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ONE COUNTRY, THREE TYPES OF CIOS: THE EMERGENCE OF TECHNOLOGY EXECUTIVES IN CHINA

"TECHNOLOGY ADOPTION AND INNOVATION DEMANDS OUR BUSINESS TO BEND LIKE BAMBOO"

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ABSTRACT

In this research, we investigated the differences in the roles and responsibilities across the CIO's job across three main regions of one country – China. We studied how the roles and responsibilities CIOs of Hong Kong, mainland China, and Taiwan varied across each region. We found that the roles and responsibilities of China's CIOs were heavily influenced by the region's government strategy and the maturity of the region's public technology infrastructure. Our second finding was that the degree to which a CIO's ability to evolve his/her roles and responsibilities was constrained / encouraged by the ability to collaborate with the government's initiatives to develop infrastructure and to leverage technological resources. And our third finding was that a CIO's exposure to global business partner's operations, technologies, and processes influenced how and when the technology executive developed and matured their current roles and responsibilities.

CIO roles have evolved to reflect the information systems (IS) infrastructure and strategy of their own firms, leading to two versions of the role: one, an executive-level manager who is focused on the firm's strategy and processes; the other a technical manager focused on minimizing costs and increasing revenue through the rationalization and by leveraging the country's and firm's existing IS infrastructure. The degree to which a firm has standardized its IS architecture infrastructure and the degree to which IS enables core products, services, processes, or competitive advantage of the firm impacts the nature of the role.

Keywords: Chief Information Officer; CIO; Technology Executive; Digital Transformation; China

INTRODUCTION

For over 45 years, Information Systems (IS) researchers have researched the roles and responsibilities of the United States Chief Information Officers (CIO) [e.g., 2, 7, 14, 32]. Over this time, the role of technology has evolved from a role of general avoidance to one of embracement and change. Whether through cost reduction or innovation, the CIO has played a critical role in ensuring that organizations have received sustained or innovative services amidst drastically shrinking budgets [14, 18]. Yet in many organizations, the IT function has been seen as a hindrance rather than an enabler of the firm's ability to innovate. Successful CIOs have expanded their roles and responsibilities from IT cost center managers to business-savvy enterprise leaders [11]. These CIOs were full C-suite peers and have adapted their roles, responsibilities, and skills to match the changing needs of the enterprise and the marketplace within which they operate. They were responsible for educating colleagues and stakeholders and leading change both horizontally and vertically throughout their organizations [17].

Within the last 25 years, China has begun to play a significant role in technological and global usage and innovation [33]. The country has grown to be the second largest economy in the world, and studies like this are warranted to better understand how to shape and influence the roles of their technology executives. As more Chinese government agencies, State Owned Enterprises, and private firms leverage technology to enhance their operations and to engage in innovation, the reliance on technology to provide sound IS support has become even more imperative and dependent on the environment for which they operate [33]. In this paper, we used the World Economic Forum's framework on establishing digital ecosystems and the factors that influence an environment's development to understand how the roles and responsibilities of Chinese senior executives have been developed, adapted, and evolved to match the unique environments for which their businesses operate. In particular, we engaged in a research project to study how the roles and responsibilities of CIOs across three regions of China – Hong Kong (HK), mainland China, and Taiwan. These three economic centers were chosen because they are part of greater China but distinct in terms of history, infrastructure and economic development. It was envisioned that these distinctions would help illuminate the dynamics of this evolving technology executive role in China.

The research question posed in this study is: *How have regional government strategies and economic factors influenced the roles and responsibilities of Chinese Technology Executives?* The goals of this study were threefold: 1) to understand how the country's regional government strategy and technical infrastructure have developed and impacted the formation and establishment of the Chinese technology executive's roles & responsibilities 2) to understand how key economic factors can influence and modify the roles and responsibilities of CIOs across three Chinese economic regions (Hong Kong, Mainland China, and Taiwan), and 3) to identify the key characteristics and roles that are necessary for CIOs in across these three regions of China. Later in this paper, we provide evidence to argue that the technology executive's leadership roles and responsibilities are uniquely influenced by the specific characteristics of regional digital ecosystems.

LITERATURE REVIEW

The Evolution of CIO Roles & Responsibilities

Over the last 45 years, the title of the senior information systems (IS) executive has changed from Data Processing (DP) Manager, to Management Information Systems (MIS) Manager / Vice President, to CIO as the underlying roles and responsibilities of the positions have changed. These changes in the technology executives emerged because of technological and competitive factors - both internal and external to the firm. These changes have forced companies to rethink and re-strategize how they use IT resources to improve operational efficiency and competitiveness. Internally, companies have more completely integrated their technical resources with their business operations to develop organizational capabilities and to establish new competitive advantages. Externally, new competitive challenges and opportunities have motivated business executives to rely on the IS executive to use the company's IT resources to drive strategic change within and outside the organization. Furthermore, industry regulations have led to firms to turn to the IS executive to facilitate and achieve compliance.

In a study on management information systems (MIS) executives, Wetherbe and Whitehead [34] found that there was a strong distinction among the roles of MIS executives that related to two primary sub-organizations within the IS function – operations and development. They described operations as somewhat of

a closed, stable, and mechanistic environment which required the use of formal policies and procedures. The development environment was described as a relatively open, adaptive, and organic, an environment where the managers were required to function in a flexible, decentralized, decision making, and autonomous mode. Ives and Olson [18] described the IS manager's role as that of a technician who was responsible for managing a relatively unimportant service function. They also indicated that MIS managers tended to list their primary objectives and motivations as those related to measures of system efficiency rather than to effectiveness.

Research conducted in the 1970's and 1980's generally depicted the senior IS executive as one who served the organization by acquiring, implementing, and maintaining the technical infrastructure to processes and store information within the firm. In the title of CIO was introduced to describe a new breed of IS executive that had been elevated to a C-level position within certain firms, who would assume senior executive stewardship of the firm's information resources. During this time, CIOs transformed their roles from that of primarily a technical manager to that of a technical and organizational manager who was capable of leading efforts to deploy IS that generated value-adding information for the firm.

In the early 1990s research found that the characteristics of IS executives had undergone a fundamental change over the previous decade. These executives focused on strategic technology planning and control, IT architecture management and standards development, and human resource management [1, 13, 17, 18]. Also during the 1990s most of the studies on the CIO [e.g., 2, 19, 22, 27, 28] argued that the primary issues influencing and shaping the CIO's role arose from factors primarily *within* the firm. Only towards the end of this decade did researchers begin to address the effects of *external* factors impacting the use and management of the firm's IS. At that point researchers began to argue that the firm's business functions have become more heavily involved with, and dependent upon, IT from an operational and strategic standpoint [3, 29].

