

PART I. REFEREE REVIEW PAPERS

(DOUBLE-BLIND, PEER-REVIEWED PAPERS)

UNDERSTANDING THE CHANGES IN THE ROLE AND THE TASKS OF CIOs: AN EVOLUTIONARY BOUNDARY MODEL

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ABSTRACT

Research on the role and the tasks of CIOs has been conducted ever since the term was introduced. Several CIO role models with varying numbers of factors as well as descriptions on the evolutions of CIOs' work have been published. We consider them characteristic to the deployment of specific technologies or to certain periods of time. We opted to find a more robust explanation and applied Leavitt's model to describe the evolving boundary factors that define the tasks of CIOs over time and across organizations. We modified the wording of the original model to reflect the evolution of technology, business strategy, and other factors. We applied the modified model to categorize earlier research findings, recommended CIO competencies and analyzed data collected from interviews with 36 CIOs within six industries. We discovered that the modified model was able to categorize the findings of prior studies and to describe the tasks of the interviewed CIOs with links to prior studies.

Keywords— CIO profession, CIO tasks, CIO role, CIO competencies, CIO curriculum, Qualitative Interview, Leavitt's organizational development model

1. INTRODUCTION

This article focuses on the evolution of the Chief Information Officer's (CIO) profession. According to prior research, issues that CIOs address and manage have changed and grown continuously in number and in scope [e.g. 17]. Both one-time studies on how the boundaries of information technology (IT) have changed, that is, enlarged [e.g. 62] as well as repeated studies such as the Society for Information Management (SIM) Annual IT Trends Study in

the US [e.g. 39] tell this story. The experiences of our research team are similar. In addition to academics, our research team includes practicing CIOs and participates in the annual "CIO of the year" selection. Shortlisted candidates are interviewed with so-called 360-degree interviews. Interview results together with other data are then used to make the nomination. The 12 CIOs of the year nominated so far and the more than five dozens of shortlisted and interviewed candidates each appear to execute their CIO role and tasks in a unique organization-idiosyncratic way. As myriad issues impact the CIO profession the motivation for this research comes from the question: *is it possible to model factors that define the boundaries of the evolving CIO profession over time including variations in the tasks and the role of CIOs within and between organizations?* We define the role as the organizational status and influential possibilities within an organization. For tasks we refer to work content, that is, what a CIO actually does in his/her profession during his/her CIO career.

Ever since the CIO term emerged some 35 years ago [64] research has been conducted on what CIOs do or should do [2, 13, 21, 55, 56, 57, 70], what are their main concerns [e.g. 39, 47], what kind of professional and personal competencies they should have [8, 11, 18, 36, 54, 65], and whether the CIO belongs to the top executives of his/her organization or not [7, 29, 35, 38, 44, 58, 59, 63]. Other investigated research questions include questions such as, are there differences between corporate and public sector [e.g. 19], between developed and developing economy [e.g. 25] and between group-level, regional/ divisional [e.g. 61] and special purpose, such as infrastructure or business/digitalization [e.g. 13] CIOs. Mentioned studies indicate how versatile the CIO profession and its evolution

have been and are.

During the past five decades, the deployment of IT has grown, widened and deepened. Correspondingly, the significance of IT has increased, as more organizational activities have become IT-enabled [15, 29]. Within an organization, the CIO has been regarded as one of the key persons responsible for the management and deployment of IT ever since the term emerged [5, 7, 58, and 64]. Thus, it is logical to reason that constant growth of IT usage will also impact the work of CIOs. Indeed, research has shown that the number of issues that CIOs need to manage has increased over the years [2, 11, 20, 26, 39, 47, 52, and 62]. Similarly, changes in the perceived focus of CIOs' work have been reported [1, 10, 12, 15, 33, 34, 38, 39, and 60]. Consequently, recommendations for the IS curriculum, such as the ACM/AIS MSIS curriculum [46, 66, 67], and for CIO competencies, such as the CIO Council Clinger-Cohen list [18, 36], have been modified several times. Changes in the CIO profession appear to be related to technology advancements, ever-increasing deployment of IT, but also to the evolution in organizational and strategy thinking as well as in governance and managerial practices. Nonetheless, it is legitimate to ask if we have really been able to model how the role and the tasks of the CIO

profession are defined in general and within organizations in particular - and especially how and why changes in the CIO profession occur over time. This was the starting point of our research. We felt and it appeared to us that although the CIO role and tasks descriptions as well as the IS curriculum and CIO competence recommendations change constantly there should be deeper theoretical understanding about the factors that establish boundaries for the CIO profession and its evolution.

Several models about the role of IT, the IT function and CIOs have been proposed. In general, most of them either suggest alternative roles for a CIO or describe the changes and evolution of issues that CIOs need to consider. Previous studies have suggested that CIOs could have one [11], two [9], three [63], four [13, 17, 68], five [31, 55] or six [28] alternative roles. Therefore we categorize them as CIO role studies. It is worth to note that the meaning of the term role in these studies differs from the definition given and used in the present research. Table 1 summarizes CIO role studies. CIO role studies describe what is a CIO's dominant scope in IT deployment [13, 55] or what tasks dominate the time consumed by a CIO while (s) he performs his/her various tasks [68].

TABLE 1: CIO ROLE STUDIES AND CIO TYPES (=ROLES) PROPOSED IN THEM

	Researchers	Research	CIO types
One CIO type	Brown (1993)	Research integrates the organizational and individual perspectives as well as the CIO partnership role.	General manager
Two CIO types	Broadbent and Kitzis (2005)	Research is recognizing different kind of organisations which require different behavior and actions from CIOs.	Demand-side leadership for shaping and managing expectations and Supply-side leadership for delivering cost-effective services
Three CIO types	Stephens et al. (1992)	Researched how MIS managers and CIOs use their work time within IT and outside IT and how close the activities are compared with CEOs work.	MIS manager, CIO in decisional role and CIO interacting outside IT function
Four CIO types	Chun and Mooney (2009)	Introducing the CIO types according to company's IT strategy and how the IT infrastructure is managed (divergent or orchestrated)	Innovator & Creator, Opportunity Seeker, Landscape Cultivator, Triage Nurse & Fire Fighter
	Carter et al. (2011)	The study points out three traditional IT management roles: Decisional, Informational and Interpersonal, and suggesting a new business technology strategist	Decisional CIO/Entrepreneur & Resource Allocator, Interpersonal CIO/Leader, Informational CIO/Spokeperson & Monitor Interpersonal CIO/Liaison, Business Technology Strategist
	Weil and Woerner (2013)	A study of CIOs role from digital economy point of view; Identifying key activities for four type of CIO's and how CIO's should spend their time across these activities.	Embedded CIO, ICT services CIO, External customers CIO, Enterprise processes CIO
Five CIO types	Peppard et al. (2011)	A study of ambiguous role of a CIOs; "CEO's need to understand what type of CIO is appropriate at a particular point in the organisation's journey"	Innovator CIO, Utility IT Director, Agility CIO, Evangelist CIO, Facilitator CIO
	Guillemette and Pare (2012)	The objective of the study is to offer an explanation of the contribution of the IT function in organizations with a typology of ideal profiles.	Partner, Systems provider, Architecture builder, Technological leader, Project coordinator
Six CIO types	Gottschalk (2000)	A study of IS/IT leadership roles, analysing how the individual, position and organisation characteristics predict the CIO role in an organisation.	Product developer, Technology provocateur, Chief operative strategist, Chief architect, Change leader, Coach

Previous studies have also described the changes and growth of IT deployment and the impact of this on the work of CIOs [e.g. 3, 16, 30, 34, 46, 56, 58, and 60]. We categorize these as evolutionary CIO studies. Evolutionary CIO studies usually refer to the characteristics of IT and especially to the changes in the deployment of IT, often in relation to new emerging technologies, during a specific time period [34] and/or within a specific managerial context

[31]. These contexts include, for example, the use of IT to execute business strategy [56], to manage risks [23, 69] or to manage information [8, 40]. Some other factors considered include the impact of how IT and innovation intensive organizations or industries are [1], how much organizations rely on IT in business process management [10], or how IT sourcing is managed [42].

