data network (with wireless technology and voice over IP that today connects 24 units with 962 voice nodes and 1,381 data nodes).
Source: Merida IT Department				

Table 2: Merida IT staff and budget (1987-2007)

	Before 1987	**1987-1994**	**1994-2001**	**2001-2007**
IT Staff	It didn't exist	24 people	52 people (24 in the IT department and 28 in peripheral agencies)	99 people (49 in the IT department and 50 in peripheral agencies)
Budget	It didn't exist	$165,000.00 average	$850,000.00 average	$1,900,000.00 average
Source: Merida IT Department				

However, the increase in demand required additional actions. The limited availability of infrastructure, specialized staff, and budget created a complex situation that needed to be addressed not only with budget increases, but also with a more comprehensive organizational transformation in the city of Merida. Some of the problems the CIO of Merida mentioned were (1) limited points of access for citizens (hardware); (2) high dispersion and low integration of existing systems; (3) limited budget to implement IT solutions; (4) lack of coordination and integration among agencies; and (5) lack of IT education and culture among executive-level decision makers.

Table 3: Internet, digital divide, and processes in Merida (1987-2007)

	Before 1987	**1987-1994**	**1994-2001**	**2001-2007**
INTERNET PRESENCE	Total absence.	Total absence.	In 1996, some local governments created a Web presence with static information. In 1998, launched the official website of Merida, (http://www.merida.gob.mx) with objective information, precarious interactivity, and information that was more dynamic.	The municipality website is consolidated as Merida's portal. All public data required by the Law of public information access (Open Government Act) is available. Website content includes both informational and transactional services.
DIGITAL DIVIDE	No actions.	Internal training for the use of systems.	The Digital Virtual Library, with 30 computers with Internet access, opened to the public.	Merida sets up a network of 11 community centers led by the Digital Virtual Library, providing public access to training programs and schools. At the end of 2007, the first 10 parks with wireless Internet are open and free.
PROCESSES	Manual processes.	The city creates the first circle of quality control in order to begin continuous improvements focused on municipal processes	Creation of COMUNI (Municipal Committee of Computing) to be an open space for decision-making regarding technology establishing in this way, the first technological standards. They apply mechanisms for simplifying, documentation, standardization and automation of processes within the framework of continuous improvement.	Documentation of internal processes as a prelude to automation. Focus on continuous improvement continues and standardized processes are achieved through certification processes in ISO 9001-2000. With the use of technology and integration processes, and procedures, five municipal parks open.
Source: Merida IT Department				

3. The leadership role of a local government CIO

This section describes the main motivations for the creation of the CIO position in Merida, as well as some of the positive results that were achieved in Merida in the last few years thanks, at least in part, to the leadership role of the CIO.

3.1 Objectives and motivations for the creation of the CIO office

According to the CIO, the main reason for raising the IT function to the top management level was that "the Merida city council understood that technology is a strategic tool to improve processes in an exponential way, eliminating internal problems and re-work, and adding value." In the case of Merida, there were four additional motivations for the creation of the Office of the CIO: (1) the globalization context; (2) a change in paradigms and ways of thinking about IT; (3) a customer-centric approach; and (4) business pressures related to efficiency and effectiveness of government procedures and services.

A Globalization Context. New social demands, global competition, tax crises, an increase in political competition in Mexico, the development of new technologies, and an increase in demand for local government services pushed the Merida City Council to consider new ways of using IT.

A Change in Paradigms and Ways of Thinking about IT. The CIO of Merida says, "Our way of thinking and acting about IT in the last 17 years has been affected by a series of factors in our environment that have generated important changes." For instance, a new generation of politicians in the Merida City Council identified with the National Action Party (Hahamis et al., 2005) won the elections in Merida, which resulted in more competition among political parties and local governments. One way to compete was using more information technologies for internal operations and the provision of government services. This competitive environment changed the way of thinking about IT and technological sophistication among local governments in the state of Yucatán and elsewhere in Mexico.