Feeny and Willcocks [14] identified nine core IS capabilities that executives possessed while exploiting IT. These capabilities fell within three main domains of CIO responsibilities: 1) the identification and establishment of business and an IT vision, 2) the design of a firm's IT architecture, and 3) the delivery of information systems (Figure 1). The nine core IS capabilities identified in this research were: *Leadership* – integrating IS efforts with the business purpose and activities; *Business systems thinking* – envisioning the business process that technology makes possible; *Relationship building* -- getting their businesses constructively engaged in IS issues; *Architecture planning* -- creating a blueprint for a technical platform that responds to current and future business plans; *Making technology work* -- rapidly achieving technical progress; *Informed buying* -- managing the IS sourcing strategy in a way that meets the interest of the business; *Contract facilitation* -- ensuring the success of existing contacts of IS services; *Contract monitoring* -- protecting the business's contractual positions; *Vendor development* -- identifying the potential added value of IS service suppliers.

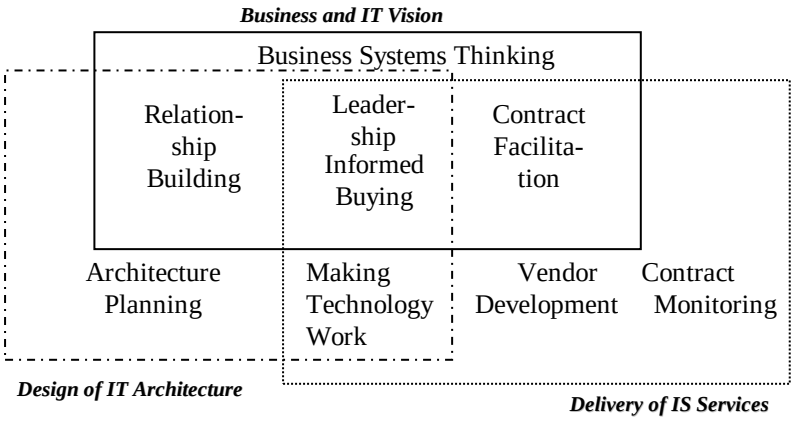

Figure 1: Feeny & Willcocks, 1998, "Nine Core IS Capabilities"

Over the recent past ten years, practitioner-oriented commentaries on CIOs have argued that these executive roles have continued to fail to provide value for their organizations and have become obsolete for today's quickly changing work environment [4, 5, 6, 25]. However, other researchers have argued that the role of the CIO had evolved to one responsible for weaving the IT infrastructure and capabilities into the fabric of business operations [9, 11, 16, 18, 20, 21, 23, 26]. Chun and Mooney [7] argued that the ability for CIOs to change and evolve their roles is highly dependent on two factors: 1) the extent to which a firm has standardized and integrated its IS infrastructure and 2) the degree to which IT is core to the firm's product, service, processes, or competitive positioning. They found evidence to argue that the evolution of the CIO role has bifurcated into two roles – one of a Director of IT and a second of the Chief Innovations Officer. (Figure 2). This research has found that corporations have experienced a significant evolution of the CIO's role, with these executives increasingly playing a key, strategic, and forward-looking executive role for the organization.

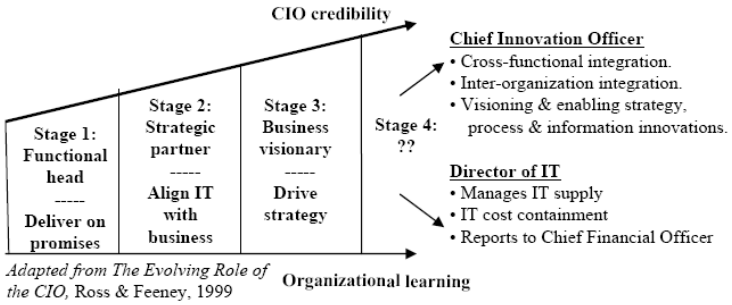

Figure 2: Chun & Mooney, 2009, Bifurcated CIO Roles

There is very limited research that exists in the current body of research literature on the roles and responsibilities of Chinese CIOs. Little is known about how the identification, establishment, and development of skill-sets of CIOs exist in China [33]. In particular, this gap suggests a need to investigate how the role of the CIO exists in China and to determine how CIO roles differ across the three main regions of China – Hong Kong, Mainland China, and Taiwan. In particular, this research is interested in also investigating how a country's regional economic environment and the government's intervention can aid (or hinder) the development of CIO roles and responsibilities. This juncture marks the point of departure for this research. In this research we utilize the literature on the digital ecosystems to help understand the factors that affect a country's regional environments for which firms operate across China. The definitions within the literature of digital ecosystems helped to better establish and understand who controls the development of economic environments and the roles that are needed for development and change within the ecosystem. The factors influencing the development of digital ecosystems offered in the World Economic Forum's report [35] offers 7 dimensions to better understand how market and government intervention can change the existing technology landscape and usage. These findings will also provide useful in a comparison between how CIO roles and responsibilities are established in the United States and China.

The Influence of Digital Ecosystem and Key Factors on the Development of CIO Roles & Responsibilities

A publication by the World Economic Forum [35] provided a framework and discussed how the convergence of digital users in the digital ecosystem (i.e., IT, Telecommunications Companies, and the Media and Entertainment companies) has influenced the establishment of digital communities. Digital users is defined as users, companies, governments and civil society, as well as the infrastructure that enable and empower (or not) users to engage in digital interactions. It is also defined as how these users take control of when, where, and how they access and consume digital content. In particular, the publication identified three types of digital ecosystems that can exist within a national or regional infrastructure - *Conventional Hierarchy, Disintegrated, and Open Community* (see Figure 3). *Conventional Hierarchy* was generally defined in the publication as a digital

ecosystem that exhibited a more formally established and closed infrastructure development. An example of this type of digital ecosystem would be a state run government infrastructure, whereby the nation's government provides the framework, oversight, and execution over its technology infrastructure. A *Disintegrated* digital ecosystem was generally defined in the publication as a formally established environment, where there was more evidence of open development of the infrastructure from key players. A scenario where multiple federal agency affiliations (e.g., armed forces branches) with an integrated or shared infrastructure and digital strategy would be an example of this type of digital ecosystem. An *Open Community* was defined in the publication as a digital ecosystem where it was generally categorized by the grass-roots community of digital infrastructure, whereby many are encouraged to openly contribute and develop the digital ecosystem. An example of this type of digital ecosystem would be a situation like Linux, where different entities and agencies are able to openly & freely contribute, share, and develop products using the resources of others in the ecosystem.