We feel that the descriptive validity of both the role model and the evolutionary CIO studies are limited to certain types of organizations or to the deployment of IT in a specific way or for specific purposes, and/or to specific periods of time. Diverse priorities within an organization and changes in the environment of the organization may change the tasks and the roles of the CIO in a short time, even several times every day. For example, in a large organization, the CIO may need to interact in various ways with each division/region/function of the organization. Similarly, changes in the competitive environment influence the priorities of an organization and thus also the priorities of the CIO. Furthermore, it is likely that evolution in IT, strategic management thinking as well as in organizational behavior, skills and processes could make these models outdated. For example, descriptions of CIO focus and tasks reported in studies conducted during the 80s, 90s and early 00s appear no longer depict what most CIOs focus on and do today.

Our conclusion was to look for an alternative approach. That produced the research idea to search for an explanation – and a robust model - that describes the boundaries of CIOs' role and tasks as well as their evolution. Therefore, we ask if it possible to find or craft a generic model, which describes factors impacting the CIO profession and its boundaries. This would include: over time across organizational units, organizations and industries; changing IT and organizational environments, and evolving strategic management thinking and practices. In addition to describing the CIO profession, such a boundary model should be able to capture the findings of prior CIO research and CIO competence requirements. We claim that such a generic model offers both researchers and practitioners a robust means to define factors that shape and confine the organizational role and tasks of the CIO in general and within a specific organization.

The work of the CIO is conducted in an organizational context with the overall objective to deploy IT for the benefit of the organization [e.g. 5, 18]. The need to respond to continuous changes in technologies, services and user expectations from the perspective of organizational performance improvement and strategy execution is probably a most accurate description of a CIO's work. Hence, changes in the business environment of an organization and in the strategy of the organization influence what a CIO needs to do. Such changes might affect even the CIO's organizational status and power structure. Motivated by these reasons, we decided to seek the theoretical basis of our research from organizational diagnostic models since they describe organizational evolution from a socio-technical perspective [48]. Socio-technical perspective to organizational diagnosis means that the organization's current level of functioning and activities are assessed in order to design appropriate social and technological efficiency and effectiveness improvements (i.e. interventions) such as IT investments and IT service/legacy improvements. We considered evolutionary IS theories, for example, Jaspersen et al. [37], Leonardi and Barley [45] or Wheeler [71], as alternatives to evolutionary organizational theories. We chose the latter due to the

socio-technical and organizational rather than the information systems technological nature of CIOs' work.

From the organizational diagnostic models, we selected Leavitt's model [45]. It has become established during the past decades both in organization [e.g. 24, 49] and in information systems (IS) research. Leavitt's model has been used in previous IS research to investigate IT in stationary contexts [e.g. 72], IS changes caused by punctuations [e.g. 48], and in evolutionary IS environments [e.g. 50]. The use of Leavitt's model in IS research helps to relate our work to past research. Leavitt's model suits also well to describe the continuous growth of IT and CIO work as well as the expansion of their boundaries. To reflect this, we modified the wording of the Leavitt model factors by including concepts becoming used during the recent decades, such as governance, business model, and ICT services.

Finally, the model fits well to analyze our empirical data and categorize past CIO studies, as later sections of this article will show. We interviewed 36 CIOs. Each interview covered the entire career of the interviewee as a CIO. We noticed already during the first interviews that the tasks and roles of each CIO were different, reflecting the variability in the business imperatives and other characteristics of the organization. In addition to variability, the tasks of a CIO typically changed in relation to technology evolution and especially in relation to the changes in the business imperatives of the organization such as the economic cycle, customer demands, the need to improve productivity and other similar issues. The tasks of some interviewees had changed significantly and several times whereas there was more stability in the careers of other interviewees. Both the CIO role and evolutionary CIO studies were useful but insufficient to describe our data. That finding was one of the motivations to search for an alternative approach. Our findings were also in strong contrast to our initial assumption that changes in IT would define the CIO profession and dominate changes in their tasks and role. Leavitt's model provided the framework, which was able to capture the variation in the tasks and roles of the interviewees as well as changes in them.

Our research question is "*What boundary factors shape CIO's role and tasks in general and within an organization?*" The main contribution of our research is to use the Leavitt diamond as the generic model explaining factors, which define the evolving boundaries of CIOs' work. To demonstrate the contribution of the proposed approach, we used the modified Leavitt model to analyze both the findings of prior research and our interview findings from 36 Finnish CIOs.

2. THEORETICAL BACKGROUND WITH THE MODIFIED LEAVITT MODEL

2.1. CIOs' everyday tasks change constantly and the role remains stable

Electronic data processing (EDP) Manager, EDP director, and IT director were some of the titles used for the head of the IT function prior the CIO term, which was introduced by Synnot and Gruber [64] as one of the first. During the last 30+ years, the use of the CIO term has raised the status

of the IT function head conceptually to the level of other C-level executives [57]. Yet, still today several interpretations about the role and the tasks of CIOs exist. This probably results partly from the fact that organizations deploy IT in different ways and for different purposes and partly from variations in the history of IT deployment within organizations. We reviewed close to 50 articles from the beginning of the 1980s to recent times in order to understand how researchers had described the work of the CIOs during the last four decades.

Researchers have studied changes in CIO work from a variety of perspectives, which range from technological to organizational. Consequently, many factors have been proposed to act as the underlying explanatory reasons for the change in the role and the tasks of CIOs. As stated earlier, we feel that most of the models are historically descriptive and valid but also limited. They characterize technologies, organizational practices and/or other factors that depicted the CIO work during specific periods and/or in specific contexts. Cumulatively, these models reflect the continuously growing deployment of IT in organizational activities and the related increase in the number of issues that CIOs need to address and manage. There is a strong consensus among the reviewed studies that the organizational role and the tasks of the CIO emerged and evolved gradually and also that the role and the tasks of the CIO will continue to change over time as the volume, depth, and maturity of IT deployment increases.

Benbasat, Dexter, and Mantha [5] analyzed data collected during the 1970's. Significantly, they stressed the importance of the people and business perspectives rather than technology. In summary, the striking feature of literature published during the 1980s is that the role of the CIO was described as a strategic and business-oriented executive who has a good understanding of technology and who works organization-wide with all units/functions to deploy IT in order to better implement business strategy and to support the achievement of business objectives [5, 6, 7, 20, 22, 33, 58, 64, 70]. The strategic stance of IT in business execution emphasized during the 1980s mirrors current concerns of CIOs [e.g. 39].

During the 1990s, CIOs' competencies and personal skills including interpersonal skills were investigated [8, 65]. Other new issues addressed included CIOs' capabilities to manage the complexity of technology [2, 59] and to establish co-operation between business and IT [8, 60, and 63]. During the 2000s the governance of IT, enterprise architecture and the ability of IT to create value and support innovations were investigated as new descriptors of CIO work [e.g. 1, 12, 15, 23, 27, 29, 56, and 69]. Fuelled by so-called business IT such as digital strategy, web-service technologies, digital data explosion, Internet of things and other developments, many issues concerning the CIOs' profession have re-emerged into research. CIOs' role in enterprise transformations, in information asset and capabilities management as well as in the creation of IT and digital understanding and digital strategies among business executives are new or reinvented demands placed on CIOs [4, 13, 31, 35, 39, 40, 47, 54, 55, 57, and 67].

Against the widely held belief that the organizational role of the CIO changes over time, it seems remarkable that what was written about the role the CIO during the 1980s appears fresh and valid in 2016. Our conclusion is that the concrete everyday tasks of IT CIOs related to technological understanding as well as to strategy and business orientation have changed over time and will probably continue to do so. At the same time, the organizational role of the CIO has remained unchanged and may continue to do in the near future. For example, in the 1980s, IT technological understanding focused on mainframe and minicomputer environments and on organization-internal software development. The importance of mainframes has drastically decreased, minicomputers have vanished and software application development is largely outsourced. Today, the range of necessary technological understanding is significantly wider with a focus on the Internet, web services, enterprise architecture, mobile technologies, business IT, digital and big data, cloud services and other emerging technologies and in linking them to IT legacy. Similarly, during the 1980s, strategy and business orientation focused on value chains, competitive advantage, and business-IT relations. Globalization, value and business networks, digital strategy, electronic business, business models, IT-enabled business transformations characteristic for today were not on CIOs' agendas. In summary, the organizational role of the CIO is still to act as a strategy-oriented and business-focused executive whose specialty is to understand how IT and digital data can be deployed. By supporting and enabling all units, regions, functions and stakeholders of an enterprise to deploy IT, by managing IT services and assets and by helping to establish IT governance CIOs participate into the execution of their organizations' strategies, to the achievement of organizations' business objectives as well as to the creation of product, service, process and other innovations.

