Developing a GCIO System: Enabling Good Government Through e-Leadership

Jean-Pierre Auffret
George Mason University
4400 University Drive, Fairfax, Virginia
+1 703-993-1000
jauffret@gmu.edu

Elsa Estevez[1], Ignacio Marcovecchio, Tomasz Janowski
United Nations University - IIST
Center for Electronic Governance
P.O. Box 3058, Macao SAR, China
+853 85040499
{elsa, ignacio, tj}@iist.unu.edu

ABSTRACT
Electronic Government (e-Government) has the potential to contribute to the good government agenda through citizen engagement, effective service delivery and improved efficiency in government. However, realizing this potential is dependent on strong Technology Leadership (e-Leadership) realized through executive IT leaders and Government Chief Information Officers (GCIOs). The paper presents the motivation for e-Leadership and GCIOs, introduces the evolving role of GCIOs, and discusses the main components of GCIO systems, such as readiness assessment, legal and regulatory frameworks, institutions, and education and development. It also presents and analyzes the experiences of five countries in establishing GCIO systems including regulatory frameworks, capacity-building programs, organizational support and national mechanisms and policies to coordinate GCIO efforts through cross-agency institutions and programs. Learning from such experiences, the paper proposes a step by step framework for instituting a GCIO system in the public sector.

Categories and Subject Descriptors
K.4.0 [**Computers and Society**]: Public Policy Issues – *Regulation.* K.6.0 [**Management of Computing and Information Systems**]: Project and People Management – *Strategic information systems planning.*

General Terms
Human Factors, Legal Aspects, Management

Keywords
Electronic Government, Chief Information Officer (CIO), Government Chief Information Officer (GCIO), e-Leadership

1. INTRODUCTION
While most countries view Information and Communication Technologies (ICT) as key components of national development strategies, and pursue e-Government programs in this view, many have not undertaken the initiatives to formally strengthen their Technology Leadership (e-Leadership) systems and institutions.

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The importance of strengthening e-Leadership is increasing as the goals, possibilities and aspirations of e-Government become broader and as the corresponding challenges in developing and implementing e-Government programs increase. The "2008 UN Global E-Government Survey: From E-Government to Connected Governance" and the "2010 UN Global E-Government Survey: Leveraging E-Government at a Time of Financial and Economic Crisis" highlight the increasing complexity and challenge of e-Government development, especially as many governments struggle with budget shortfalls resulting from the current economic and financial downturn.

The 2008 Survey describes the enhanced role of e-Government: "The concept of connected government is derived from the whole-of-government approach which is increasingly looking towards technology as a strategic tool and an enabler for public sector innovation and productivity growth." [16]. Likewise, the 2010 Survey describes the possibility of e-Government during a challenging economic period: "Similarly, e-Government can add agility to public service delivery to help governments respond to an expanded set of demands even as revenues fall short." [1].

To meet the enhanced role of e-Government and possibilities offered by it, formalized efforts are required to strengthen e-Leadership systems and institutions. These interrelated and self-reinforcing efforts comprise a GCIO System – a set of activities designed to establish and maintain the CIO role in government. While dependent upon local needs and circumstances, such systems usually consist of the following major elements:

- Legal or regulatory formalization of the roles, responsibilities and reporting lines of GCIOs;
- Development of GCIO institutions to foster cross-ministry or cross-agency collaboration on the issues of IT governance, enterprise architecture, security, program management, human capacity development and procurement; and
- Development of the GCIO and ICT workforce through educational programs to enhance ICT executive leadership.

The rest of the paper is structured as follows. Section 2 presents the evolving role of GCIOs and discusses the main components of GCIO systems - readiness assessment, legal and regulatory

[1] On leave from the Department of Computer Science and Engineering, National University of the South, Argentina

frameworks, institutions, and education and development. Section 3 presents five country experiences in establishing GCIO systems: United States of America, Thailand, Canada, United Kingdom and Singapore. Based on the understanding of the GCIO function and country experiences, Section 4 presents a step by step framework for instituting a GCIO system in the public sector, and outlines an approach for applying such a framework. Finally, Section 5 presents related work and Section 6 draws some conclusions.