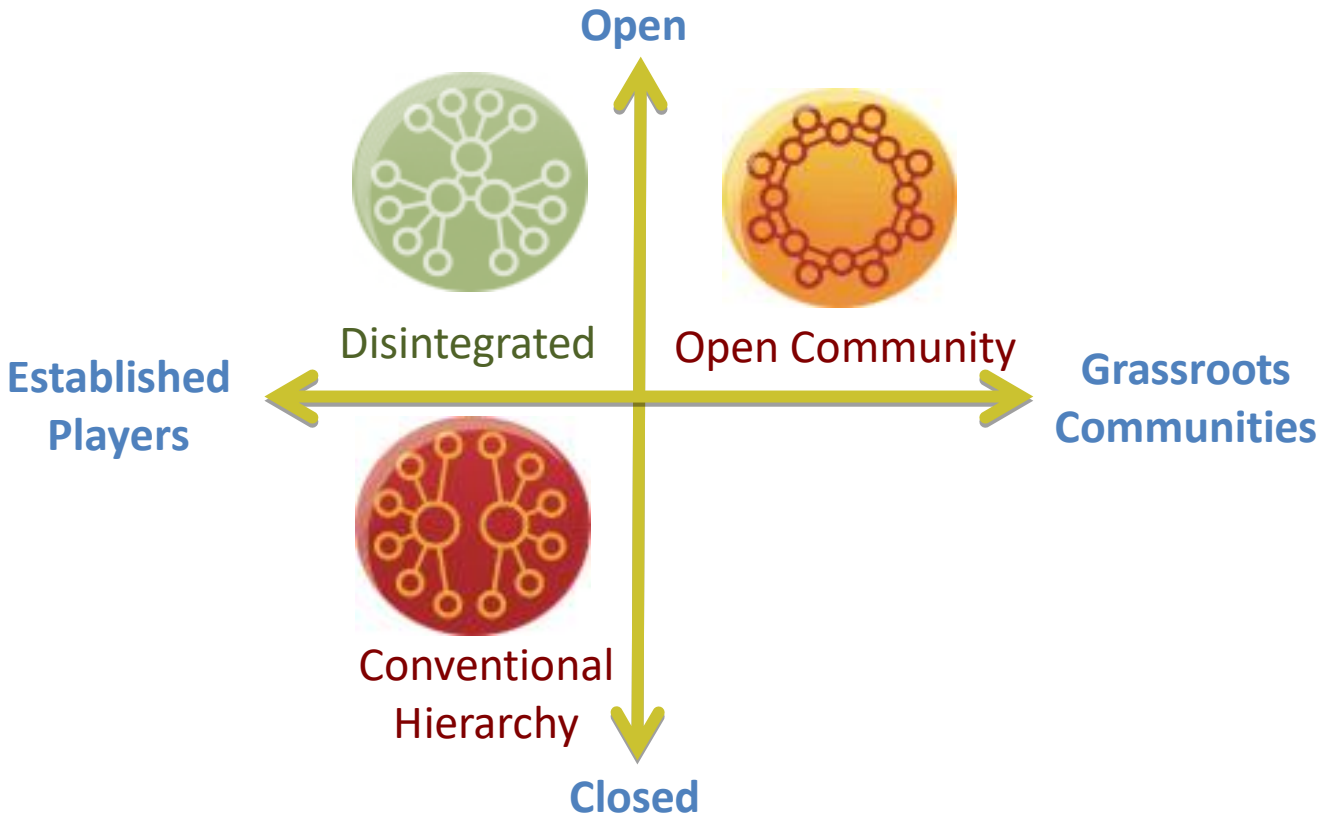

Figure 3: World Economic Forum Framework on Digital Ecosystems

The publication also identified and provided seven key factors that can influence the establishment and development of a nation's or region's digital ecosystem. The seven factors include: Global Environment, User Empowerment, Market Structure, Market Regulation, Intellectual Property Rights, Security & Privacy, and Innovation. The World Economic Forum's framework on digital ecosystems was applicable in this research because it aided in understanding the reasons for leadership development in the different types of ecosystems across the three regions of China. Table 1 summarizes how each of the seven key factors identified by the World Economic Forum's Digital Ecosystems framework differently affected each of the three types of digital ecosystems (i.e., Conventional Hierarchy, Disintegrated, Open Community).

For the purposes of this study, we leveraged this framework to better understand the digital ecosystem context for which the CIOs of three regions across China operated, and to investigate how each of the seven key factors influenced these CIOs were required to adapt their roles and responsibilities to accommodate their respective digital ecosystems that they operated in (Table 4). Given that there appears to be differences in the CIO roles and responsibilities across Taiwan, Hong Kong and mainland China, this framework helped us to better understand and explain why the phenomenon exists.

We adapted the World Economic Forum's framework on digital ecosystems (Table 1) to reflect the environment and the seven factors that can influence the development of the CIOs roles and responsibilities. For the purposes of this research, we define *Conventional Hierarchy* here as a digital environment where online security concerns create an environment for consumers, businesses, and governments to operate in a protective and controlled setting. Typically businesses and governments operate on closed standards, resulting in users being constrained by the infrastructure, access to resources, and limited innovation purposefully established in the industry. We also define *Disintegrated* here as a digital world where users, governments and businesses favor interoperability, leading to a diverse range of offerings to become viable propositions. This digital economy is dominated by intermediaries that effectively connect to other consumers who have similar mindsets and who can best complement each other's needs. Here, the strength of ties among all those involved is where the power lies. The term *Open Community* is used here as a digital world where the rise of organic grassroots communities create value through creating new types of organization structures and creating innovative digital experiences that are unique and personalized to the individual. The motivation for survival in this type of economy is to capitalize on distributed innovation.

This research sought to study the establishment of digital ecosystems arose across three distinctive regions across China (i.e., Mainland China, Hong Kong, and Taiwan) and to understand how it has influenced the development of roles and responsibilities of Chinese CIOs. To pursue this investigation, we first mapped our research data to the digital ecosystem framework to determine which of the three categories best described the three unique Chinese regions we investigated. We then used the seven factors described in the framework (Table 1) to provide context about how the roles and responsibilities of Chinese CIOs can be uniquely moderated across different regions. Finally, we mapped our research data across the nine core IS capabilities described by Feeney and Willcocks [14] to provide additional context as to how the establishment of Chinese CIO roles and responsibilities uniquely evolved across each of the three regions. The research question posed in this study is: *How have regional government strategies and economic factors influenced the roles and responsibilities of Chinese Technology Executives?* The goals of this study were threefold: 1) to understand how the country's regional government strategy and technical infrastructure have developed and impacted the formation and establishment of the Chinese technology executive's roles & responsibilities 2) to understand how key economic factors can influence and modify the roles and responsibilities of CIOs across three Chinese economic regions (Hong Kong, Mainland China, and Taiwan), and 3) to identify the key characteristics and roles that are necessary for CIOs in across these three regions of China. Later in this paper, we provide evidence to argue that the technology executive's leadership roles and responsibilities are uniquely influenced by the specific characteristics of regional digital ecosystems.