2.2. The modified Leavitt model

We conclude that within the CIO's organizational role evolutions to a CIO's everyday tasks happen in order to improve the CIO's and the organization's performance. Even these merits the use of organizational diagnostic models, also known as organization development models, as compared to more IS and technology diagnosis oriented models such as Jaspersen, Carter and Zmud [37]. Our literature review suggests that changes in CIOs' everyday tasks are driven by certain identifiable factors. For these and for reasons given earlier we chose the Leavitt's model presented in 1965 [43]. Instead of case specific forces, Leavitt's model identifies four factors, which describe organizational development. They are structure, task, people, and technology. Leavitt's model is also known as the diamond model, where the shape comes from the interrelations between the model's factors. The diamond shape means that if one of the factors of the model changes, this has potential to affect all other factors of the model and they will also change. All relations between the factors of the model are bidirectional.

Leavitt's model could also be seen as an evolutionary boundary model. The specifics in the content of each factor

may evolve over time whereas the (boundary) structure of the model remains unchanged. Thus the boundaries of the model could move. For example, the boundaries of the model could enlarge (move outward) as the consequence of evolutions in the specifics of the model factors. Above we discussed the growth of CIO tasks. After 1965, new practices and constructs such as business models and corporate governance of IT have also been introduced and become established. These reasons motivated us to modify the wording of some factors in the model, that is, to include the evolution of those factors. Contemporary (IT) technology consists of technologies, ICT services, and information. We enlarged the wording of the technology factor to reflect this. For the same reason we modified structure into strategy, business model and governance; task into tasks and processes. Please, note that we regard this as an evolution of wording in the model, which reflects currently used constructs and practices, not a model revision the modified model is shown as Figure 1.

The strategy, business model and governance factor include the governance and management systems of an organization, its communication systems as well as its work, material and money flow steering structures. The task and processes factor refers to all tasks and subtasks and their sequences that are associated with the products and services of the organization including their design, sales, manufacturing, delivery etc. The people factor consists of people as actors in the organization and organizational arrangements used to carry out the tasks and processes of the organization both within the organization and between organizations. Finally, the technology, services and information factor includes all equipment, hardware, software, facilities, services, data and information used to conduct the tasks and processes of the organization.

The model shown in figure 1 is useful in describing and categorizing the findings of both the CIO role and evolutionary CIO studies. For example, Weill and Woerner [68] proposed four roles for CIOs on the basis how CIOs allocate their time between various tasks. These roles are embedded (strategy dominates time usage), ICT services (technology dominates), external people (people dominate) and enterprise process (processes dominate) CIO roles. Similarly, as an example of evolutionary CIO studies, Ross and Feeny [60] described changes in technology and how those changes had influenced strategy, people (CIOs) and processes. According to Ross and Feeny, technology changes have been the driving force for the work of CIOs from the very beginning [60].

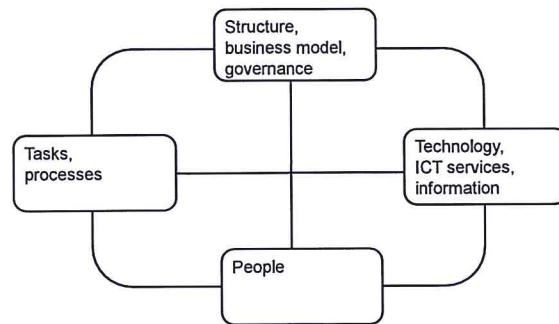


FIGURE 1: THE MODIFIED LEAVITT DIAMOND MODEL

By looking at the history of the IT function, one sees that it is among those functions that have changed most during its short existence as compared with other significant organizational functions such as accounting [1, 15, and 29]. IT has been considered to be in wider use in business processes and to be more integrated and more complex to manage [59]. Organizations have always developed operational processes but IT has provided entirely new means to automate and restructure them [42, 59]. For example, technology has enabled the global economy to flourish by providing networks for rapid exchange of vast amounts of data between organizations. For organizations, this has provided opportunities to redefine strategies, to increase revenue streams and profits. In addition to the transformation of existing markets into electronic markets, IT deployment has also helped to create totally new markets such as digital content [41]. The deployment of technology in alignment to business strategy enables an organization to differentiate its operations from competitors [33]. Consequently, CIOs not only need to consider a wider set of issues than most other executives but they are also the chief information system strategists in their enterprises. [29] In this capacity they meet a set of expectations, the content of which evolves constantly since the information needs of the organization and the technologies used in its systems are in constant flux [29]. The factors of the modified Leavitt's model capture forces mentioned in these studies.

In summary, we have discussed why we chose Leavitt's model as the theoretical basis for our research. We explained why and how the wording of the Leavitt's original model was updated to better suit the research on the CIO profession by reflecting the evolving boundaries of this profession. We also demonstrated with a few examples how to use the model to explain the findings of previous studies. We feel that the modified Leavitt model captures issues/topics investigated in earlier studies, which we have highlighted above while discussing them. We next show that the modified Leavitt's model provides the means to understand factors that shape and confine the tasks of the CIOs within organizations as they appear in our interview data. We also propose that the modified Leavitt's model captures how information technology developments impact the other organizational factors shown in the model and that therefore the model is well suited to describe both the role and the tasks of a CIO and changes in his/her role and tasks.

We finally propose that the model is able to explain why the lag between technology development and its deployment exists. The model suggests that persons responsible for IT deployment – most notably CIOs - need to consider strategy, the business model and governance, tasks and processes, and people issues in addition to technology implementation, all of which require time.

3. RESEARCH METHODS: THE CIO INTERVIEWS

To understand how the work of CIOs has changed over the years and to evaluate the usefulness of the modified Leavitt model in the analysis of these changes we interviewed 36 Finnish CIOs from six industries mainly during the years 2011 – 2013, with four interviews prior the year 2011. Industries are media, public sector organizations (government, agencies, municipalities), finance, manufacturing, wholesale and retail sale commerce (in Finland a few branded coalitions dominate the markets) and services. A summary over interviewees is shown in Table 2. Detailed data on each of the 36 CIOs is provided as Appendix 1.

Table 2 describes the number of CIOs interviewed in each industry and the time span of interviews. The table also shows the time period covered by the interviewees in their CIO profession and the average work experience of CIOs in years by industry, the distribution of gender and the age groups as well as the size of the enterprises measured by their revenue. All empirical data were collected with personal face-to-face interviews. An interview lasted typically two hours. We first selected industries and then stratified the collection of enterprises according to deemed privileged access to them. Since two of the authors have

worked as CIOs for several years and since one of the authors had participated to the selection of the CIO of the year in Finland and in Europe for 10+ years we knew most of the interviewees. We used this infrequent opportunity to invite recognized CIOs with long CIO careers from the leading organizations in their industries to interviews.

The industries were chosen to represent the diversity of IT deployment and the CIO profession. Interviewees include both group level and divisional, corporate and public sector as well as national and global level CIOs. We opted to interview several CIOs from one industry in order to remove possible organization related idiosyncrasies. The idea was also to collect data across a few industries in order to find similarities and differences between industries but also to understand whether the characteristics of specific industries impact how the CIOs of that industry perceive their role and tasks. During the time span, we conducted the interviews; the media industry experienced the pressures of business transition from print media to digital services. Public sector organizations faced severe cost issues and the transfer of services from manual to digital. Manufacturing companies had shown good results year after year and focused on further process improvements and on increases in service business. The finance industry had transformed most of its services into electronic channels but struggled with increased regulations, lower margins, the consequences of economic downturns and new entrants from other industries to the financial markets. The future looked promising for the commerce industry with expansion opportunities in new geographical markets. Cost pressures and business transition of digital services were typical challenges in the service industry.

