

# 25 Years of CIO and IT Leadership – Revisiting Managerial Roles in Information Systems Research

*Completed Research Paper*

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## **Abstract**

*Knowledge-intensive organizations are challenged by the digitization of business models and the need for IT knowledge throughout entire organizations. This changes the role of CIOs from a central IT leader towards a digitization ambassador for the whole organization. In this research, we develop and validate a multidimensional IT leadership roles construct, theoretically grounded on Mintzberg's managerial roles. We empirically evolve the construct based on a quantitative survey among 228 CIOs in the U.S., where we assess the management roles of prior information systems research. Based on the empirical analysis, we add a new role definition. The result is an updated, comprehensive, and modernized IT leadership construct, taking the role of the CIO not only as IT leader, but as central agency for developing a digital mindset in the top management team but also throughout the whole organization. Thus, we contribute to 25 years of information systems research in that field.*

**Keywords:** IT leadership, IT capabilities, IT knowledge, IT decision making and planning, IT management, CIO, scale development, item refinement

## Introduction

The ongoing and progressively all-encompassing digitization of business processes and business models will yet again change the role of information technology (IT) in organizations. Some researchers propose that with the next wave of digital revolution, the importance and function of IT strategy, IT alignment, and IT governance will be challenged in future (Bharadwaj et al. 2013; Coltman et al. 2015). The current digitization process will force organizations to rethink their existing organizational structures, control, and IT innovation concepts (Henfridsson et al. 2014; King 2011; Tilson et al. 2010). Especially in the light of ever-increasing information sharing and management of large data volumes, technologies such as virtual reality, artificial intelligence, or social media analytics have created innovations and new opportunities for businesses (Lasi et al. 2014; Yoo et al. 2010). Innovative methods and tools for data analytics and data utilization known as big data, data mining, or machine learning offer potentials for continuous business development, but at the same time challenge businesses to cope with these sometimes disruptive digital changes (Chen et al. 2012; Yoo et al. 2010).

Organizations can only deal with these challenges by building up adequate IT capabilities, which can be described as a combination of organizational practices and competencies in operating, controlling, and leveraging IT (Aral and Weill 2007). More specifically, IT capabilities as an organizational resource build on business process related IT competencies, which again rely on individual skills, experience, and most basically on the breadth and depth of the knowledge possessed by employees (Peppard and Ward 2004). In extent research on IT capabilities, those capabilities are typically conceptualized as based upon the skills of the IT experts within the company, which in turn ignores the potential importance of IT skills and competencies possessed by employees on the business-side (Peppard and Ward 2004; Ravichandran and Lertwongsatten 2005). It is not a stretch to assume that a digital mindset is of importance throughout the organization, and that developing IT capabilities and the corresponding mindset is within the responsibilities of the CIO who is in charge of delivering value from IT investments (Chen et al. 2010b; Peppard and Ward 2004). Given the rather broad and complex responsibility, the position and importance of the CIO have gained increased interest in research and practice as member of the top management team (TMT) (Banker et al. 2011).

In-line with the increasing importance of IT for viable business models and processes, recent research spends more focus on the availability of IT capabilities in the whole organization, instead of concentrating on the IT employees and the IT function only (Chakravarty et al. 2013; Lu and Ramamurthy 2011). Consequently, this research widens the view of the responsibilities of the CIO, thus not only being limited in the leadership role as head of the IT department, but as an IT mindset leader throughout the whole organization. Given this change, in this research we want to investigate by which means a CIO can influence towards business-side employees in terms of IT capabilities. Due to the lack of adequate measuring instruments that allow us to capture this empirically, the main purpose of this research is to develop an appropriate set of items for such a measuring instrument.

In order to do so, we build our understanding of the CIO's roles on established concepts defining leadership, both from management as well as information systems (IS) literature point of view (Grover et al. 1993; Mintzberg 1971, 1989). Leaders in that sense are executives characterized by a certain degree of responsibility for an organization (Karahanna and Watson 2006). Mintzberg identified a classification of ten managerial roles (Mintzberg 1973, 1989) which are meant to be common to all managerial or hierarchical leader functions. Corresponding results claim that despite different functions of TMT members, they all have a strategic leadership role in common (Grover et al. 1993; Menz 2011). In the case of IT leadership, a strong CIO leadership position is crucial to establish IT capabilities (Chen et al. 2010b; Preston et al. 2008), which is especially true in knowledge-intensive industries (Chatterjeem et al. 2001), where the CIO has been found to have a central role as source of knowledge in organizational learning (Škerlavaj et al. 2010). In order to investigate the underlying organizational structures and relations in more detail, we thus specifically focus our research on knowledge-intensive industries, which typically are also industries characterized by a high amount of investments in IT (OECD 2013).