A Customer-Centric Approach. The transformation in the Merida city government was also affected by international trends such as new public management (NPM). One of the main characteristics of NPM is a clear customer orientation, which motivated the creation of a position responsible for using information technologies in this customer-centric fashion. Oscar Brito states, "The customer orientation was implemented through a goal of 100% satisfaction. The time frame for a city government is very short, so the results have to be seen in the short-term. They also need to contribute to long-term goals and allow us to have measurable impacts through management and result indicators. At the same time, we also need to highlight the social, economic and political value, in order to obtain the support of elected officials." Therefore, in the city of Merida, IT was seen as a way to generate value for government customers and that helped to obtain support for the creation of the CIO position within the city's top management.

Business and Political Pressures. Historically, local government services in Merida were time consuming and red tape was always a problem. As a consequence, there were also strong pressures from businesses to improve government processes and services. Some of these areas for improvement were simplifying the procedures for opening a business, searching for a job, promoting international trade, fostering society's collective capacity in the use of technology, and creating opportunities for economic and social development. The political pressures and the goal of short-term implementation both contributed to the need for a CIO to lead these changes.

3.2 Some positive results for local eGovernment

Similar to other local governments in the last few years, the objectives of the IT department were diverse and oriented more towards technical support and help desk activities. Then in the 90s the main objective was the automation of select bureaucratic procedures, particularly financial processes. In 2000 the objectives emphasized the development of applications to improve citizen services, using the Internet, the phone, or a one-stop service window. The functions of the CIO were gradually changing from purely operational to more strategic in nature. Structurally, the old IT department was replaced with a new CIO office at the executive level (see Figure 1).

In 1996 the *Ayuntatel* system (a telephone system that provides assistance and support to citizens) in Merida was the first municipal government call center in Mexico dedicated to providing information and services to citizens and allowing reports of government service deficiencies. In 1998, the Merida City Council implemented the first electronic procurement system in a local or state government in Mexico. Once the Office of the CIO was formally created and the IT department incorporated into it, the next step was to address some new service demands. For example, in 2000 the Merida City Council improved the procurement website, making it more interactive. The new version sent questions directly to government suppliers and provided access to payment schedules for goods and services the city government buys. In addition, the site now provides financial services to the city government's suppliers.

3.3 Recent progress and results

In 2002, the City of Merida launched its first interactive online application. It included information about real property taxes, a feature for requesting property values, and a sub-site for construction experts to assess the value of houses. In 2003, the city implemented an integrated system for financial administration. In addition, information systems profiles were created for the city government staff members, who currently manage 28 applications for internal operations and management. The initial efforts were mostly related to informational services. However, three important transformations occurred in 2005. First, online transactions started that year and the city developed a clear emphasis on citizens. Currently, the city government's website offers 16 interactive processing systems online,

including eight online transactions, a virtual shopping cart, and an online job search service. Second, a voice and data municipal network was implemented with a total of 1,300 data nodes and 900 voice nodes (VoIP), linking 24 buildings that cover all local government agencies. Third, a one-stop window to offer 42 services in a single government office was created. Some of these services were urban development licenses, legal services, and local taxes processing. Currently, all service offices in the city work with a one-stop window system. The same model of one-stop window service was used to by the Yucatán state government as a model of technological interaction among government levels.