TABLE 2: SUMMARY OF INTERVIEWS AND INTERVIEWEES (me = MILLIONS OF EUROS)

Industry: CIO #s	Dates of interview s	Time period covered	Average Years as CIO	Gender	Age at the time of the interview	Size of the company (revenue)
Media: CIO1-CIO5 (n=5)	03/11- 08/12	1997-2012	8	3 Males 2 Females	1 age 30-39 4 age 50-59	1 > 1000 me 3 100-1000 me 1 < 100 me
Public sector: CIO6-CIO10 (n=5)	10/11- 09/12	1984-2012	14.8	5 Males 0 Females	5 Age 50-59	2 > 1000 me 2 100-1000 me 1 < 100 me
Finance: CIO11-CIO14 (n=4)	11/11- 06/13	1987-2012	10.75	4 Males 0 Females	1 age 40-49 3 age 50-59	2 > 1000 me 2 100-1000 me
Manufacturing: CIO15-CIO24 (n=10)	03/09- 11/13	1976-2012	10.55	9 Males/ 1 Female	4 age 40-49 4 age 50-59 2 age 60<	10 > 1000 me
Commerce: CIO25-CIO32 (n=8)	10/06- 06/13	1956-2012	14.63	8 Males/ 0 Females	2 age 40-49 4 age 50-59 2 age 60<	4 > 1000 me 4 100-1000 me
Services: CIO33-CIO36 (n=4)	08/07- 07/12	1991-2012	14.75	3 Males/ 1 Female	1 age 30-39 2 age 40-49 1 age 50-59	3 > 1000 me 1 N/A

We followed the methodological principles of semi-structured interviews as outlined by Yin [73] and expanded on by Myers and Newman [51]. With the interviews, we tried to capture the historical evolution of each issue to the extent that the interviewee had personal experience. Several questions were therefore formulated in two ways; how was the issue managed in the past and currently. Appendix 2 lists our survey questions.

The final interview questionnaire evolved over time. The first five interviews were used to learn what kinds of survey items are useful for our study. These five interviews constitute our pre-study. The first interviews were conducted with an open question formulation. Interviewees were asked to compare the past and the present for each topic, 46 in total. On the basis of the experiences of the first interviews, to avoid situations where interviewees told long

and as such interesting and amusing narratives sometimes for several hours, which often fell outside the scope of our research, we limited the interview time to two hours. In this way, we refined the survey instrument towards a semi-structured interview questionnaire with open-ended questions. Interviewees were still asked to compare the past and the present for each topic but now within a fixed/maximum timeframe. We added first 4 and then one question to the 46 questions on the basis of the pre-study and guided by the Leavitt / our research model. The final version had thus 51 questions. The last added question asked the interviewees to explain how IT technology has affected and affects the strategy and the business models of their enterprise in the past and currently. Of the 36 interviewees, 22 answered to this question and consequently, we do not have the answers of 14 interviewees to this question. All of these 22 interviews were conducted in the years 2012 -2013.

During the interviews, we used a projector and screen as we wrote down their responses *verbatim*. Thus in real time, an interviewee saw what was written as the answer to each question and was able to correct possible misunderstandings immediately. This technique shortened answers and an interviewee considered more carefully what (s) he said as compared to the convoluted stories of the pre-study interviews. The adopted approach also helped the interviews to focus on the questions of the questionnaire. In addition to the projector and the screen we used a digital recorder and recorded each discussion (interviewee permission was sought and obtained) including the five pre-study interviews. Recordings were used as backups and to complete transcripts written and shown to the interviewee during his/her interview. Each interviewee except the first five was also given the opportunity to modify the transcript of his/her interview. We did this by sending the written transcript to an interviewee for his/her final approval after we had verified and, if necessary, completed the already at-the-interview accepted transcript by listening to the recording of the interview. Two researchers did the verification and completion of the transcripts by listening recordings independently and by then comparing notes and agreeing on findings reach a consensus. Twelve of the interviewees used the opportunity to augment their interview transcript prior its final acceptance. From the verified and accepted transcripts, we then compiled a 36x51 excel sheet (matrix) to analyze the data. Two researchers verified independently that the matrix was based on the interviewee-accepted transcripts by comparing notes if needed. The verified matrix was then translated into English. During the final data analysis, three researchers analyzed the responses of the matrix independently and agreed on the classification of tasks and how they fall into the factors of the Leavitt / our research model.

At least the following related questions arise from the evolution of the survey instrument and the change of the interview procedure and protocol. Is it possible to use the data from the five first interviews as they were carried out earlier and with a different interview procedure and protocol? We opted to use also the data of the five first interviews. Most of the survey items are the same, 46 out of

51. Thus we do not have data on five questions from five respondents. Secondly, we investigate what factors influence and establish boundaries for the role and the tasks of the CIOs with a proposition that those factors have been the same over decades rather than what concrete issues CIOs meet at a specific time. By including all interviews we were able to cover the time from the 1960s to present. Why through away these unique insights? It is still worth to notice that the choreography of the early interviews was different and that this impacts the responses of these interviews. We had to do more work to interpret the long narrative responses that were transcribed into text. When the other 31 interviewees saw their responses verbatim on a screen their awareness over the response content was higher and they corrected immediately what the interviewer had written and were also given the opportunity to change their responses a second time prior to final acceptance.

Another important question is, are the responses of the interviewees true or even reliable, see e.g. points highlighted by Meyers and Newman [51]? One part of each interview question asked an interviewee to look back and contemplate, how the issue was managed in the past, that is, at the beginning of his/her CIO career. As the durations of the interviewees' CIO careers varied they were asked to look back for several years or even decades. Is it possible to remember past CIO tasks correctly or at all after many years? Is it possible to compare responses that cover diverse periods of time? It is possible and even likely that interviewees provided answers and told anecdotes that appealed to them for various personal reasons. Yet, even possible embellished or untrue anecdotes include data about the interviewee's role and tasks as a CIO. It is also possible that the interviewees did not remember or did not want to reveal all CIO tasks they had performed. The interviews of 36 persons, however, probably brought forward a significant number of CIO tasks and role descriptions. In addition, it is possible that interviewees could make timing errors. From the perspective of the present study possible timing errors concerning the execution of various CIO tasks are irrelevant. We investigate factors that influence and establish boundaries for the role and the tasks of the CIOs with the proposition that those factors have been the same over decades and those individual tasks can be classified on the basis of those same factors. We did not investigate how the interviewed CIOs understood the significance of their profession, what each of them did at a particular time, what typical CIO tasks were during a certain period of time or how well each of them performed as a CIO. Determining the reliability and truthfulness of responses to such questions would have been more difficult. The purpose of the 51 interview questions was also to help an interviewee to remember from multiple perspectives tasks and issues that were relevant for him/her as a CIO. We triangulated data reliability with the interview and data analysis procedures and protocols described above.

The CIO experience of six interviewees was less than five years whereas five had over 20 years of experience with the overall average of 12.25 years. Four interviewees (11.1%) were females. According to Pemberton (1992), a typical CIO is highly educated. In contrast to that finding, twelve

(33%) of our interviewees did not have a university degree. However, the remaining twenty-four interviewees had cumulatively 31 university degrees including four doctoral degrees. Three interviewees had retired and three more planned to retire in the near future. The status for 72 % (26) of the interviewed CIOs had changed, whereas the organization and the CIO status had remained unchanged for only ten interviewees. This finding is in line with Peppard et al. (2011). At the time of writing, two interviewees are deceased and six others have retired.

Those who had long history in IT explained that the main reason to acquire computers in the first place was to reduce accounting related manual work. At that time it was logical that the head of IT reported to the CFO. Even today, thirteen of the interviewees reported to CFOs, whereas eleven reported to CEOs and twelve to other C-level executives. Only a handful of them had been either executive committee or board members in the beginning of their CIO careers or were invited to participate in executive committee meetings and/or to business unit steering committee meetings. Almost all interviewed had experienced restructuring of their IT function organizations during the time they had acted as the CIO, but the reasons varied. Some restructurings were related to business strategy changes and some to mergers and acquisitions (M&A) including divestments.