2. GCIO – ROLES AND SYSTEMS

The evolving role of GCIO provides the context for e-Leadership and its institutions in government. As the vision and possibilities of e-Government change, so does the corresponding vision of e-Leadership and GCIOs. In the early stages of e-Government, characterized by the introduction of ICT to government agencies and the development of government information portals, e-Leaders functioned much like ICT managers. As e-Government became more complex and strategic, e-Leaders changed into executives who play key roles in the development of strategies for service delivery and increasing the effectiveness of government through ICT. As part of such change, e-Leaders play several roles - chief IT coordinator, chief IT standards enforcer, chief IT budgeter, chief IT strategist, chief IT policy advisor and, most recently, chief IT security officer [2].

To ensure that the required e-Leader roles are successfully played within government and that human capital exists for fulfilling such roles, governments develop GCIO systems. The following sections explain four major elements of such systems - readiness assessment, legal and regulatory frameworks, institutions, and education and development.

2.1 GCIO Readiness Assessment

Many e-Government rankings include considerations of the presence of ICT human capacity and GCIOs. For example, the annual Waseda University e-Government Ranking includes the presence of GCIOs as one component in its ranking calculation. In the discussion of its 2009 ranking, Waseda commented that its ranking should be enhanced to reflect the full system of legal, institutional and educational structures for GCIO 0.

Developing a GCIO system depends on the starting point for e-Government, particularly the results of e-Government Readiness and National e-Readiness assessments. Particular assessment measures include: capabilities and perceptions of current ICT leaders and staff, the resources available for the development of e-Leadership, and the corresponding e-Leadership institutions.

2.2 GCIO Legal and Regulatory Frameworks

The key aspects of GCIO systems are legal and regulatory frameworks that institutionalize the presence of GCIOs and establish their roles and responsibilities. While many countries have established GCIO positions within their civil service structures, an increasing number is now formalizing such positions legislatively in order to strengthen and enhance their role in public administration and management. While the U.S. Clinger-Cohen Act of 1996 was one of the earliest acts of this nature, a number of countries (e.g. the Philippines and Indonesia) have either passed or developed GCIO legislations.

2.3 GCIO Institutions

Coordination amongst GCIOs and ultimately the success of GCIO systems is facilitated by cross-ministry GCIO institutions. In the absence of these institutions, an individual GCIO and its corresponding e-Government programs may be successful in one ministry. However, the overall success of e-Government for the whole public administration system depends on coordination across ministries and agencies. The effectiveness and constancy in the provision of public services and the potential for government transformation are enhanced by common views and synergies on the issues ranging from enterprise architecture to procurement.

One model, with record of successful deployment in practice, is a GCIO Council (or Forum) with roles ranging from formalized responsibilities for enterprise architecture and security, to less formalized focusing on exchange and sharing of best practices. Hanna et al. [11] developed a typology of coordination models including policy and investment coordination, administrative coordination, technical coordination and shared coordination.

2.4 GCIO Education and Development

As part of their GCIO systems, many countries are facilitating GCIO education. These initiatives range from partnering on university masters degree and executive programs, to continuing professional education and establishment of GCIO networks.

3. CASE STUDIES

This section presents five case studies of the countries that implement advanced GCIO systems - USA, Thailand, Canada, UK and Singapore, focusing on legal aspects, as well as organizational development and human capacity-building. The last section compares the case studies and identifies common practices.