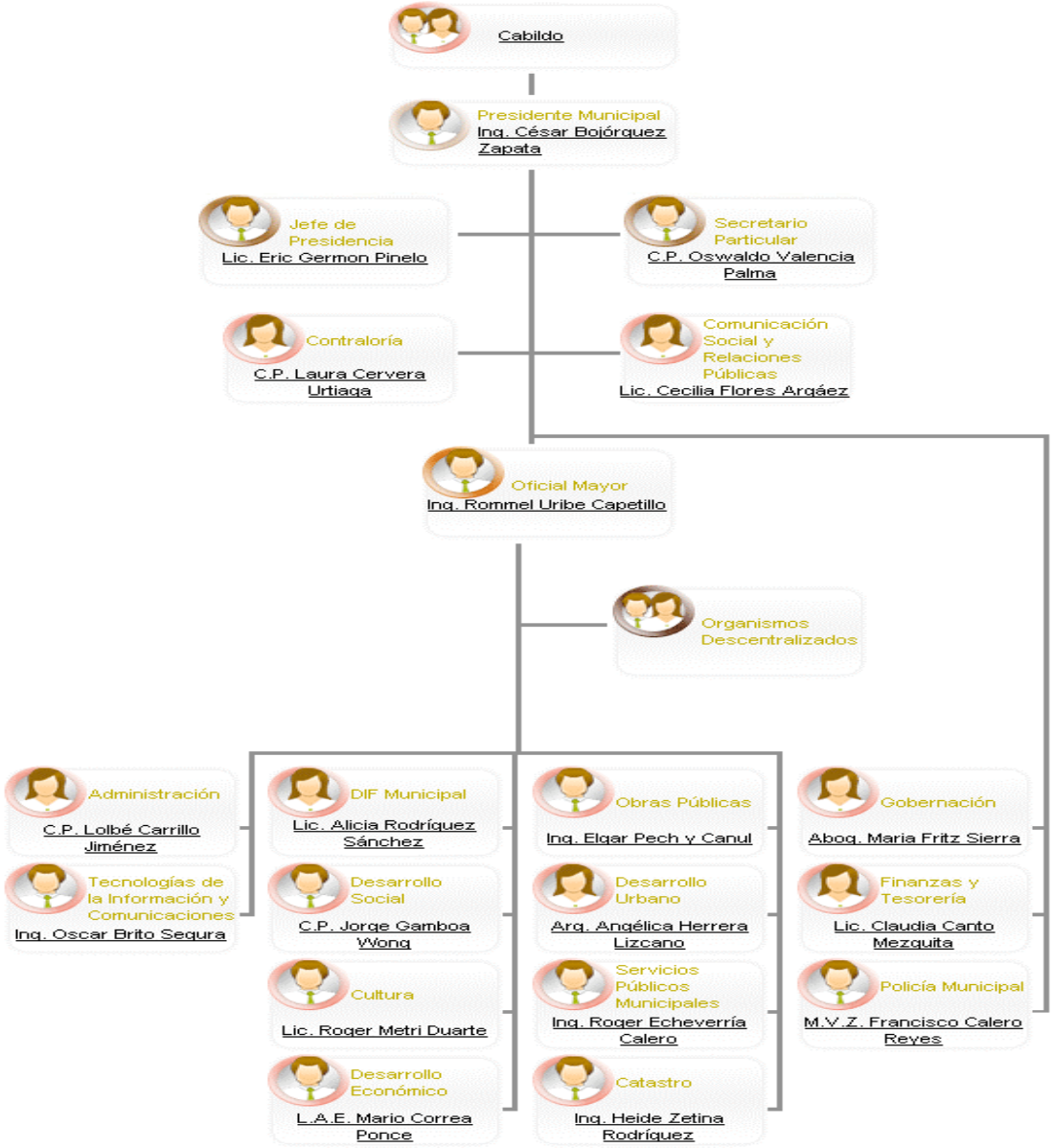

Figure 1: Merida's City Council organization

In Mexico, state authorities usually regulate real estate transactions with public notaries. Yucatán is one of the few Mexican States that transfers the relationships with public notaries to the local governments. In 2006, Merida implemented online services for public notaries, allowing them to process land transfers, tax payments for real estate purchases, official and unofficial blueprints, and property tax registrations. This same year, the Office of the CIO issued the first handbook of guidelines and policies about information and communication technologies for the Merida government. Finally, in 2007 the Merida city government website launched the module for open queries to the city's geographic information system (GIS). This system includes cartographic blueprints, 120 socioeconomic indicator thematic maps, and information related to urban resources, infrastructure, and other topics of interest. In 2007, all processes included in the technology guidelines

and policies for the Merida government were certified under ISO 9001-2000. In addition, in the same year, the first 10 free Internet access parks were opened to the public.