4. FINDINGS

4.1. CIO role and tasks perceptions

We analyzed the interviews by counting how many similar answers we received to each question. More than half (24) of the respondents described their past and current role to be something other than a technology-oriented CIO role. The common feature of these responses is that the CIO work was described as a business executive role, which is related to the industry of the enterprise. For example, CIO29 said: *“Our executive committee only consists of book sellers, who have different areas of responsibility, such as IT, finance or logistics of the book selling business.”* The role and responsibilities of some CIOs transcended IT and included logistics, business intelligence, purchasing or process development to name a few examples. All ten CIOs of the manufacturing industry worked in global or regional enterprises and seven of them were either responsible for process development or heavily involved in it. CIO20 stated: *“There has been a clear demand for global processes and global IT among business leaders already for several years.”*

Although the business environment of the organizations within an industry was similar, the tasks a specific CIO performed differed. For example, CIO11 - CIO14 were from the finance industry. CIO11's main task was to develop enterprise architecture and data security, whereas CIO12's focus was on off-shoring activities and application integration. CIO13 focused primarily on internationalization as the company was involved in an M&A process. CIO14 did not work in the industry anymore.

We asked what have been and are the biggest challenges for the interviewee as the CIO. The change in business operations or in IT functions way of working was challenging for eleven respondents when they started their career as CIOs. Twelve thought them to be major challenges still today or at the end of their CIO career. Fourteen respondents mentioned that at the beginning of their careers the creation of IT services from scratch or the development of IT services to business had been demanding. Fifteen interviewees regarded the development of IT services to business still challenging. Nine respondents considered that cooperation with business had been the toughest challenge in the beginning of their career. Seven still felt the same way. Competence development was the next often mentioned challenge at the start of the career and it was almost as important currently. Twenty-six interviewees mentioned that access to deep technical skills had been important at the beginning of their careers. Project planning, project management, and supplier management were also mentioned several times and they were still considered important skills. Only four respondents felt that business skills had been important earlier, whereas fifteen considered them important currently. Probably the most significant change is the increase in the number of skills needed. *“Managing the whole”, “customer service skills”, “ability to demonstrate technology opportunities”, “innovation management”, “service management”, “network management”, “information management”, “international business-IT knowledge”, “architecture skills”, “data security”, “communication skills”, “negotiation and contracting” and “legal skills”* are just a few of the mentioned skills needed currently.

4.1. CIO tasks and roles classified with the modified Leavitt model

4.1.1. Description of the model factors

Strategy, Business Models, and Governance: We asked respondents to describe how much business executives and managers needed IT in the past and currently. Twenty-three interviewees told us that in the past IT was seen as some kind of necessary evil, a technology tool, a support function or a cost center. Only a few explained that in the past, IT was considered important or critical to business or for automation. Some also pointed out that IT people were considered “snobbish” like CIO12 who told us: *“We were respected because no-one understood what we were doing.”* Most of the interviewed CIOs think that current business executives believe that IT is deployed to create new digital services and new business opportunities. Echoing others, CIO21 said: *“Nowadays business leaders see two roles for IT. On (the) one hand, basic IT services exist in every enterprise and on the other hand, IT has the capability to create new strategic opportunities. I need to manage both these roles of IT in a balanced way.”* Thirty interviewees told us that they currently, that is, at the end of their CIO career or at the moment of the interview if they still held the CIO position, participate into the business strategy process. Some enterprises have a separate IT strategy, which is aligned with business strategy. In some

other organizations, business strategy also covers IT and there is no need for a separate IT strategy. A few CIOs explained that IT and processes are now recognized to be a critical part of the business strategy. Still, the interviews provide inconclusive evidence on this topic. Therefore it is safe to report only that CIOs understand strategy, business models, and corporate governance better than previously and that this factor clearly influences their work.

Tasks and Processes: The task and process factor was partly covered above with its interconnection to the strategy, business models and governance factor. According to our interviews, it appears that CIOs are heavily involved in M&A activities, especially within media and retail industries. CIOs' involvement in M&A's becomes understandable when one considers that it is necessary to secure the continuity of processes, which are usually heavily IT-dependent. Faster than normal changes to processes could also be required. As CIO15 explained: "We have done a lot of divestments, M&A's and (organization) structure changes within the last 15 years and I've been heavily involved in these." We also found that many CIOs considered processes to be a natural part of their current work, even though the relation of their role to processes was not asked directly in our questionnaire. CIO22 commented: "At first the challenge was to align IT and processes. Currently, globalization, open network, data security and information management are the ones." The tasks and processes factor clearly impacts the work of CIOs.

People: We asked how IT functions are valued earlier and currently and how well business managers understood IT in the past and now. During the early days of the CIO profession, those holding business manager positions had not received any IT education in universities or elsewhere. Twenty-three respondents thought that in the past business managers understood IT poorly or not at all. Similarly, IT organizations' contribution to business was poorly valued.

The current situation is totally different. Thirty-two interviewees expressed that business managers' current IT understanding is clearly better. Almost the same number (28) of interviewees felt that the IT function is valued higher. Several CIOs, like CIO15 and CIO33, said: "IT is a normal part of our business structure." CIO19 stated: "Should business slow down, which one is easier to replace; sales persons or IT systems?" As these quotations show, the people factor also shapes the work of the CIOs.

Technology, ICT Services and Information: Of the 36 interviewees we asked 22 to describe how technology is related to business strategy with the last survey item. Twenty-one responded that technology enables business or creates new opportunities for business and new technology-enabled services which can be launched into markets, and thus allowing the business to grow. For example, CIO3 said: "All the time, (the) bigger part of our business rests on technology... it has changed our value chain in the market." Only one CIO said that technology has no major role in their organization and one commented that technology has a negative impact on their business as it cannibalizes their current arrangements.

4.1.2. Results classified with the modified Leavitt model

We then used the modified Leavitt's model to classify the results of the CIO interviews. Three researchers reviewed the transcribed and translated interviews (36x51matrix) independently and classified the impact of each factor on a CIO's work into weak, mediocre or strong for each interviewed CIO. The interpretations were compared and agreed if there was a difference. The three interpretations were fairly consistent. Out of 144 (4 x 36) values, only 16 (11%) were discussed and there were no weak – strong differences between the individual interpretations. The cumulative outcome of classifications is shown in Table 3.

TABLE 3: SUMMARY OF RESULTS CLASSIFIED WITH THE MODIFIED LEAVITT MODEL

	Strategy, business model, governance	People	Technology, ICT services, information	Tasks, processes
Weak	6	6	4	8
Mediocre	11	19	10	12
Strong	19	11	22	13
Total	36	36	36	33

We discovered that the technology, ICT services, and information factor had the biggest impacted on the interviewed CIOs' work. Twenty-two CIOs expressed that technology strongly influences their work. The impact of the strategy, business model and governance factor was almost equally strong. Thus, both business strategy and technology drive CIOs work. This is in line with the earlier reported finding that several CIOs participate into their company's strategy process in a similar way to other business executives. Interviewees described the impact of the people and task as well as the processes factor to impact

their work less than the business strategy and the technology factors. However, people and tasks as well as processes are also important determinants for the work of CIOs. Almost all CIOs participated in the meetings of their company's steering group and/or had established IT steering groups to interact with other people. They also felt that business leaders understand IT increasingly better. Our questionnaire did not include questions, which directly and explicitly address the processes of an organization. Probably for this reason three interviewees did not mention

processes as Table 3 shows. Thirteen CIOs emphasized that their organization's processes impact their work strongly.

Tasks mentioned within the context of the strategy, business models and governance factor: Interviewees mentioned multiple specific everyday CIO tasks when they described the impact of the strategy, business model and governance factor on their work. We compiled tasks mentioned by the interviewees into Table 4. We also applied the role descriptions provided in the CIO role studies in the crafting of Table 4. A CIO role study often depicts tasks/activities that describe the alternative CIO roles proposed in the study, that is, the dominating focus area of the role or the area of tasks that consumes the biggest proportion of the CIO's time. The first column of Table 4 shows the tasks or activities described by CIO role studies and the second column lists related authors of the study. We then classified tasks mentioned by the interviewed CIOs using the same task/activity classification and placed the CIO# into Table 4 as the third column of the table. We added tasks that were not mentioned in CIO role studies at the end of Table 4. CIO role studies included six tasks and interview data added four tasks. As explained

earlier the placement of CIO#s into Table 4 was done first by two researchers independently using the original 36x51 matrix (in Finnish). After the matrix had been translated into English a third researcher did the same. Notes and interpretations were compared and discussed during both phases until a consensus was reached. An interviewee typically mentioned two or three strategy-related tasks. Especially those interviewees who had been CIOs several decades ago described that their task was to strategically manage IT – called EDP, IS or IT at a particular time.