3.1 United States of America

The GCIO position in the US Government was created by two Acts of Congress: the Clinger-Cohen Act [10] and the e-Government Act [9]. The Clinger-Cohen Act created the Federal CIO position within the Office of Management and Budget (OMB), and CIO functions in every federal agency. In addition, the Act defined the responsibilities and competencies required for the CIO role. In order to strengthen the CIO position, the e-Government Act created the CIO Council responsible for assisting the Federal CIO in fulfilling its responsibilities. The CIO Council is composed of the CIOs of federal executive agencies, the Deputy Director of OMB and the officers of other councils working on inter-agency collaboration issues. Among others, the CIO Council is responsible for updating every two years the competencies and learning objectives required from CIOs.

One approach for building human capacity for e-Leadership was the establishment of the CIO University. The University trains the current and future e-leaders in the core competencies defined for the Federal CIO. A consortium of universities coordinated by the General Services Administration, the CIO University comprises: i) Carnegie Mellon University; ii) George Mason University; iii) George Washington University; iv) LaSalle University; v) Syracuse University; and vi) the University of Maryland University College. Table 1 lists the members of the consortium and the degrees issued by them.

Table 1. CIO University - Partners and Degrees/Certifications

University	Degree / Certification
Carnegie Mellon University	Federal CIO Certificate Program
George Mason University	Master of Science in Technology Management
George Washington University	Master of Science in Information Systems Technology
LaSalle University	Master of Science in Information Technology Leadership
Syracuse University	Master in Information Management
University of Maryland University College (UMUC)	UMUC CIO Program

With over 1200 graduates since its beginning in 2000, the CIO University represents one of the main initiatives of the US Government for developing e-Leadership.

3.2 Thailand

In 2002, the Government of Thailand developed an ICT Master Plan to drive ICT-related decisions in the country. The plan comprised seven strategies, one of them concerning the implementation of e-Government. This strategy was implemented through several actions including assigning CIOs to lead e-Government initiatives and issuing a set of laws to support ICT development, such as the e-Transaction Law, the Computer Crime Law, the National Information Infrastructure Law, the Data Protection Law and the Electronic Funds Transfer Law.

Based on the ICT Master Plan, the Cabinet defined the CIO function at different levels of the government structure – ministry, agency and department, and also in public enterprises. The main responsibility assigned to the CIO function was designing and controlling the implementation of the unified IT development plans for the whole of government.

Many initiatives were carried out for building human capacity, including the development of a series of intensive training programs and delivering such programs to over five hundred CIOs. In addition, the institutions like the Thammasat University's College of Innovative Education were designated to offer capacity building courses for CIOs, and the Civil Services Commission and the National Electronics and Computer Technology Center (NECTEC) established partnerships for training CIOs.

The Government also promotes international collaboration. For instance, Thailand hosts the Secretariat of the International Academy of CIO (IAC) [12] since 2006. NECTEC, a specialized national center within the Ministry of Science and Technology, represents the Academy for South East Asia.

3.3 Canada (Ontario)

Since the development of the Information Technology Strategy in 1998, the Ontario Government defined the position of a corporate CIO to lead all ICT-related issues in government. To implement the strategy, a new organizational model was defined [1] including the creation of the Office of the Chief Information Technology Officer within the Ministry of Government Services, and a set of clusters grouping government ministries and agencies. The CIO function was defined for each of these clusters, specifying its roles and responsibilities. The function reports to both the Cluster Deputy Minister and the corporate CIO. The responsibilities assigned to corporate CIOs include strategy planning and development, policy making, controllership, architecture and ICT infrastructure development, defining common standards, and ICT-related security and procurement.

The main challenge faced by the Government was the difficulty in recruiting and retaining qualified ICT professionals, particularly the retention of successful leaders. To overcome this challenge, the Government carried out many initiatives like developing staff carrier paths, offering training packages to staff, and youth internship programs. For instance, the IT Internship Program is a two-year program aimed at attracting IT professionals who are just starting their carriers, offering opportunities to strengthen technical, managerial and communication skills.