3.4 The role of Merida's CIO

Table 4 shows a summary of the challenges that the CIO of Merida faced in recent years and the solutions he proposed. The CIO provided direction and leadership to establish a strategy for IT implementation in the city. Previous efforts had been random and provided only partial solutions to the problems. The CIO's vision provided an integrative approach to problem solving and significantly helped to overcome the city's challenges. Some of these solutions provided information for decision making to the City Council. Specifically, they helped to reengineer the financial administrative processes that suffered from significant red tape, over-regulation, and lack of effective control mechanisms. The changes included a reform to the legal framework to allow for the implementation of these innovations. In general, these changes solved many problems related to the management and control of Merida's city government. In particular, these actions solved issues related to lack of information, information quality, and slow-processing of public services, payments, municipal public service reports, and job search services. The new focus on the end-user was important in the development of software applications. In addition to these results, the city achieved IT infrastructure improvements (see Table 4). It was the combination of a customer orientation and important investments in IT infrastructure that was essential for the success of the overall IT programs and projects.

Table 4: Challenges and solutions of the CIO of Merida

Challenges	Solutions
Not enough links to operate systems (hardware).	Voice and Data Municipal Network (2005) Hardware acquisition (See Table No. 5)
Low integration of disparate systems.	Suppliers Website (2002) Financial Integration System (2003) Online transaction System. Shopping Cart (2005) One-stop window integration (2005) Notary Public On-line services (2006) Geographic Information System (GIS) 2007
Not enough funds to implement IT solutions.	Budget increased from US $850,000 in 2001 to US $1,900,000 in 2007
Lack of coordination and integration among agencies.	In 1995 the Municipal Committee for Informatics (COMUNI) is informally established by the heads of the computer departments of the municipal branches. In 1998, creation of Information Technology Management Department and the sub-department systems. The department assumes the functions of issuing policies, standards, development, implementation and management of technologies for the city council.
Not enough IT education and culture among the decision makers.	Handbook of guidelines and policies for Merida City Council (2006)

When acquiring new hardware, the Office of the CIO had two goals they wanted to achieve. First, they were trying to obtain better performance power for the existing applications. Second, they were also looking to integrate database systems and increase network connections in order to provide services through cellular phones. As a result, citizens can currently check their taxes, receive weather forecasts, and ask for messages about government services through a SMS message system. The overall IT goals were clearly established in the Municipal Development Plan, which is a three-year plan that every mayor has to develop. In addition, the IT department proposed its own long-term objectives. According to the Merida CIO, there are currently five objectives:

Continuity and Long-Term Vision. From 1991 to 2007, the efforts of the IT departments were focused on creating and maintaining long-term goals and objectives. The IT department was also trying to be more proactive rather than reactive.

Continuous Improvement. The IT department is focusing on the main business processes. Their philosophy is that they can improve long, bureaucratic, and repetitive processes by redesigning them, introducing information technologies, and taking users' feedback into consideration.

Establishing a Technological Vision for Executive Level Managers and Officials. It is necessary for top managers and elected officials to have a shared vision of information technologies and their value for the city government. This need was one of the reasons behind the creation of a CIO, who could work closely with top managers and promote the strategic use of IT across all local government agencies.

Cultural Change. The goal was to introduce important changes in behavior and influence the expectations of individuals across the local government. They were also trying to reduce individual resistance to technology and organizational change.

IT Training and Development. Ninety percent (90%) of all applications the Merida city government uses have been developed in house. Therefore, continuous training and knowledge sharing are very important for making progress and producing IT innovations.

The previous five objectives, as well as the citizen orientation, have been the basis for the work of the IT Department in Merida and they have achieved positive results. However, the department has also faced important challenges. Following, we mention some of these challenges: (1) staff deficiencies such as unmotivated personnel, lack of training, resistance to change, and low educational levels; (2) mid-level public managers lack a vision about technology; (3) lack of human and financial resources; (4) low-quality IT suppliers (equipment, materials, and services) in the region; (5) absence of an adequate legal and regulatory framework (privacy of personal data, security, electronic signatures, electronic invoices, etc.); (6) no collaborative and technological culture among government agencies; (7) significant economic, social, educational, and digital divides among Merida's society; (8) short city government terms and few incentives for long-term vision and the creation of the necessary IT infrastructure; and (9) due to the lack of a national digital government agenda in Mexico, IT initiatives are disconnected and there is no enterprise-wide vision that could guide efforts at the local government level. The CIO of Merida implemented actions to overcome some of these challenges. Consistent with previous studies, most of the problems that the CIO identified were about individuals and organizations, and relatively few were about financial resources or technology (hardware and software).