Tasks mentioned within the context of the tasks and processes factor: Interviewees mentioned seven organizational tasks and process related everyday CIO tasks. Five of them were covered in the reviewed literature: landscape cultivator by [17]; facilitator by [55]; opportunity seeker by [17]; product developer by [28]; and enterprise process CIO by [68]). Interviewees also described process harmonization in M&A integrations and process governance tasks. Table 5 provides the summary. Table 5, as well as Tables 6 and 7, were crafted similarly to Table 4.

TABLE 4: CIO TASKS MENTIONED BY INTERVIEWEES FOR THE STRATEGY, BUSINESS MODEL, AND GOVERNANCE FACTOR

Strategy, business model, governance: Role proposed in literature and/or task described in interviews	Author of the CIO role study	Task referred by the interviewed CIOs
CIO's formal resource allocation authority	Stephens et al. 1992	Not mentioned explicitly in interviews
CIO as chief operating strategist	Gottschalk 2000	Not mentioned explicitly in interviews
Opportunity seeker (drive strategy) Technology provocateur (embedding IT into the business strategy)	Chun and Mooney 2009 Gottschalk 2000	CIO2, CIO3, CIO5, CIO10, CIO15 (Brand, challenge eBusiness, value chain)
CIO as product developer (helps define the company's place in the emerging digital economy) Innovator and creator (new revenue from new products etc.) – digitalization Innovator (IT enabled processes, innovative services, products) Business technology strategist (use technology as a tool to create competitive advantage)	Gottschalk 2000 Chun and Mooney 2009 Peppard et al. 2011 Carter et al. 2011	CIO1, CIO2, CIO3, CIO4, CIO5, CIO7, CIO8, CIO13, CIO14, CIO16, CIO17, CIO18, CIO21, CIO22, CIO24, CIO25, CIO26, CIO28, CIO30, CIO31, CIO33, CIO35 (digitalization; products, services, innovations, ...)
Decisional role activities (entrepreneur – resource allocator)	Carter et al. 2011	CIO2, CIO4, CIO7, CIO35 (cost savings)
Decisional role activities	Stephens et al. 1992	
Embedded CIO (focus on strategy, business process execution, innovation).	Weill and Woerner 2013	CIO6, CIO8, CIO9, CIO10, CIO13, CIO14, CIO15, CIO16, CIO19, CIO20, CIO21, CIO22, CIO25, CIO28, CIO29, CIO36
Mergers and acquisitions, major internal structural changes in organization & ICT, alignment of global and local, group and Bus		CIO1, CIO10, CIO11, CIO12, CIO13, CIO16, CIO18, CIO19, CIO22, CIO25, CIO27, CIO28, CIO32, CIO34
Customers or other stakeholders as the basis of business strategy with IT enablement		CIO7, CIO17, CIO26, CIO30, CIO36
Climate change, real-time economy and other global drivers		CIO19, CIO21, CIO33, CIO35
Managing technology challenges as a whole with a business strategy perspective		CIO3, CIO4, CIO12, CIO15, CIO21, CIO27, CIO32

TABLE 5: CIO TASKS MENTIONED BY INTERVIEWEES FOR THE TASKS AND PROCESSES FACTOR

TASKS, PROCESSES: Role proposed in literature and/or task described in interviews	Author of the CIO role study	Task referred by the interviewed CIOs
Landscape cultivator (applications and processes)	Chun and Mooney 2009	CIO3, CIO4, CIO5, CIO6, CIO15, CIO16, CIO21, CIO27, CIO29, CIO32, CIO36 (educator-facilitator, competence developer, ...)
Facilitator (of process improvement, empowering and enabling business with information capabilities)	Peppard et al. 2011	CIO1, CIO2, CIO3, CIO7, CIO8, CIO9, CIO11, CIO12, CIO15, CIO16, CIO17, CIO19, CIO20, CIO21, CIO22, CIO23, CIO25, CIO26, CIO29, CIO31, CIO33 (participates into/or facilitate process development)
Enterprise process CIO (manages non-IT tasks such as sourcing, shared services)	Weill and Woerner 2013	CIO14, CIO17, CIO26
Process harmonization in M&A integrations		CIO24, CIO33
Process governance (allocation of tasks and responsibilities to units & persons)		CIO1, CIO2, CIO9, CIO12, CIO15, CIO21, CIO27

Tasks mentioned within the context of the people factor: Interviewed CIOs described eleven people-related everyday CIO tasks all of which were covered in the reviewed literature. [63] investigated CIO’s level of peer acceptance; [11] showed the CIO as a leader and manager; for [28] the CIO was a change leader; [17] pictured the CIO as a landscape cultivator able to lead change; for [28] the CIO

was a coach; [13] called the CIO an informational spokesperson – monitor; for [13] the CIO became ALSO an interpersonal leader – liaison; [55] pictured the CIO as an evangelist; for [17] CIO was a landscape cultivator – educator; [68] showed the CIO as an external customer CIO; and for [17] the CIO was an innovator and creator. Table 6 summarizes these findings.

TABLE 6: CIO TASKS MENTIONED BY INTERVIEWEES FOR THE PEOPLE FACTOR

PEOPLE: Role proposed in literature and/or task described in interviews	Author of the CIO role study	Task referred by the interviewed CIOs
CIO’s level of peer acceptance	Stephens et al. 1992	CIO1, CIO3, CIO4, CIO5, CIO6, CIO7, CIO8, CIO10, CIO12, CIO13, CIO14, CIO15, CIO16, CIO17, CIO21, CIO22, CIO24, CIO27, CIO28, CIO29, CIO30, CIO33, CIO34, CIO35, CIO36 (Status in various committees and strategy process)
CIO as a leader and manager	Brown 1993	CIO12, CIO13, CIO14, CIO16, CIO17, CIO21, CIO24, CIO32
CIO as a change leader	Gottschalk and Taylor 2000	CIO9, CIO19, CIO34
CIO as a coach	Gottschalk 2000	Not mentioned explicitly in interviews, mentioned in the context of processes
Informational (spokesperson – monitor)	Carter et al. 2011	CIO1, CIO2, CIO3, CIO4, CIO5, CIO6, CIO7, CIO8, CIO10, CIO21, CIO22, CIO24, CIO27, CIO28, CIO29, CIO30, CIO31, CIO35, CIO36 (influence behavior, relationship building)
Interpersonal (leader– liaison)	Carter et al. 2011	CIO1, CIO3, CIO4, CIO5, CIO6, CIO7, CIO8, CIO10, CIO12, CIO13, CIO14, CIO15, CIO16, CIO17, CIO21, CIO22, CIO24, CIO27, CIO28, CIO29, CIO30, CIO33, CIO34, CIO35, CIO36 (participation into committee work and strategy process)
Evangelist (educate people)	Peppard et al. 2011	Not mentioned explicitly in interviews, mentioned in the context of processes

External customer CIO (works with external customers/partners, sells)	Weill and Woerner 2013	Not mentioned explicitly in interviews
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Tasks mentioned within the context of the technology, ICT services, and information factor: Not surprisingly interviewees mentioned as many as fifteen technology, ICT services and information factor related everyday CIO tasks. Twelve of them were covered in the reviewed literature. [28] described CIO as a chief architect; [17] as a landscape cultivator with technical improvement and IT architecture management; [28] as a technology provocateur; [9] as ubiquitous presenter of technology; [9] as technology downturner; [17] as triage nurse and fire-fighter; [55] as an agility leader; [28] as a technological change leader; [55] as a utility leader; [68] as IT services CIO; and [13] as interpersonal technology leader. Interviewees mentioned also technological governance of IT and data, data security, and access as well as data analytics and data search. These findings are compiled into Table 7.

Finally, with Table 8 we return to Table 1 and show how according to our understanding CIO role studies reviewed in the present text can be placed into the modified Leavitt Model. Cumulatively Tables 3-8 and the CIO tasks depicted in them show how diverse the tasks of CIOs have been and still are.