In addition to government initiatives, a number of educational projects exist aimed at building human capacity for IT Leadership. For instance, the IT Leadership Development Program [5] is a university-level program to prepare technology managers and IT leaders to deal with the challenges faced by current organizations. Operating since 2004, the program is jointly organized by the Ryerson University's Ted Rogers School of Information Technology Management (Toronto, Ontario) and the CIO Summit - a forum for senior IT executives. In addition, other institutions like the CIO Summit also offer courses to CIOs and IT leaders.

3.4 United Kingdom

The UK Government placed the GCIO function within the Cabinet Office, responsible for leading the strategy for transforming and improving public administration using ICT. In order to fulfill such responsibilities, GCIO has a holistic view and understanding of IT applications across the government and is supported by the GCIO Council, created in 2005 to analyze and solve common issues across different levels of government. The Council is directed by the Government CIO and comprises representatives of the central government, government agencies and local governments. Its responsibilities include defining the agenda for GCIOs.

In order to build human capacity, the Government IT Profession program was launched. Targeted at the government IT staff, the program aims to build and train the IT workforce able to develop and deliver quality IT services. In addition, a skill map was established to facilitate the organization of the training programs, including the following topics: Leadership, Business Systems Development, Acquisition, End-User Skills, IT Professionalism, Specialist User Skills and Information Professionalism. The approach followed by the capacity building program is not only providing training in specific IT areas, but identifying existing needs and developing training from a holistic point of view.

To promote collaboration within government, the Civil Service organized a Community of Practice called "Community Space" [8]. By joining the Community, all public servants from IT-related areas can cooperate and share experiences and good practices.

3.5 Singapore

The Government of Singapore established a Government Chief Information Office for executing all ICT-related initiatives. The office is located within the Infocomm Development Authority

(IDA) which is responsible for the development of the ICT industry in Singapore [7]. In turn, IDA is located under the Ministry of Information, Communication and the Arts (MICA). The responsibilities assigned to the Office include: master-planning; project planning; developing ICT systems and capabilities; supervising IT standards, policies, guidelines and procedures; and managing the security of ICT infrastructures.

To support human resources responsible for leading government ICT projects, several initiatives are promoted, like community support and educational programs. Community support for e-Leadership includes the Information Technology Management Association (ITMA), a professional association representing Singapore IT leaders from the public and private sectors [13]. ITMA promotes communication among its members in order to share know-how and experiences in IT management using forums, newsletters, workshops, seminars and other activities. For example, the Toastmaster Club initiative aims at enhancing the communication skills of IT leaders, like the ability to place IT in the context of business values and organizational strategies, as a key skill of GCIO success. Another example is the annual CIO workshop that brings together IT leaders from the region to share good practices and encourage networking.

Regarding educational programs, there are various institutions and programs supporting the education of IT leaders and CIOs. The National University of Singapore (NUS) has two institutes offering training for IT executives and leaders - the Institute of System Sciences (ISS) and the Lee Kuan Yew School of Public Policy (LKY SPP). The former offers courses, postgraduate programs and consultancy services on the topics of innovation, technology and management, while the latter offers training opportunities to IT leaders and policy makers. For example, the Senior Management Program on Leadership and Governance is targeted at top-level managers in private and public organizations.

As part of international collaboration and promotion, the Government of Singapore created the e-Government Leadership Centre (eGL). Established in partnership with NUS, eGL has the goal of sharing knowledge and lessons learnt in e-Government [6]. The center organizes events and courses on theoretical and practical aspects of e-Government. Example events include the CIO Training Program on Strategic Planning and Management of IT, and the Executive Development Program for Government Chief Information Officers. The latter is an intensive ten days program including topics such as IT Strategy and Leadership, IT Portfolio Management, Enterprise Architecture and others.

3.6 Comparison

After reviewing the GCIO experiences of the five governments, this section aims at identifying some common good practices.