Table 1: Key Factors Influencing the Development of Digital Ecosystems

* Adapted from the World Economic Forum's framework on Digital Ecosystems.	**Conventional Hierarchy**	**Disintegrated**	**Open Community**
Global Environment	• Unstable global environment encourages protection. • Focus on local distinctiveness	• Stable global environment fosters cooperation and openness. • Worldwide culture and sense of global cooperation.	• International cooperation and openness facilitated by global geopolitical stability. • Global connectedness & collaboration around common interests and initiatives.
User empowerment	• User & community involvement accepted in industry. • Economic value captured primarily by industry.	• Industry embraces user creation and competes for it. • Limited, but growing opportunities for economic value creation.	• Users lead the establishment of rules and collaboration. • Organic communities are economically significant.
Market structure	• Large & vertically integrated consortiums offer end-to-end customized bundles on proprietary, closed, and incompatible platforms dominate. • Large barriers to entry.	• Organized around a few large and powerful intermediaries and specialized niche businesses. • Low switching costs and low barriers to entry.	• Value network is fragment, volatile, highly innovative. • Specialized offering targeted at niche markets dominate. • Digital ecosystem is diverse and bottom-up.
Market regulation	• De-emphasis of anti-trust concerns and non-discrimination by service and content providers. • Networks and convergence services are subject to licensing.	• Governments actively support and enforce open and interoperable systems.	• Governments respond to lobbying power of users through self-governance of digital community.
Intellectual Property Rights	• Industry leaders collaborate to establish corporate proprietary IPR technologies.	• IPR actively facilitated, monitored, and enforced.	• IPR are diversified. Licensing is often open source. • Businesses adopt interoperable digital rights management techniques.
Security & Privacy	• Government and industry players closely cooperate to establish more control and security. • Limited privacy due to tracking of user's digital activities.	• Self-regulation of security & privacy to maintain brand equity. • Government-industry co-regulation improves cross-border enforcement.	• Self-governing communities become commonly accepted. • Digital identity owned and managed by users.
Innovation	• Innovation takes place inside the consortia. • Limited grassroots disruptive innovations.	• Industry led innovation, focused on leveraging community power, personalization, and niche markets. • Economic value captured primarily by industry.	• Innovation is community driven. • Businesses experiment with organizational structure to exploit user and grassroots innovation.

RESEARCH APPROACH

Prior research has found that the role of the CIO has changed and evolved over time. This prompted us to engage in this research investigation using an exploratory multiple case study approach, incorporating a temporal ordering process model [10]. This research design enabled us to explore the phenomenon at hand in a natural setting, and to engage in theory-building in an area where there has been relatively little prior research and theory formulation [10]. The unit of analysis focused on CIOs across three regions across China. The strategy that we used to collect the data is known as triangulation, involving multiple methods for collecting historical and longitudinal data [36]. Extensive and available documentation, in addition to the availability of key technology executives for interviews, made this study possible [10, 15]. Multiple sources of data (e.g. participant observation, open / structured interviews, etc.) were collected to enable the researchers to map out the sequence of events and to better understand how key economic factors shaped and affected the CIO roles and responsibilities [30]. The data collection for this research study was justified for this research because it involved multiple methods of collecting data and helped to deal with problems of establishing reliability and construct validity [10].

Over a seven year time period (2013 – 2019), the data were collected in two different phases. In the first phase of the data collection, we collected and analyzed secondary research data sources to document the general characteristics, responsibilities, and roles of the CIO. We initially collected the job listings for CIO positions from various public sources such as CIO community publications, newspapers, and trade magazines. We also reviewed academic articles related to the CIO roles in academic and practitioner-oriented journals, and identified the key roles and responsibilities of the senior IS executive. These sources of secondary research data provided a valuable source of data, as it provided an indication and validated key characteristics that were needed to establishing analytical codes and to aid in determining the direction of this research investigation [30].

We then categorized this data according to job function and ordered the data to develop a generalized framework for the evolution of the CIO role over time. Analytical codes were created to reflect the themes used by the interviewees in explaining the roles and responsibilities that these CIOs established. These codes helped to segment the data into more manageable categories. The analytical codes and sources of evidence were then grouped into natural categories in order to segment the data into different dimensions of IT capabilities. These dimensions were then used to segregate the data, to tabulate the frequency of events, and to document the evidence supporting theoretical predictions. Coding the data and grouping the evidence by dimensions also enabled the researcher to discover themes within the data, to raise questions, and to provide provisional answers about the relationships among the variables. This process of analysis also helped to expand and tease out the data in order to formulate new questions and levels of interpretation [8]. Once coding was completed, the researcher explored the data in order to generate meanings [8]. This research approach gave insights into a cross-sectional study to enable temporal ordering of the data, which provided opportunities to determine the cause and effect of events that occurred over the seven years of this study. This framework and process also assisted the researchers in developing an interview protocol.

In the second phase of data collection (2013 – 2019) interviews were conducted with 43 Chinese CIOs drawn from diverse businesses – government agencies, State Owned Enterprises, and private corporations across three regions of China (Table 2). The interview protocol is provided in Attachment #1. All CIOs interviewed for this study were executives of agencies and firms that were considered top leaders in their respective industries and organizations. These firms, agencies, and industries represented are described in the table. The interview format was semi-structured and used open-ended questions. The interview phase provided primary data on CIO perspectives and interpretations of their current roles and responsibilities, as well as their perspectives on the critical attributes currently required to be successful in these roles. Interviews provided insight into how these executive roles and responsibilities were developed over time and the factors which influenced their roles. In particular, the interviews helped this research to gain an understanding of the executives' perception (i.e., the interviewee's contribution, attitude, and motivation), to identify the key events that happened over time, and to understand how decisions were influenced and made. The interviews also helped the researchers to understand how these executives interacted with and influenced executive managers, divisional executives, directors, managers, employees, contractors, customers and ex-employees of the Procurement, IT, and Finance Departments. The interviews were tape recorded, translated, and transcribed. A database was generated to organize and document the data collected from the field interviews and secondary data research [3].

Table 2: List of CIO Interviews

Company Description	Public / Private	Country of Origin
Largest District City Government Office	Public	Taiwan
Country Finance Division	Public	Taiwan
Country Transportation Office	Public	Taiwan
Country City Government Office	Public	Taiwan
Accounting and Budgeting Department	Public	Taiwan
Payroll and Banking Department	Public	Taiwan
Government Finance Department	Public	Taiwan
National Economic & Development Office	Public	Taiwan
Blood Bank & Services Department	Private	Taiwan
Higher Education Department	Public	Taiwan
Immigration Services	Public	Taiwan
Semiconductor Manufacturer	Private	Taiwan
Household Electronics Manufacturer	Private	Taiwan
Electronics Manufacturer	Private	Taiwan
Consumer Electronics Distributor	Private	Taiwan
Electric Vehicle Manufacturer	Private	Taiwan
Gaming & Virtual Reality Company	Private	Taiwan
Government Information Agency	Public	Mainland China
National and Regional Finance Office	Public	Mainland China
National Government Division Office	Public	Mainland China
Technology & Science Industry Park	Private	Mainland China
National Information Center	Public	Mainland China
Regional Economic & Development Commission	Public	Mainland China
Official National Agency of Information	Public	Mainland China
Leading Internet Search Company	Public	Mainland China
Government Bank Division of China	Public	Mainland China
Telecommunications Corporation in Shanghai	Private	Mainland China
Financial Holding Group	Private	Mainland China
Leading transportation & Logistics Company	Private	Mainland China
Leading Global Beauty & Makeup Manufacturing Firm	Private	Mainland China
IT Consulting Firm	Private	Mainland China
Leading Fashion Retail Global Conglomerate	Private	Mainland China
IT Telecommunications Provider	Private	Mainland China
Leading Telecommunications Provider	Private	Hong Kong
Leading high-end Fashion Retailer	Private	Hong Kong
One of the Largest Banks in China	Private	Hong Kong
European Transportation & Logistics Corporation	Private	Hong Kong
Healthcare Management Services	Private	Hong Kong
Prominent Securities & Exchange Commission	Public	Hong Kong
Prominent Hotel Chain	Private	Hong Kong
Transportation & Logistics Corporation	Private	Hong Kong
Operations & Transportation Corporation	Private	Hong Kong
Third Party Telecommunications Service Provider	Private	Hong Kong