The Clinger-Cohen recommendation for CIO competencies consists of 12 categories [18]. The categories are numbered from 1.0 to 12.0. Many - if not all - of the competence categories are related to more than one factor in the modified Leavitt model. This is consistent with the diamond shape of the model. Thus, if one of the model factors changes, this potentially affects all other factors through their bidirectional interrelations. For the present

study the most important point is that all the twelve competence categories fall inside the boundaries of the modified Leavitt model. The relations of the modified Leavitt model and the Clinger-Cohen competence categories could, for example, be described as follows (Note: this is only a suggestion as we have not verified these relations empirically):

- Strategy, business model and governance: Policy and organization (1.0 partly), information resources strategy and planning (4.0 partly), IT performance assessment: models and methods (5.0 partly), IT project and program management (6.0 partly), capital planning and investment control CPIC (7.0), acquisition (8.0 partly), information and knowledge management (9.0 partly) and enterprise architecture (11.0 partly)
- Tasks and processes: Process and change management (3.0), IT performance assessment: models and methods (5.0 partly), IT project and program management (6.0 partly) and acquisition (8.0 partly).
- People: Policy and organization (1.0 partly), leadership and human capital management (2.0) and IT performance assessment: models and methods (5.0 partly).
- Technology, ICT services and information: Information resources strategy and planning (4.0 partly), IT project and program management (6.0 partly), information and knowledge management (9.0 partly), Cybersecurity/information assurance IA (10.0), enterprise architecture (11.0 partly) and technology management and assessment (12.0).

TABLE 7: CIO TASKS MENTIONED BY INTERVIEWEES FOR THE TECHNOLOGY, ICT SERVICES, AND INFORMATION FACTOR

TECHNOLOGY, ICT SERVICES, AND INFORMATION: Role proposed in literature and/or task described in interviews	Author of the CIO role study	Task referred by the interviewed CIOs
CIO as a chief architect	Gottschalk 2000	CIO12, CIO14, CIO15, CIO17, CIO21, CIO23, CIO31 (Enterprise architecture, process, data, application, infrastructure, integration architecture)
CIO as a technology provocateur	Gottschalk 2000	CIO2, CIO3, CIO4, CIO6, CIO17, CIO10, CIO20, CIO28, CIO29, CIO30, CIO33, CIO36 (Challenger with eBusiness, digital products and services)
Ubiquitous presence of technology (impact on business – IT alignment)	Broadbent and Kitz is 2005	CIO5, CIO8, CIO13, CIO22, CIO35 (Usability, mobility, BYOD)
Technology downturner (Impact on business – IT alignment)	Broadbent and Kitzis 2005	CIO4, CIO7 (shared services) see also the entries of the next row
Triage nurse & fire-fighter (keep lights on and minimize costs)	Chun and Mooney 2009	CIO9, CIO11, CIO17, CIO18, CIO19, CIO20, CIO26, CIO27, CIO28, CIO31, CIO35 (Consolidation, cost cutting, centralization to reduce costs)
Agility (agile infrastructure, organizational information and technology requirements)	Peppard et al. 2011	CIO2, CIO3, CIO4, CIO5, CIO6, CIO8, CIO10, CIO11, CIO12, CIO13, CIO14, CIO17, CIO20, CIO21, CIO25, CIO30,

		CIO33, CIO35
Utility (technologies, services)	Peppard et al. 2011	CIO1, CIO5, CIO7, CIO8, CIO11, CIO13, CIO16, CIO23, CIO31, CIO32 (Legacy renewal, technological agility)
IT Services CIO (provides Its services, manages IT unit and vendors)	Weill and Woerner 2013	CIO1, CIO5, CIO7, CIO8, CIO9, CIO11, CIO13, CIO15, CIO16, CIO17, CIO18, CIO19, CIO20, CIO23, CIO26, CIO27, CIO28, CIO31, CIO32, CIO35 ((includes transformation from internal to external services)
Technological governance of ICT and data		CIO1, CIO15, CIO16, CIO19, CIO25, CIO26, CIO27, CIO29, CIO33, CIO34 (an aspect of IT governance)
Data security and data access		CIO10, CIO22
Data analytics, data search		CIO5, CIO12

TABLE 8: CIO ROLE STUDIES CLASSIFIED ACCORDING TO THE FACTORS OF THE MODIFIED LEAVITT MODEL

	Researchers	Research	Strategy, business model, governance	Technology, ICT services, Information	People	Tasks, Processes
One CIO type	Brown (1993)	Research integrates the organizational and individual perspectives as well as the CIO partnership role.	General manager			
Two CIO types	Broadbent and Kitzis (2005)	Research is recognizing different kind of organisations which require different behavior and actions from CIOs.	Demand-side leadership for shaping and managing expectations	Supply-side leadership for delivering cost-effective services		
Three CIO types	Stephens et al. (1992)	Researched how MIS managers and CIOs use their work time within IT and outside IT and how close the activities are compared with CEOs work.	CIO in decisional role	MIS manager	CIO interacting outside IT function	
Four CIO types	Chun and Mooney (2009)	Introducing the CIO types according to company's IT strategy and how the IT infrastructure is managed (divergent or orchestrated)	Innovator & Creator, Opportunity Seeker	Landscape Cultivator, Triage Nurse & Fire Fighter	Innovator & Creator, Landscape Cultivator	Opportunity Seeker, Landscape Cultivator
	Carter et al. (2011)	The study points out three traditional IT management roles: Decisional, Informational and Interpersonal, and suggesting a new business technology strategist	Decisional CIO/Entrepreneur & Resource Allocator, Business Technology Strategist	Interpersonal CIO/ Leader	Informational CIO/Speakers on & Monitor Interpersonal CIO/Liaison	
	Weil and Woerner (2013)	A study of CIOs role from digital economy point of view; Identifying key activities for four type of CIO's and how CIO's should spend their time across these activities.	Embedded CIO	ICT services CIO	External customers CIO	Enterprise processes CIO
Five CIO types	Peppard et al. (2011)	A study of ambiguous role of a CIOs; "CEO's need to understand what type of CIO is appropriate at a particular point in the organisation's journey"	Innovator CIO	Utility IT Director, Agility CIO	Evangelist CIO	Facilitator CIO
	Guillemette and Pa...	The objective of the study is to offer an explanation of the contribution of the IT function in organizations with a typology of ideal profiles.	Partner	Systems provider, Architecture builder, Technological leader	Project coordinator	Project coordinator
Six CIO types	Gottschalk (2000)	A study of IS/IT leadership roles, analysing how the individual, position and organisation characteristics predict the CIO role in an organisation.	Product developer, Technology provocateur, Chief operative strategist	Chief architect, Change leader, Technology provocateur	Change leader, Coach	Product developer

It is almost self-evident to claim that the evolution of CIO tasks will continue also in the future. Our point is, however, that the modified Leavitt model is likely to capture new emerging CIO tasks also in the future to be described by the four factors of the modified Leavitt model. This four-factor model defines the evolving boundaries for the role and the tasks of CIOs in general and for a CIO in a specific organization. The role and the everyday tasks of a CIO reflect the past, present and envisioned future strategy and objectives, the governance model and management practices, the technologies used, the structural and regional organization model of people, and processes of the organization that employs the CIO. The four factors of the modified Leavitt model thus provide lenses to understand the driving factors and boundaries of the volatile and evolving CIO profession. This is also the answer to our research question, "What boundary factors shape CIO's role and tasks in general and within an organization?"

5. DISCUSSION AND CONCLUSIONS

Both the literature review and the interviews of the 36 CIOs showed that CIOs' tasks have changed and grown significantly during the last four decades. Although information technology (IT) evolution is an almost self-evident factor for the changes in CIOs' tasks, it is not the only one. Technology is interrelated with changes in organizational strategy, tasks and processes and people and organizational changes. At the same time, the underlying role of the CIO has remained unchanged – to deploy IT as a strategy-oriented and business-focused technology-expert executive. Thus, as the answer to our research question, what factors shape CIOs' role and tasks, we showed that the factors outlined in the modified Leavitt model perform this role. The model provides a solid basis to understand CIO profession and to describe factors that shape and establish boundaries for the concrete content of the CIO's role and

tasks in an organization at any specific time and over time. This finding is also the main contribution of our research. Both CIO role and evolutionary CIO studies describe the impact of specific technologies, organizational practices and other factors that prevail during specific periods of time, whereas the modified Leavitt's model captures the factors that make the specific items of those technologies, organizational practices and other factors to emerge, evolve and then disappear. We feel that the modified Leavitt model will help to describe the everyday tasks of CIOs impacted by the digitalization of business, Internet of things, BYOD, robotics and other emerging technologies

The other contributions of our research relate to the findings of the 36 CIO interviews. One of the contributions and also surprising findings of our research concerns the significance of the technology factor. Evolving and emerging information technologies create new business opportunities for organizations and hence technology appears to dominate the evolution of CIOs' work. We discovered, however, that the strategy factor is almost equally important for them and that processes and people factors also have a significant impact. Echoing other recent studies [4, 13, 31, 40, 55, 68], our empirical research revealed that CIOs' work has a stronger business strategic focus than ever before. CIOs are more involved in the strategic management of their organizations and are able to provide greater value than in the past.