All five governments have clearly assigned the responsibility for leading and coordinating government ICT initiatives. While some governments (e.g. USA) passed legislations to define the GCIO function, including its position within the government structure as well as its roles and responsibilities, others (e.g. Thailand) defined GCIO as part of an ICT Master Plan. In recognition of the complexity and importance of responsibilities assigned to the GCIO function, most governments also set up organizational structures to support GCIOs. Some were formally defined, for instance the CIO Councils in the USA and UK, while others have emerged naturally, such as the Community of Space in the UK.

Another good practice is the engagement with regional and international initiatives in the GCIO area, like the participation of Thailand in the International Academy of CIO. Finally, all five case studies show the existence of carefully-designed GCIO capacity building programs. The cooperation between government and academia (e.g. USA and Singapore) is a good practice applied to support the demanding and evolving responsibilities of GCIOs.

Instituting and sustaining a GCIO system also requires overcoming certain typical challenges and barriers. A common challenge is developing qualified human resources to successfully discharge GCIO responsibilities. When appropriate candidates cannot be identified among existing government staff, recruiting people from outside government is increasingly practiced [4]. However, many CIOs from the private sector face difficulties to effectively perform their functions inside government due to different organizational rules and dynamics. In addition, while technically qualified CIOs could be available, their recruitment is challenging due to the lack of knowledge and expertise in specific government issues. Another obstacle for implementing a GCIO system is the prevailing silo mentality in government, and the difficulties to break it. In response, some countries (e.g. Canada) adopted motivation-based methods to encourage the development of collaborative projects and information sharing in government.

4. INSTITUTING A GCIO SYSTEM

After providing the rationale for e-Leadership in government (Section 1), introducing the evolving role and responsibilities of GCIO and the components of GCIO systems (Section 2), and reviewing GCIO experiences of selected countries (Section 3), this section presents a framework for instituting a GCIO system. In particular, Section 4.1 depicts and explains the framework, while Section 4.2 shows how the framework could be applied.

4.1 GCIO System Framework

Introducing a new function in government requires a combination of actions from validating the function and defining regulations, through modifying organizational structures to incorporate the function, to ensuring organizational capacity for performing the function. Based on the review and synthesis of country experiences for establishing and executing GCIO functions in government, we propose a framework to define major activities that must be undertaken for establishing a GCIO system in the public sector. The framework is depicted in Figure 1.

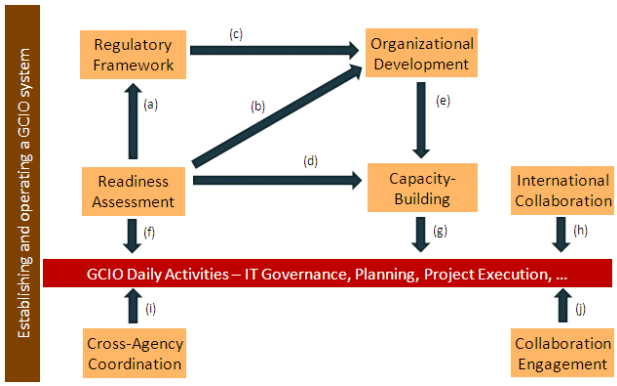

Figure 1. GCIO system framework

The framework involves seven activities - Readiness Assessment, Regulatory Framework, Organizational Development, Capacity-Building, International Collaboration, Cross-Agency Coordination, and Collaboration and Engagement. The aim and scope of each activity is explained as follows:

1) *Readiness Assessment* – The aim of Readiness Assessment is to determine the level of preparedness of the Public Administration (PA) for establishing a GCIO system. The assessment areas are based on major elements affecting the GCIO function (see Figure 2) including:
   - *IT Leadership and Staff* – profile of the PA IT workforce including knowledge, skills, experiences, continuous learning practice and authority for making decisions;
   - *Perceptions* – perceptions of policy and government leaders as well as senior IT staff on the barriers and enablers for IT leadership in the PA;
   - *Resources* – IT-related resources – financial, human, technical, organizational, etc. available in the PA;
   - *Alignment* – portfolio of IT projects planned or under development and its contribution to the PA strategy; and
   - *Regulatory Framework* – current laws, regulations and policies affecting IT-related initiatives in the PA.