In analyzing the research data, the analysis and convergence on the multiple sources of data supported the validity of our findings. We then used the codes established in phase one to match the data among the three data sets to identify common threads and to develop an understanding of the changing and evolving CIO roles and responsibilities. We modified and enhanced additional codes based on any new themes that were represented in and emerged from the data. Researchers involved with this project cross engaged in cross verification and validation of coding the data in order to bolster inter-rater reliability of the coding procedures and accuracy [15]. Next, we looked for matching patterns of activities across multiple sources of data. This allowed us to identify qualifications or gaps in responsibilities that were inconsistent among the three data sets. Patterns identified in the data were then compared with patterns that would be predicted by the extant literature. For the patterns that coincided, the results helped to strengthen the internal validity of the case study [15, 24]. For the patterns that did not coincide with theory, the results helped to identify potential contributions to extend existing literature and understanding [15, 24].

RESULTS

Mainland China

China was one of the world's four remaining socialist states that espoused communism (Table 3). With 1.43 billion citizens, China is comprised of 31 providences and 517 cities. Aside from the larger cities like Beijing, Shanghai, Guangzhou, many of the mainland China cities have remained largely independent and isolated from being able to integrate its infrastructure with other cities and the national government. The Cultural Revolution (aka, Chinese Civil War, 1966 - 1976) established an environment of scarce resources, which resulted in the general public have little to no access to basic resources. Up until the last 10 years, the business landscape consisted primarily of government agencies and state owned enterprises (SOEs), whereby the government had very strict and close control over how technology was used to conduct business.

Recently, Mainland China has seen a more prominent influx of private corporations, many which operate somewhat under limited influence or heavy regulation from the government. With a heavy influence on Government rule, many State Owned Enterprises began to establish a prosperous business environment that generated profits to grow the national economy. As the Chinese economy began to experience a 10% annual economic growth, citizens began to focus on making quick and plentiful profits so that families and communities would prosper from business success. The primary focus of Chinese business has been on manufacturing. The revolution contributed to the desire to make quick and bountiful profits, whereby encouraging Chinese businesses to promote and engage in short business cycles. This resulted in establishing a nimble and flexible business environment, enabling companies to enter and exit markets as the business opportunity presented itself.

Table 3: CIO Roles, Business Environments, & Technology Uses Affecting CIO Roles Across China

	Mainland China	**Hong Kong**	**Taiwan**
General Role of the CIO	Data processor	Supply Chain Facilitator and Executor	Coordinator and innovator.
Business Planning Cycle	Short: 1-5 years	Medium: 5-7 years	Medium/Long: 3-15 years
Technology Planning Cycle	Short: 1-5 years	Medium: 5-10 years	Long: 5-15 years
Maturity of Industry	Young & bustling	Mature	Young & Accelerating
Primary Industry Focus	Manufacturing	Service & Operations Management; Finance	Service & Manufacturing; Technology Innovation

From a technology perspective, the Chinese government began to establish the Golden Projects in 1993 to unify the country's IT infrastructure and to provide a platform for the government and its agencies to share information. Technology was generally perceived as a tool to control, to standardize, to facilitate, and to monitor business transactions within the country. The country's IS strategy is generally seen to have a focus on stabilization and being risk adverse. For many SOE and private corporations, the infrastructure focuses on ena-

bling silo application as determined by functionality. There were limited common infrastructure or technology resources available to private corporations. Hence, divergent technologies, processes, and functions are commonplace in the workplace. This is consistent with the *Conventional Hierarchy* digital ecosystem, whereby the Chinese central government allows businesses and government agencies operate on closed standards, resulting in users being constrained by the infrastructure, access to resources, and limited innovation purposefully established in the industry. Consumers, businesses and government agencies typically operate in a protective and controlled setting environment.

This digital ecosystem environment had a profound impact on the CIOs of Mainland China, where their roles typically did not have significant prominence or recognition in Mainland China. Across both government agencies and private corporations, the technology leader role was commonly known as the *Deputy of IT* or the *IT Manager*. The majority of the CIOs that we spoke to in Mainland China focused their efforts on supporting the organization's attempts to generate quick profits. From a technology perspective, much of the infrastructure and architecture planning is based on short term goals of the company. This has resulted in numerous siloed applications and processes. This has resulted the CIO's hesitance to invest in or to adopt advanced technologies, and there exists minimal coordination between IS and processes. The main functions of mainland China's CIOs is to keeping the lights on, to leverage the existing technology environment, and to standardize and stabilize the applications and processes within the company. The main roles of CIO include technological leader, contracts manager, technical liaison, budget manager, and prioritization. Attributes common to CIOs in Mainland China include problem solver, leaders of change, and technology experts.

The future initiatives for mainland China CIOs will be focused on the continued development of infrastructure, which will enable SOEs and private corporations to leverage common resources. In the recent several years, the Chinese government has established Technology Parks, whereby working with global high technology companies to establish an environment for businesses to attract more advanced technology and business opportunities.

Hong Kong (HK)

For 156 years, Hong Kong was a city-state that was ruled by the British Colony and developed a Western capitalistic culture and society. Since its return to China in 1997, HK has established a mature economy and continues to enjoy a high degree of autonomy. HK has touted to be the Asian gateway of the financial industry. Corporations in HK do little manufacturing. Instead, they focus on facilitating manufacturing and trade with mainland China and the rest of the world. Because HK's general business environment is focused on service – including financial, supply chain management, & operation management – much of their business cycles depend on their customer's demands. The focus on service has resulted in many HK businesses to be horizontally focused and dependent on their alliance partners. This has resulted in a lack of establishing long-term business cycles.

From a technology perspective, the HK government has worked closely with private corporations to support the needs of the business and to establish a unified infrastructure that benefits both parties. Corporations have often taken the leadership role while working with the government to establish an established infrastructure. Technology was generally perceived as a tool to help support, integrate, connect, and engage in multiple-disciplinary and competencies for both businesses and government agencies. HKs IS strategy was generally focused on the facilitation and enablement of business transactions within and across the corporation's value chain. There exists a bit more integration of infrastructure, applications, and processes across HK businesses.