Another important aspect of implementing IT in the municipal government is the political willingness or support for these changes. The mayors of the City of Merida have supported the implementation of IT solutions. Five mayors have participated in this process, each one with a different leadership style and vision about technology. However, they all contributed to the development of a more strategic use of IT in the city government--from financial resources to the creation of the Office of the CIO. The CIO of Merida explains the impact of this support:

> *"The most important support we received was the promotion of the IT function to the executive level. This helped a lot to introduce important changes, transform substantial processes, and effectively collaborate with other agencies. Another important factor was the introduction of process quality certifications... All of them – the five mayors – have had something in common. They had trust in technology as a factor to add value to the services provided by the city government and a way to impact the well-being of Merida's citizens."*

It is clear that one of the most important actions that produced real transformation in Merida's vision and use of information technologies was the creation of the Merida's Office of the CIO. The CIO's leadership and coordination contributions were fundamental for the development of public policies and specific IT initiatives.

4. Lessons about local government CIO'S

The case of the Merida IT department provides eight topics for discussion of the importance and role of the CIO in the Mexican local governments: (1) a long-term IT strategy; (2) support from elected officials; (3) financial resources; (4) in-house development as a good option; (5) an adequate legal framework; (6) resistance to change; (7) specialized staff, and (8) appropriate digital divide policies. These topics have been identified in the literature as important factors for IT success.

Develop and Consolidate a Long-Term IT Strategy. Due at least in part to the use of the Internet in the 1990s, government agencies began an automation process. In the case of Merida, their initial efforts were not related to the implementation of an eGovernment strategy, but to the adoption of personal computers and the automation of key processes. However, these efforts continued in the following local government administrations and the city laid the foundation for a long-term strategy through the development of committees, public policies, and IT infrastructure. In 2000, this long-term strategy was strengthened as a result of the creation of the Office of the CIO in Merida. The CIO became a real promoter of Merida's long-term IT strategy. Another city following a similar long-term strategy is Guadalajara with eight years of work. Durango's local government has been working on a plan to achieve the digital city certification for six years now.

Obtain the Support of Elected Officials. Undoubtedly, the support of five consecutive mayors in Merida was a very important factor in the transformation of the city government IT department. Many local governments face problems because of a lack of political support for their IT initiatives. In the case of Merida, the competitive environment of Mexican politics increased the pressure for politicians to improve their management structures and processes in order to gain support for the next election. The CIO became a link between top management, elected officials, and his technical staff. He was always promoting new technology uses to create value for the city government and spent a significant amount of his time obtaining support from elected officials and the other executive-level city managers. Not many local governments in Mexico receive the support of the mayor to promote their IT strategy, making Merida a rare exception.

Secure Adequate Financial Resources. Financial resources are always necessary for new initiatives. However, the case of Merida shows that the main problem was not the IT department's budget. In fact, as positive results were obtained from projects, the budget also increased. After the creation of the Office of the CIO, the CIO began negotiating resources for IT developments; as a result, the IT budget doubled from 2001 to 2007. Since then, the CIO has always been able to obtain resources for projects that promise great value for the city of Merida. This access to funding does not mean that there are unlimited resources, but that most of the time good projects get funded. There are not many local governments in Mexico that can secure financial resources for a long-term IT strategy. Most IT strategies change everything every three years, which is the term period of mayors and local government administrations in Mexico.

Understand the Potential Value of In-House Development. Sometimes people think that an IT department can only have success with certain powerful software. In the case of Merida, that was not quite true. Most of the software they use for city government operations was developed in-house and with relatively few resources. It may not be powerful off-the-shelf software, but it is adapted to the city's needs and has been working very well in the improvement of processes and services. A good example of in-house development is the case of an online procurement system that is linked to suppliers and local government agencies. Another example is the development of an online parks system in order to manage their Internet access and to determine if there are problems with the system. With the help of Merida's IT staff, Queretaro's local government also started developing applications in-house and using open source software.