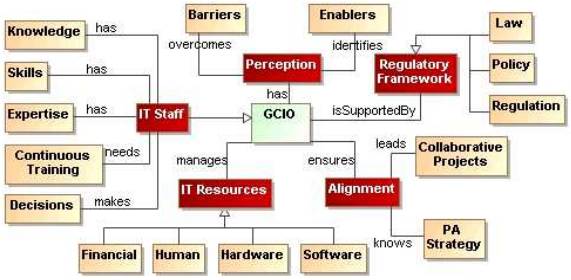

Figure 2. GCIO Conceptual Model

The activity could be conducted by executing a survey and focused group meetings with policy and government leaders and IT Heads across the PA in order to assess four areas – IT Leadership and Staff, Perceptions, IT Resources and Alignment. In addition, interviews could be conducted with appropriate division heads to assess Regulatory Frameworks.

2) *Regulatory Framework* – This activity aims to formalize the e-Leadership function and to provide the necessary legal and regulatory foundations to introduce and operate ICT-driven innovations in the PA. Depending on the legal system in the PA, different instruments can be used like laws, regulations, acts, master plans or policies. In order to formalize the e-Leadership function, the regulations are required to define the GCIO system at various levels of the PA – federal, ministerial, sectoral and departmental, and to define supporting structures like the GCIO Council or high-level commissions, boards or committees. For instance, the GCIO position for all federal agencies and the Chief Information Officer Council in the USA were defined by government acts, while a master plan created the GCIO office in Thailand. Regulations can also define the rules, rights and obligations for the use of ICT-related products and services. Examples are the e-Transaction Law and Computer Crime Law in Thailand, and the Data Protection Act in the UK.

3) *Organizational Development* - After establishing the GCIO function and supporting governance structures, this activity aims to make the function operational in the PA. This includes defining the required competencies for the GCIO positions – experience, knowledge, skills and abilities; identifying prospective candidates; populating the function with the appropriate staff; defining career paths; building partnerships with academic and international organizations to support capacity-building tasks; and establishing a continuous learning practice for IT leaders. The activity should also address all aspects not considered by the Regulatory Framework.

4) *Capacity Building* – The aim of this activity is to provide the continuous training required for executing the GCIO function. Capacity building programs are defined to address in particular the competency requirements of Organizational Development. Such programs may include different type of training like lectures, e-learning courses, study visits, case studies, experimental learning, coaching, etc. Usually, capacity-building tasks for government are executed through partnerships. While planned and monitored by governments, such tasks are typically executed by academic, private or international institutions.

5) *International Collaboration* – This activity aims to strengthen the capacity of the PA for establishing a GCIO system through collaboration with international organizations. By learning from the experience of other countries, the PA can accelerate the process of instituting a GCIO system. In such a process, international organizations can play various roles, such as assisting the PA in networking with the countries that have more mature GCIO systems, facilitating international study visits to help new GCIOs better understand their roles, facilitating participation of GCIOs in international events to interact with their peers, identifying international good practices that could be adopted by the PA, and assisting the PA in localizing such practices.

6) *Cross-Agency Coordination* – The aim of this activity is to support the GCIO role by the development of cross-agency institutions and processes to provide foundations for effective e-Leadership across the whole of government. One of the main transformations requested from GCIOs is breaking the silo-mentality in government. Therefore, all tasks related to cross-agency coordination must be facilitated and enabled, including the execution of collaborative projects to deliver one-stop, seamless services; the reengineering of business processes to eliminate duplications; the implementation of shared services to improve efficiency; the development of software infrastructure to support the deployment and execution of electronic public services; enterprise architecture deployment; developing common practices to address security, procurement and human capacity development; etc.