We also found a slightly contradictory position from the interviews. Even though CIOs were taking part in the business strategy processes, still only eleven out of thirty-six were reporting to a CEO and only five were members of group level executive committees or board of directors. This might reflect the difference between the CIOs' own evaluation and the CEOs' and board of directors' evaluation of the strategic importance of IT and his/her position.

Another surprising finding was that the industry had no clear impact within the organizations of the 36 interviews. Within all industries, the tasks of the interviewed CIOs varied greatly with no clear pattern. We also discovered that the tasks of some CIOs had changed several times during their career within an organization whereas the tasks of some other CIOs had remained stable. The reasons why the tasks of some CIOs changed several times were often related to business strategy changes, e.g. the organization wanted to expand its market share or grow in international markets. In more stable business environments, CIOs' tasks were thus also more stable.

In our study, we couldn't find any clear disjunctive factors that could explicate the differences in tasks of CIOs at the industry level. However, those factors were found at company level. While CIOs told us that they participate into business strategy processes, CIOs still do not have a clear formal position with the power of an executive committee member. CIOs also told us that the work of a CIO could be understood in many ways in the organization of the CIO. There is little knowledge about how these different perceptions about CIO work impact the work of CIOs especially after major business strategy related changes happen. In addition to Leavitt's model, other

organizational diagnostic models might provide additional insight to understanding the CIO profession. Future studies could consider these issues in more detail.

Our research is also subject to limitations. Due to the interview method and the relatively low number of interviewees, statistical analysis methods were not applied. Above we also discussed the limitations related to the inclusion of the five early interviews and ex-post interviews. Secondly, the length of the CIO experience and the ages of the interviewees varied. Younger CIOs with shorter CIO experience do not have the same perspective as older CIOs with extensive careers. The relatively small size of the Finnish economy with its relatively homogeneous leadership behavior could be related to this issue. Finally, although most of the organizations in the interview are global or regional, the empirical evidence is still from a single country origin.

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APPENDIX 1- CIO PROFILES

Sector	Date	Timeframe of the answers, then - now	Years acting as CIO	Gender	Age Group	Size of the company (revenue)
Media		average:	8	3 Males, 2 Females		
CIO1	09/03/11	2005 - 2011	6	Female	50-59	Large <500me
CIO2	26/06/12	2000 - 2012	2	Male	30-39	Large <500me
CIO3	21/06/12	1997 - 2012	15	Male	50-59	Large <500me
CIO4	07/08/12	2001 - 2012	11	Female	50-59	Large >1000me
CIO5	13/10/11	2005 - 2011	6	Male	30-39	Large <100me
Public sector		average:	14.8	5 Males, no Females		
CIO6	01/08/12	2006 - 2012	6	Male	50-59	Large >1000me
CIO7	24/10/11	1984 -2011	27	Male	50-59	Large <500me
CIO8	27/07/12	1995 -2012	17	Male	50-59	Large >5000me
CIO9	29/06/12	2008 - 2012	4	Male	50-59	Medium <50me
CIO10	12/09/12	1992 - 2012	20	Male	50-59	Large >500me
Finance		average:	10.75	4 Males, no Females		
CIO11	14/11/11	1999 - 2011	13	Male	40-49	Large >1000me
CIO12	26/06/12	1992 - 2012	12	Male	50-59	Large >5000me
CIO13	25/06/12	1996 - 2012	1	Male	50-59	Large <1000me
CIO14	12/06/13	1987 - 2009	17	Male	50-59	Large <500me
Manufacturing		average:	10.55	9 Males, 1 Female		
CIO15	25/10/11	1980 - 2011	22	Male	50-59	Large >1000me
CIO16	18/10/11	1987 - 2011	21	Male	50-59	Large >1000me
CIO17	29/06/12	2006 - 2012	7	Male	40-49	Large >1000me
CIO18	14/10/11	2003 - 2011	8	Male	60-69	Large >1000me
CIO19	16/11/11	1999 - 2008	9	Male	50-59	Large >5000me
CIO20	15/06/12	2010 - 2012	2,5	Female	40-49	Large >5000me
CIO21	14/08/12	2000 - 2012	4	Male	40-49	Large >1000me
CIO22	28/11/13	1976 - 2000	15	Male	>70	Large >1000me
CIO23	28/06/12	2008 - 2012	4	Male	50-59	Large >1000me
CIO24	06/03/09	1995 - 2008	13	Male	40-49	Large >1000me
Retail		average:	14.63	8 Males, no Females		
CIO25	25/06/13	1988 - 2005	17	Male	>70	Large >5000me
CIO26	30/08/07	2005 - 2007	7	Male	40-49	Large >5000me

CIO27	10/10/07	1998 - 2007	9	Male	50-59	Large >5000me
CIO28	07/08/07	1999 - 2007	8	Male	40-49	Large <500me
CIO29	26/09/11	1999 - 2011	13	Male	50-59	Large <500me
CIO30	25/06/12	2000 - 2012	12	Male	50-59	Large <500me
CIO31	04/07/12	1989 - 2012	26	Male	50-59	Large <500me
CIO32	26/10/06	1956 - 1981	25	Male	>70	Large >1000me
Services		average:	14.75	3 Males, 1 Female		
CIO33	18/06/12	1996 - 2012	14	Male	30-39	Large >1000me
CIO34	18/06/12	1994 - 2012	17	Male	50-59	Medium
CIO35	03/07/12	2002 - 2012	10	Male	40-49	Large >1000me
CIO36	10/08/07	1991 - 2009	18	Female	40-49	Large >1000me
Summary		average:	12.25			

APPENDIX 2 - QUESTIONNAIRE

<Name, Date, and Place of an interview>

<Company, KPI's: personnel amount, revenue, profit>

Background (time span 10 years)

1. What is your education and how long you have been working in IT field?
2. In which years you led ICT department?/ From which year you have been leading IT department?
3. How many years you have been working as a CIO/ IT manager?
4. How many employees you had when your work started/ now?
5. In which role is your superior (CEO, CFO, some else)?
6. How has your organisation changed during the time you have been a CIO?
7. Why has it changed?

II Framework of leadership

8. Which were the biggest challenges in IT function when you started?
9. Your challenges now ?
10. What kind of competences were needed?
11. Competence needs now?
12. What was the top management's understanding of the need of IT then / now?
13. How would you describe a good leader?
14. What kind of steering groups there were and how they dealt with the IT matters?
15. What kind of steering groups there are now?

III Strategy questions

16. What is your company's strategy as of today?
17. Was the IT department able to handle strategy changes?
18. How is it now?
19. Was the company's management able to handle strategy changes?
20. Was ICT department taking part of strategy work / is it now?
21. If it is, how?
22. What kind of KPI's were used / are used now?
23. Did IT support effectively company's targets?

24. Does it now?

25. How technology's change affects to your company's strategy?

IV Valuation

26. How the IT department was valued then?
27. How it is valued now?
28. How would you estimate the IT savvyness (understanding of IT) among business leaders then?
29. And now?
30. What kind of a role and responsibility was given to IT department then?
31. And now?
32. Was the CIO also a representative of top management then?
33. And now?
34. Was CIO nominated to groups steering group?
35. And now?
36. Did top management understand IT's connection to productivity growth?
37. And now?
38. Did top management understand IT's connection to revenue building?
39. And now?

V Changes in time and place

40. Has your company had noteworthy/remarkable M&A's or divestments in your time?
41. IT's outsourcing?
42. How do you manage your network inside your company and with stakeholders?
43. What was your company's economical situation then?
44. And now?
45. How these changes have affected to IT department?

VI Challenges now and in the future

46. Your company's biggest challenges now?
 47. Your biggest challenges in CIO's role now?
 48. What tasks belonged earlier to your work? And now? And in the future?
 49. How are you involved with leading the business?
 50. How are you involved with leading business IT?
- What is your outlook to the future?