HK CIOs have experienced growth and a welcomed acceptance in the last 20 years. Typically, CIOs in HK adopt a systemic approach to technology implementation and development, where a key focus is to orchestrate technology, process, and people. Due to its focus of developing itself as a prominent service industry, the technology executive role has been geared towards facilitating and integrating systems among HK businesses, its global partners, and mainland China alliances. The roles and responsibilities of HK CIOs mapped very closely to those influenced by the *Disintegrated* digital ecosystem. We found that the HK digital ecosystem encouraged users, governments and businesses to favor interoperability, leading to a diverse range of offerings to become viable propositions. The HK digital ecosystem was typically dominated by intermediaries that effectively connected corporations to consumers who have similar mindsets and who can best complement each other's needs. Here, the strength of ties among all those involved is where the power lies.

HK CIOs were required to quickly establish infrastructure and develop business process capabilities to

support the operations and strategic plans of their global partners. Commonly, the HK CIOs worked toward technical improvement and rationalization by maintaining existing IS environment (applications & processes). There exists little to no significant change in the business and technology infrastructure. The use of innovative technology to transform business in HK is limited. Given this, much of the infrastructure and architecture planning was based on both long- and short-term goals of their partners. This has required the CIOs to adopt and to adapt to the oftentimes complex technologies and businesses processes that their alliances and partners required them to engage.

A main challenges of HK CIOs was the ability to bridge the technology gap between their technologically advanced global customers and firms from mainland China that may not have adopted such advanced technologies. Common CIO responsibilities included systems management, project management, IT architecture manager, budgeting, IT governance & regulations, negotiator, security, trainer, and engaging the business. Attributes of HK CIOs include a good communicator and leaders of change. The future initiatives for HK CIOs will continue to focus on additional integration and development of systems, enabling a more diverse range of industry participants to leverage their infrastructure.

Taiwan

Taiwan officially established itself as the Republic of China in 1940 and has since governed the island of Taiwan. The Taiwan government historically focused on developing the research and development capabilities by investing annual 10% of the national budget to science and technology. The young and bustling economy is globally known for electronics and IT, which accounts for 25% of the country's industrial structure. Its pursuit of technology development has no doubt played an important role in the worldwide IT market. The country boasts itself as the 19th largest economy in the world, which was largely due to the government's investment into the research and development support in the IT industry. Taiwan experienced rapid economic growth and industrialization in the latter half of the 20th century, resulting in it being established as an advanced industrial economy.

Taiwan consists primarily of collection of many small and medium-sized enterprises (SME), with fewer larger corporate enterprises. To accompany the quick lifecycle of technology products and usage, corporations compete by rapidly acquiring and deploying resources and skills. In Taiwan, these SMEs often rely significantly on the government to provide access to resources that typically only large corporations have access to. For example, the government has established numerous high technology and science industrial parks to help advance businesses and the nation's use of technology. And, in return, the SMEs improve the Nation's competitive landscape and ability to engage in global business.

These characteristics of Taiwan's digital economy closely mapped to the *Open Community* category. Taiwan leveraged technology and established an infrastructure that was characterized by the rise of organic grassroots communities. There was heavily reliance on SMEs to create value through the establishment of new organization structures and through the creation of innovative digital experiences which were unique and personalized individuals or entities who were included in the digital ecosystem. The motivation for survival in this type of economy was to capitalize on distributed innovation. Taiwan's heavy emphasis on technology development and deployment enabled corporations to leverage the country's resources to develop establish a competitive advantage. Hence, Taiwan CIOs are generally skilled at aiding the corporation in identifying and engaging in opportunities to implement IS to aid in establishing a competitive advantage. Common Taiwanese CIO roles and responsibilities included morale builder, networking and relationship building, collaborator, and problem solver. CIOs from Taiwan exhibited attributes such as being highly analytical, skilled at prioritization, understands process improvement, and experienced at outsourcing.

The future outlook for Taiwan tends to point towards further developing its ability to develop and deliver technology. To grow the nation's technology capabilities, Taiwanese CIOs should continue to engage in relationship building, influencing the strategy and culture of the organization, and transforming the business landscape.

FINDINGS & DISCUSSION

Our study identified three key findings as explained below. First, we learned that the roles and responsibilities of China's CIOs were influenced by the region's unique strategy and maturity of its technology infrastructure. Second, the degree to which a CIO's ability to evolve his/her roles and responsibilities is constrained/supported by the ability to collaborate with the government's infrastructure and to access technological resources. Thirdly, exposure to global business partner's

operations, technologies, and processes facilitated the need for China's CIOs to further develop and mature their roles and responsibilities.

The focus of this research was to first understand the key roles and responsibilities of Chinese CIOs across three regions – Mainland China, Hong Kong, and Taiwan. We also sought to understand the key factors in the region's digital ecosystem that influenced the development and evolution of these CIO roles and responsibilities. In Table 4 below, we mapped the data that we collected across our interviews with the three distinct Chinese CIOs across the twelve core IS capabilities established by Feeny and Willcocks [14] and provide a general summary to illustrate the extent to which the technology executives across each of the three regions of China developed or leveraged each of the 12 IS capabilities in their roles.

Table 4: Feeny & Willcocks 12 Core IS Capabilities Across Three Regions of China CIOs

(+) Strong Evidence; (+/-) Adequate Evidence; (-) Little Evidence

	Mainland China	**Hong Kong**	**Taiwan**
Business Systems Thinking	-	+/-	+/-
Leadership	-	+/-	+
Relationship Building	-	+	+
Informed Buying	+/-	+	+
Contract Facilitation	+/-	+/-	+/-
Architecture Planning	-	+/-	+/-
Making Technology Work	+/-	+/-	+
Vendor Development	+/-	+/-	+/-
Contract Monitoring	+/-	+/-	+/-
Innovation & Growth	-	+/-	+
Business Management	-	+/-	+/-
Risk Management	-	+	+/-

Given that we have provided an insight into the key roles and responsibilities established and leveraged by the three different regional types of Chinese CIOs, we now provide a discussion around three key findings. In doing so, we provide a more detailed discussion to explain *why* the unique key factors of the digital ecosystem motivated the Chinese technology executives in three regions to adapt and to evolve their roles distinctively across China. Below, we identify the relevant seven key economic factors (identified by [ ] in the text below) presented in the World Economic Forum's Digital Ecosystems publication to discuss how these Chinese technology executives' roles and responsibilities had been influenced or moderated across the country's unique and respective regional digital ecosystem.

Finding 1: *CIO's across China have oriented and tailored their roles and responsibilities according to the country's regional government strategy and technical infrastructure*.

Across all three regions of China – Hong Kong, Mainland China, and Taiwan – almost all CIOs indicated that one of their primary tasks was to establish a base technology infrastructure and functionality (Table 4). These efforts would aid their firms with the basics of information processing. However, their ability to evolve their roles and responsibilities were constrained (or enhanced) by the region's strategy and technical infrastructure [*Market Regulation*]**.** In mainland China, where CIOs were faced with short business cycles, little long term planning, and a heavily regulated government environment, the technology executives were generally complacent with establishing baseline competencies. Comparatively, CIOs in Hong Kong and Taiwan were able to develop and mature their management capabilities because the business landscape that the government helped to build helped to facilitate flexible and innovative uses of technology.