7) *Collaboration and Engagement* – This activity aims at strengthening the GCIO function through collaboration with peers and through networking with other e-Leaders. Building community support enables GCIOs share problems, solutions and experiences, achieving recognition from their colleagues, greater commitment from the person to fulfilling the function, and a feeling of belonging to the system. All such factors contribute to the development of highly-capable e-Leaders and IT staff in the public sector. Possible approaches for

conducting this activity include developing communities of practice, establishing and maintaining GCIO blogs and forums, publishing and distributing newsletters, and creating knowledge repositories, among others.

Figure 1 also depicts dependencies between activities. Perceptions on the barriers and enablers and the level of authority of senior IT staff (dependency a) can be used by the Regulatory Framework for establishing the GCIO function. For instance, by assigning responsibilities that can help overcome barriers and facilitate enablers, and defining dependency levels to empower the GCIO function. The profile of IT staff and IT projects executed by them (b) can be useful for identifying candidates for the GCIO function and for defining career paths for them, while the role and responsibilities assigned to GCIOs (c) can be useful for defining the required competencies. The gap between competencies of the current IT workforce (d) and competencies required from GCIOs (e) must be addressed by Capacity Building programs. In addition, the staff to be trained (e) can be identified as part of the Organizational Development activity.

The following elements support daily activities of GCIOs. The IT resources (f) identified by Readiness Assessment provide lists of available resources that can be used and managed during project executions. The knowledge, skills and expertise acquired from Capacity Building (g) as well as good practices (h) identified through International Collaboration empower GCIOs with the competencies and solutions used in fulfilling their responsibilities. Finally, the execution of cross-agency projects (i) and the usage of knowledge repositories and support from GCIO communities (j) allow GCIOs to perform their tasks more efficiently.

4.2 Framework Application

The framework includes seven activities needed for establishing and operating GCIO systems - Readiness Assessment, Regulatory Framework, Organizational Development, Capacity-Building, International Collaboration, Cross-Agency Coordination, and Collaboration and Engagement. The execution of the framework can be seen as following a spiral path, depicted in Figure 3. Each loop of the spiral comprises periodic (e.g. annual) execution of the seven activities, where each phase builds on the achievements or expands the capacity produced in previous phases. For example, the Readiness Assessment exercise conducted in the second loop would update the results obtained from the assessment during the first loop, while capacity building performed in the second loop would assume the existence of the capacities built during the first loop and also expand upon them.

Periodic execution of the framework activities has the following benefits: 1) Readiness Assessment – maintaining an updated record of IT leadership and IT workforce in government; 2) Regulatory Framework – providing regulations to incorporate the GCIO function and facilitating the adoption and use of new technologies; 3) Organizational Development – identifying new competencies for managing new technologies as well as staff to be trained; 4) Capacity Building – ensuring continuous training for government IT staff and keeping the training contents up-to-date; 5) International Collaboration – being aware of the lessons learnt by other countries; 6) Cross-Agency Coordination – anchoring the changes introduced by the new culture of collaboration in government; and 7) Collaboration and Engagement – developing and anchoring qualified human resources in GCIO positions.