Promote an Adequate Legal Framework. One of the real obstacles for improving the use of IT in local governments is the legal and regulatory framework. Important changes are required for certain IT and security applications and they take place very slowly. It takes too long to change law to match IT needs and technology is a very dynamic sector. A legal framework is essential to support transactions and provide citizens with a sense of security. Regulations are necessary for information security, individual privacy, and for establishing clear ways in which data collected by government can be used. The CIO has become a promoter of legal changes in Merida. He prepares presentations and proposals for the Merida City Council and the state legislature justifying the need for legal and regulatory changes. He has been able to initiate modifications to certain laws and regulations in relation to IT. For example, public notaries who pay taxes for land property sales were not able to perform this payment online and receive an official certificate of this payment until the law was changed and a digital signature was allowed. Currently, most states in Mexico have a legal framework that allows local governments to charge taxes using web applications; two examples are the states of Quintana Roo and Yucatan in the southeast of Mexico.

Show Added Value to Address Resistance to Change. There was individual resistance to change inside the Merida city government. Bureaucrats are reluctant to use a computer system, because they feel this will jeopardize their job stability, which is sometimes true. They are often also afraid to learn new things and many of them feel more comfortable using the traditional manual processes. One strategy is to emphasize the advantages of the new information systems in comparison with the previous work practices in relation to the specific tasks that employees perform. In the case of Merida, the CIO has played this role, highlighting the added value of IT infrastructure and applications not only for individual employees, but also for Merida's population. This identification of value has helped to ameliorate the resistance to change. Ciudad del Carmen's local government, in the southern state of Campeche, has faced strong resistance to change from top government officials who feel they will loose power or control as a result of the use of more information technologies and new systems.

Hire, Train, and Retain Specialized IT Staff. Another challenge is the lack of specialized IT staff. Most of the IT staff in Merida has experience and training through their work, but very few of them had previous IT experience or a strong IT background. That poses a problem in the region, because individuals with good qualifications relocate to Mexico City or work for private companies, but very few decide to work for the local government. In fact, it is very difficult for the Merida IT department to retain its staff over a long period of time. The challenge is to hire good staff, help them to develop expertise, and keep them in the city government at least for the duration of a specific project. Before the creation of the CIO position, that was virtually impossible. Now, the CIO is deeply involved in the hiring process. He also negotiated resources for training and better salaries, and was able to retain several key individuals of the IT staff during his period in office. As another example, Queretaro's local government was able to keep specialized IT staff for more than eight years with the help of a CIO.

Develop and Implement Appropriate Digital Divide Policies. This challenge is related to the demand for eGovernment services. Many people in Merida are aware of information technologies and some of their potential. However, not many use the Internet and government electronic services. There is a need for IT training and guidance to foster meaningful use of information technologies among Merida's people –also known as digital literacy. One of the initial goals of Merida's CIO was to foster the information society through the promotion of IT use in everyday life and the development of easy-to-use information systems such as the government online portals. The CIO has been a very important actor in the development of appropriate digital divide policies. Several local governments in Mexico are promoting free Internet access in public parks through a contract with TELMEX, which is the leading telecommunications company in the country. In contrast, the local government of Boca del Rio in the state of Veracruz has developed its own wimax network across the municipality with good results, but the maintenance costs are very high.

These eight factors were important in the Merida experience and could be seen as potential elements of an eGovernment strategy for local governments. These factors do not necessarily have the same importance in all cases. For some local governments, digital literacy could be the most important challenge; for others, the lack of a long-term strategy could be the main determinant of the results of their eGovernment efforts. However, it is expected that they are all issues commonly found in local governments and, as shown in the case of Merida, the CIO could be a key player in overcoming many of these challenges and developing an integrated IT strategy. Table 5 is a summary of all these achievements.