We mapped the data onto the nine core IS capabilities proposed by Feeny and Willcocks [14] and found that CIOs across the three regions of China (Hong Kong, Mainland China, Taiwan) exhibited strong evidence across all five capabilities (*making technology work, vendor development, contract monitoring, contract facilitation, and informed buying)* of the *Delivery of IS.* Table 3. In the majority of cases these responsibilities were given little attention or delegated to lower-level IT managers [*User Empowerment*]. There were some evidence of purchasing and vendor management tasks, where the IS executive was responsible for managing the firm's IT

demand, creating value through existing technology purchases, and ensuring that the software and hardware suppliers had delivered the items listed in their negotiated contracts. The data also indicated that both Hong Kong and Taiwan CIOs had begun to exhibit D*esign of IT Architecture* capabilities (*architecture building; relationship building*) in anticipation of engaging in and developing global market operations [*Global Environment*]. Further, there was some evidence that only Taiwan CIOs demonstrated *Business & IT Vision* capabilities *(Business Systems Thinking)* [*Innovation*].

CIOs from each region in China were both encouraged or hindered by the technological and business landscape for which the government had established, hence enabling or hindering the development and maturity of their competencies [*Market Structure*].

Finding 2: *The degree to which a CIO attempted to evolve his/her roles and responsibilities was in accord with the business cycles that were established in the region for which they operated.*

Our analysis of the research data revealed that consistent with prior research, there was a bifurcation of the CIO role across the three regions of China. Recall that Chun & Mooney [7] found that the role of the CIO bifurcated to either the *Director of IT* role or the *Chief Innovations Officer* role (Figure 2). It appeared that CIOs in mainland China followed a dominantly technical career path, oftentimes the *Director of Technology* (Table 3). The data indicated that mainland China CIOs were executives who had achieved higher degrees in computer science-related fields. The data indicated for government agencies and SOEs, CIOs were primarily responsible for processing and reporting data for the agency. For most private corporations that we spoke with, their business cycles were extremely short because of their need to support a rapid manufacturing and operations environment. As a result CIOs tended to focus on short term planning and were not encouraged or required to develop additional characteristics for managing the technology and information of the firm [*Market Structure; Market Regulation*]. In all circumstances in Mainland China, there was minimal investment into technology implementation and limited demand for the CIO to mature his managerial skills because they wanted to keep the infrastructure agile and lean in case they needed to abandon the short business cycle. CIOs were primarily tasked with assisting the operations to produce information related to manufacturing.

Comparatively, the roles and responsibilities CIOs from HK and Taiwan operated in environments where businesses cycles were more towards the medium- to long-term. Generally, the CIOs from these regions were equally from computer science and business backgrounds, and well educated in business operations. All HK and Taiwan CIOs believed that they were successfully able to understand the competencies that were necessary for their job success. However, the CIOs also indicated that their ability to act on developing or utilizing these skills was either encouraged or hindered by the length of business cycles that the firm attempted to implement [*Market Structure*]. We found that in instances where there was a medium- or long-term business planning cycle like in HK and Taiwan, where technology played a key source of competitive advantage (e.g., business intelligence, semiconductor manufacturing, or digital content entertainment), the CIOs operated in more stable environments and were better able to mature their roles and responsibilities. CIOs in these agencies or firms indicated that senior management understood the role of IT and that the IS departments had established standardized IS infrastructures which were synchronized with the firm's strategy. These technology executives were required to put more thought into planning and managing technology adoption and implementation. As a result, CIOS from HK and Taiwan exhibited more examples of using technology to innovate and influence the environment for which the business operated. This included both operations *internal* to the firm and global partnerships *external* to the firm [*Global Environment*]. Perhaps what explains this is the fact that there is broad awareness and understanding of the role and importance that IT plays in their organizations.

Finding 3: *Exposure to global business partner's operations, technologies, and processes facilitated the need for China's CIOs to further develop and mature their roles and responsibilities.*

Opportunities to partner with global alliances forced these CIOs to focus on issues such as integration, infrastructure, processes, and standardized applications (Table 4). As a result, they were more closely categorized as trending towards the *Chief Innovations Office* role. This finding is in line with Chun and Mooney [7] who argued that the ability for CIOs to change and evolve their roles is highly dependent on the extent to which a firm has standardized and integrated its IS infrastructure. A HK CIO mentioned that the most exciting thing about his job was that *"technology adoption and innovation demands our business to bend like bamboo."* This CIO indicated that he not only is required to learn about his job responsibilities and to understand how

technology can aid his company, but he also needed to understand how his company's technical infrastructure should be flexible enough to accommodate their global partners' business and technology requirements within a highly regulated and constrained environment [*Innovation; Global Environment*]. We found that the degree to which a firm worked at standardizing the IS architecture – through efforts to rationalize its data, to pursue an environment of homogeneous IS applications and hardware across multiple business units, and to establish consistent processes across multiple functions – enabled or prohibited the CIO's ability to successfully support global operations from their business partners [*User Empowerment*]. Further, their efforts were oftentimes constrained by the regulations and infrastructure limitations set up by the Chinese government.

All CIOs that we spoke with in HK and Taiwan indicated that they wanted to eventually be more innovative in their approach to technology management. However, they indicated that there are several constraints which prohibited them from achieving this. At the top of the list was the concern for information security [*Intellectual Property Rights*]. CIOs from HK and Taiwan often commented about their concern of the security and the integrity of the data that was processed through the national infrastructure while doing business in mainland China [*Security & Privacy; Security & Privacy*]. CIOs that fell into this particular role spent much of their time educating, persuading, and preparing the organization and its alliance partners to better understand how to leverage IT resources within these constrained environments. Further, we also learned that these CIOs needed the skillsets which allowed them to identify technological and business operation alternatives for their global partners, so that their security concerns were alleviated. These efforts were often constrained and limited by several years of national culture and socially-embedded influences as it relates to how technology can or should be used within the country's borders. The established norms and procedures for identifying, adopting, and maintaining technology significantly contributed to the unwillingness of employees to support technology adoption and use. Hence, many of the CIOs from HK and Taiwan spent their time educating the firm on the importance of IS. This prohibited them from engaging in roles that were more strategic in nature.

CONCLUSIONS

The CIO roles and responsibilities have significantly evolved and matured in the United States over the last Twenty-five years. As CIOs from Hong Kong, mainland China, and Taiwan start their journey and begin to leverage technology to support their business infrastructure, each has taken a different approach. We learned that there are distinct differences across these three regions of China as to how technology executives perceive and attempt to mature their roles over time. In particular, we learned that the roles and responsibilities of Chinese CIO have bifurcated into two different types of executive leaders. One is an executive-level manager – the *Chief Innovations Officer* – whose primary goal is to work with other C-level executives inside and outside of the firm to change the firm's strategy and processes. Generally, CIOs from Hong Kong and Taiwan fall into this category. And, the other CIO role exhibits a technical focus, identified here as the *Chief Technology Officer*, whose primary function is to maintain and manage the firm's existing legacy IS infrastructure and cost-cutting initiatives. Generally, CIOs from mainland China fell into this category. These CIOs typically focused on developing their technical skill-sets and were responsible for supporting a quick and nimble manufacturing environment.