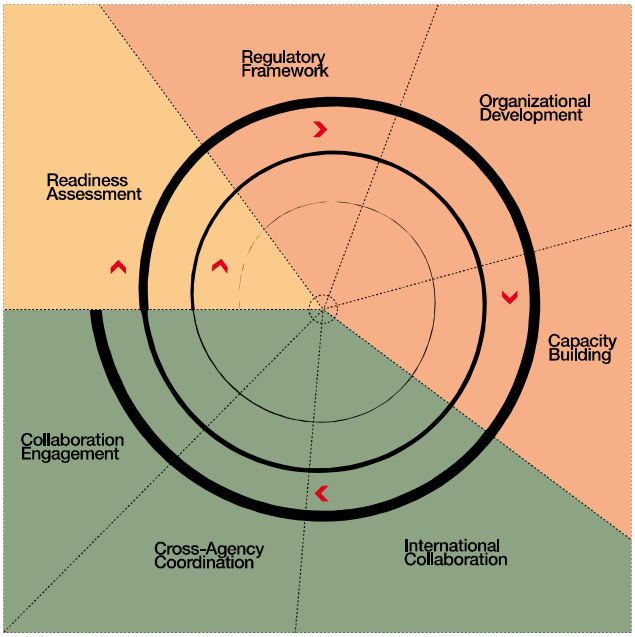

Figure 3. Applying the Framework

5. RELATED WORK

The relevance of the GCIO function for successful development and operation of e-Government has been recognized by well-known international studies and rankings assessing e-Government maturity. For instance, the UN e-Government Survey 2008 [16] recognizes the shift towards a stronger CIO model in many public administrations due to the increasing strategic importance of ICT in management and governance, and the need to align information, technology and strategy. The report highlights that GCIOs have become the heads of e-Government strategies in many countries. As another example, the 2009 Waseda University International e-Government Ranking [18] includes the CIO function in government as one of the main areas to assess, due to its relevance to e-Government success. The ranking highlights the new role of GCIOs, broadening their responsibility for e-service development from strictly technological, to social and managerial. The 2009 edition explains that many of the assessed countries have implemented the GCIO function, with capacity-building programs and structures to support the function.

The GCIO function is also recognized as an approach to building institutional capacity required for e-Government. Institutional models frequently implemented for e-Government are surveyed in [11]. The report highlights four models based on ministerial structures – Policy and Investment Coordination, Technical Coordination, Administrative Coordination, and Shared or No Coordination, and two alternative models based on ICT agencies and CIO Councils. About one-third of countries in the study are instituting or experimenting with national CIO councils and CIOs in ministries and agencies. The responsibilities of such councils usually include investment planning, IT procurement practices, information security policies and IT human resource development. In addition, other responsibilities assigned to CIO councils include consensus building, improving communication across all levels of government, solving problems based on team work, and sharing knowledge and experiences [12].

Many studies also highlight the importance of building human capacity for e-Government [3][15], with recommendations issued for planning human resource development for e-Government [14]: (1) maintaining a skills inventory of employees, (2) assessing skill-gaps for e-Government, (3) forming strategic partnerships with academic and international organizations, and (4) promoting the philosophy of lifelong learning among staff, among others.

The four features are considered by the framework proposed in the paper. For instance, the skills inventory could be maintained using the data produced by Readiness Assessment; Capacity Building could base the training programs on the skill-gaps identified during assessment and facilitate lifelong training of IT workforce; and Organizational Development is responsible for partnership with academic and international institutions.

Also, the framework proposed in the paper includes all major aspects of the GCIO practice by e-Government leaders reviewed in Section 3 - regulatory frameworks that facilitate e-Leadership, human and institutional capacity development, and partnering with academic and international institutions.

6. CONCLUSIONS

e-Leadership has been recognized as a major factor for successful e-Government development and in turn the achievement of Good Governance. Responsible for driving ICT-related transformations and their alignment with organizational strategies, e-Leadership has been recently introduced by various e-Government leaders through the GCIO function. After presenting the motivation for GCIOs and explaining the evolution of their roles, the paper presented major components of a GCIO system, and reviewed the experiences of five countries in establishing and operating such systems, before presenting a framework to institute the CIO function in government. The paper explained various activities of the framework, their implementation approaches, and possible applications in practice. Finally, it outlined the work related to the CIO function and the introduction of this function to government.

The main contribution of the paper is a framework for establishing a GCIO system, a step-by-step approach to introducing and operating the e-Leadership function in the public sector. While country experiences are well documented in literature, we are not aware of any documented model to support the introduction of the e-Leadership function to public administrations.

Future work includes designing a survey to be carried out as part of Readiness Assessment, and refining other activities like Capacity Building in more detail, e.g. defining mechanisms for identifying skill-gaps, defining training programs to address such gaps, and developing curricula for GCIOs, among others.

7. ACKNOWLEDGMENTS

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