Therefore, it is clear that the CIO position could be key for local governments. Most cities, towns, and counties have an IT department, but the individual responsible for this department is a low-level staff member who does not have decision-making power and is not in charge of the enterprise-wide IT strategy. For instance, one of the main differences between the case of Merida and other less successful local government experiences in Mexico is the existence of the Office of the CIO. The CIO was the leader of strategic actions such as the coordination of agencies for information sharing, promotion of new laws and regulations, development and management of innovative applications, testing of new products, contracting suppliers, and development of standards, among others. Merida's experience clearly shows the strategic role of the CIO as other local governments may be exploring the possibility of creating this position.

Table 5: Obstacles and solutions of the CIO of Merida City

Obstacles	Solutions
Personnel	Training organization's personnel and making them aware of use of technology advantages. Motivate the organization, especially the ICT area, by means of prize-winning, recognition awards, national and international awards, certificates for their work, and participation in formal organizations that disperse successful cases and encourage idea exchange in the field.
Leadership	Efficient management of human resources and materials that the organization already owned and becoming knowledgeable in the field of technologies.
Cost and Funding	Development of executive projects in simple language that defined the cost-effectiveness of technological developments and their impact on economic, political, social, and organizational aspects.
Suppliers	Due to a lack of serious suppliers, the department's personnel developed, implemented, and managed technological tools that met the organization's needs. Over time, decreased the minimum implementation time.
Legal Issues	Promoting changes in the legal framework (laws and internal regulations) that outlines the duties and processes of Merida's city council to encourage development, implementation, and use of technological tools, as well as technological integration among governmental departments
Organizational Culture	Active participation of intermediary groups such as associations of accountants, public notaries, suppliers, and students, etc. These sectors are triggers of our society's technological culture.
Digital Divide	A massive municipal program directed towards decreasing the digital gap and the stimulation of an electronic culture.
Municipal Terms	Build standardized technologies that allowed for continuity and technological development focused on the long-term, but delivering value in the short-term too.

5. Final comments

This study provides evidence about three important topics. First, the role of the IT function in local governments has been changing, though slowly. Before the Internet era, the IT director was a technical staff member of the municipal government and her or his main function was to provide technical support and helpdesk services to users. Currently, the dynamic nature of the information economy has transformed the CIO into an important decision maker (Chun and Mooney, 2009, Janowski, 2010, Campbell, 2003, Concon, 2006, Hinde, 2005). The case of Merida is a good example of this transition and the new role of the IT function in local governments. Second, the new role of a local government CIO is less focused on technical aspects. Her or his responsibilities have a greater emphasis on developing agreements between agencies, promoting legal changes, making alliances with suppliers, getting strategic information, and applying technology to accomplish the organization's mission (Lee and Kim, 2007, Bowen, 2008). Third, the CIO is a public information steward. Her or his role now includes providing, managing, and increasing the amount and quality of information for decision-making. Information gathering and data mining have become daily tasks for local government CIOs. Currently, improving the technology local government organizations use is just one aspect of their job. The new role of local government CIOs requires the development of innovative ideas that encompass strategy, a customer orientation, and technological innovations (Chun and Mooney, 2009).

There are several opportunities for future research on this topic. First, it would be very interesting to explore the similarities and differences between CIOs from agencies at different levels of government (federal, state and local). A benchmarking study would help to understand the goals, achievements, challenges, and potential solutions for CIOs in different contexts. This article could be considered an initial step towards this goal, but there are many additional aspects that can be researched in this field. A second potential topic would be the impact of the CIO on the performance of the IT function in

local governments. This paper shows data about some motivations, strategies, and the results of certain decisions, but does not evaluate the performance and impact of specific tasks of the CIO. Future studies should assess the impact of the existence of this position in local governments and the impact of that individual's actions. Finally, a third important question for future research is to understand the characteristics and profile of local government CIOs. More knowledge is needed about the impact of certain characteristics of CIOs on their performance and the results that IT departments obtain in local governments. Information technologies have become essential for government operations and CIOs should leverage that fact, not only to improve government services and processes, but also to creatively reinvent how governments could work and relate to citizens by using technologies strategically and at their greatest potential.

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