We also learned that CIO roles are heavily moderated by the length of the business cycle for which the company operates. In mainland China, CIOs operated in environments with short-term cycles and tended to avoid significant investments in technology. They also tended to shy away from engaging in medium- and long-term planning, as they were more focused on quick manufacturing. In this situation, CIOs roles and responsibilities primarily focused on technology management and cost reductions. In Hong Kong and Taiwan, the business infrastructure was a bit more mature and developed, whereby CIOs tended to plan for and operate in business environments with longer-term cycles. This encouraged the technology executives to engage in long-term planning and setting up a more agile technology architecture and a robust technology infrastructure. And, because of this, these CIOs were encouraged to develop additional roles and responsibilities, focused on engaging with innovation within and outside of the company.

Finally, this research validates that the digital eco-systems framework can apply to understanding how CIOs roles and responsibilities are established and developed. This framework illuminate the complex dynamic interactions that influence the development of this role and new value creation for firms. We learned that the exposure to any type of global business partner's operations, technologies, and processes forced CIOs to consider maturing their roles and responsibilities to meet the

needs of the business. The data indicated that the role of the CIO from Hong Kong and Taiwan may not have been as matured as their global counterparts due to infrastructure, technology, and government regulations and constraints. However, their roles and responsivities were further developed and matured when compared to CIOs from China. We found that as the digital ecosystem environments moved from hierarchical (such as in mainland China) to disintegrated or open, the opportunities and pressures for changing CIO roles increased. The increasing demand of engaging in global business has forced these CIOs to improve their skills of systems integration, information security, and innovation. Although this research only compared the CIO roles of three regions across China, the frameworks established in this research can be used to better understand and investigate the roles and responsibilities of CIOs worldwide. The framework can also be helpful in determining whether global CIOs have the opportunity to leapfrog the development of their technology and management capabilities.

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ATTACHMENT #1: CIO INTERVIEW PROTOCOL AND QUESTIONS

Section 1: Introduction

We are conducting this research to develop an understanding the role of the CIO. Fundamentally, we are interested in finding out "What do CIOs do?"

I will be asking you questions concerning:

1. *Your background and experience*
2. *Your roles, responsibilities, and work activities as CIO within your enterprise*
3. *Your perception of the opportunities that CIOs have*
4. *Your perception of the challenges that CIOs face.*
5. *Your perception of the differences between the CIO and CTO roles*

Section 2: Background details on key informant and enterprise IT resources

First, let me ask you some questions related to your background

1. *Name*
2. *Exact full title within the enterprise*
3. *Position within the organizational hierarchy*
    a. *Prompt: ask for copy of organizational chart*
4. *Length of service with the enterprise and industry*
5. *Educational background*
6. *Nature of prior professional experience*
    a. *Career progression*
    b. *Previous professional positions/roles*
    c. *Enterprise/industry/company*

Section 3: CIO perceptions on the roles & responsibilities questions

The next set of questions is designed to help us understand your perception of the role of the CIO.

7. *How do you see/ would you describe your role as CIO?*
8. *What are your key responsibilities as CIO?*

    Ask for copy of official job description
9. *What do you actually do, i.e. how do you spend your time?*

    Describe a typical day/week/month:
    Tasks and activities; amount/proportion of time spent on each
    People, key work-related social network, purpose of interactions

    If I was to shadow you for a week/month, are these the tasks/activities that I would see you doing? Are there other activities that we have not covered?
10. *If you could, would you change anything about how you spend your time as CIO?*

If yes, ask for re-allocation of time between tasks and activities identified above
Identify any additional tasks not mentioned above

11. *What are YOUR opportunities right now?*
How are decisions made about which opportunities to pursue?
How do you prioritize these opportunities?
12. *What are YOUR key challenges right now?*
How do you deal with/ "do" each of these? (Be sure to remind CIO of each challenge)
13. *Let me ask you a related but different question:*
What are the key challenges for managing IT across the enterprise?

What are the key challenges that CIOs face? And, how does this differ from CTOs?
How do you deal with/ "do" these?

(Key areas will likely include:
Strategic planning for IT;
IT budgeting and resource allocation;
IT portfolio management (infrastructure vs. applications);
Public-domain (State / Federal / National) regulations
IT performance and impact evaluation;
Technological change;
Planning for future business scenarios;

14. *What IT-related decisions and responsibilities do you feel that you are NOT responsible for?*
15. *Do other C-level executives play a role in the management of IT resources and services within your enterprise?*

COO; CTO; CSO; Others?
If so, what roles do they play? Are there any C-suite level positions diminishing?

16. *Do you consider yourself to be **actively engaged** in the running of this business at a strategic and operational level?*

If so, how? How do you develop strategy?
formal mechanisms: memberships of committees; participation in key activities;
informal mechanisms: engagement and influence with business executives/business units

17. *How do **you** provide value to your enterprise?*
18. *What motivates and excites you most about your role as CIO?*
(What gets you out of bed in the morning?)
19. *How is your performance **assessed** and **rewarded**?*
20. *Apart from salary, does the enterprise provide any performance-related incentives?*
21. *From your perspective, has the role of the CIO changed over the past 5 years?*
If so, in what ways? Why?
If not, given all the changes in IT, why not?
(Prompt : Please provide a reflection on the CIO's personal experience AND reflection upon the CIO profession in general)
22. *What are the key **personal attributes** and **professional background** required to be a successful CIO today?*
23. *How do you think the roles and responsibilities of the CIOs are different from your counterpart CTOs?*
24. *Do you think that your role of the CIO will change over the next 5 years?*
If so:
In what ways? Why?
What will be the key the attributes of successful CIOs in 5 years?
Implications for education and professional preparation?

Section 4: Additional details on the enterprise IT resources and context

25. *Extent and nature of IT resources and capabilities at your enterprise*
    in-house versus outsourced
    centralized vs. decentralized vs. distributed
26. *Philosophy/emphasis on the management of IT*
    cost minimization vs. important agent of business innovation
27. *Heritage/history of IT capabilities and competencies at your enterprise*
28. *Enterprise context:*
    Industry, enterprise size, give a brief description of you enterprise's business strategy
    global reach: how many countries?
29. *Level and basis of competition in your industry;*
    strategic position (leader versus follower);
    velocity (pace of competitive change: slow vs fast)
    need for strategic agility (high vs low)
30. *Information intensity; Strategic and operational dependency on IT;*
    "Organizational respect" for IT;IT sourcing strategy (build/buy);
    IT organization structure (organization chart for IT)
    IT governance mechanisms; IT competency of business execs;