Thus, to gain more insights in how CIOs influence IT capabilities on the business-side of organizations, in this paper we establish a comprehensive construct with validated items to fully capture the different IT leadership roles of CIOs. The remainder of the article is organized as follows: first, the theoretical underpinnings of the investigated concepts are further highlighted. In detail, relevant literature and research results on managerial leadership, CIO's IT leadership, and existing operationalizations are presented. Hereafter, we examine a scale refinement process of Grover et al.'s

(1993) CIO managerial roles following the recommendations of MacKenzie et al. (2011), including exploratory and confirmatory factor analyses as well as testing for nomological validity. The setting of this study was an online survey among 228 IT decision makers in the U.S. In the conclusions we discuss how our findings open avenues for future research on IT leadership, IT capabilities, organizational cultures, and differentiated execution of CIO roles, explicitly oriented towards the business-side in knowledge-intensive organizations.

## **Theoretical Background**

### ***Managerial Leadership***

Leadership typically refers to the behavior and style of managers enacted in their different functions within organizations (Mintzberg 1973). Important functions of leaders comprise acting in a responsible way to steer the organization, facilitate knowledge exchange, as well as to act as liaison or relationship manager (Mintzberg 1971). In other words, the behavior and style of a leader influences organizational knowledge creation, sharing, and transformation (Nonaka 1994; Škerlavaj et al. 2010). The term leadership typically comprises more or less well defined concepts and phenomena ranging from individual to group level leadership issues, leadership in different kinds of organizations and industries, or attributes of leadership such as different behaviors according to changing situations (Karahanna and Watson 2006; Yukl 1989). Our understanding of leadership has been significantly influenced by the work and publications of Henry Mintzberg (Mintzberg 1971; 1973). His work received a lot of attention and is still often cited, not at least because of its general applicability. Mintzberg's conceptualization covers a multi-facet categorization of ten managerial roles which contain a broad variety of behaviors that are applied when in a leadership position, independent from the area or industry one is working in (Mintzberg 1973). Those ten roles can be subdivided into three groups, namely interpersonal (leader, figurehead, liaison role), informational (disseminator, spokesperson, disseminator), and decisional roles (resource allocator, entrepreneur, negotiator, disturbance handler) (Mintzberg 1971, 1973). The interpersonal roles derive from formal authorization and comprise essential interpersonal relationships; informational roles describe the manager's influence on and reception of or exposure to information flows based on the interpersonal relationships within as well as outside of the organization. Based on this information, the leader configures organizational properties within his or her decisional roles. In this paper, we will investigate the leadership measurement instruments developed in the last 25 years and develop a modified operationalization based on the Mintzberg conceptualization.

### ***IT Leadership: CIO as Highest Organizational IT Leader***

The CIO is the highest IT representative in charge within an organization (Banker et al. 2011) and as such can also be regarded as the IT leader (Grover et al. 1993; Karahanna and Watson 2006; Rockart et al. 1982). As one of the first, Grover et al. (1993) assessed the importance of managerial roles for executives such as CIOs which has influenced the research on general management (Menz 2011), IT strategy research (Chen et al. 2010a), and IS strategic alignment (Preston and Karahanna 2009; Smaltz et al. 2006). The prominent role and the hierarchical position of the CIO reflects strong executive leadership (Chatterjeem et al. 2001) which has been found to be important to facilitate the organizational creation of knowledge as well in creating and influencing organizational cultures (Alavi et al. 2006). A positive knowledge sharing climate between IT and business managers leads to higher managerial IT knowledge, resulting in higher IT use of business employees (Boynton et al. 1994). Furthermore, the IT leader positively effects the dissemination of strategic IT knowledge within the top management team (Wunderlich and Beck 2017).

The main difference between CIOs and other C-level managers is the need for specialized, technical IT skills, combined with a profound understanding of operational as well as strategic facets of the organization (Karahanna and Watson 2006). Advanced non-technical competencies become increasingly more important with the progressive importance of digitization in organizations to fulfill the CIO's function (Smaltz et al. 2006) to develop new IT-based opportunities for the business side. Directed towards the top management colleagues, additional competencies in communication gain importance for the CIO as well (Preston and Karahanna 2009) to make substantial contributions to firm efficiency and strategic growth (Chen et al. 2010b). The IT contribution to firm performance depends directly on the CIO's authority in decision making (Preston et al. 2008). We therefore summarize the roles of a CIO as leader and relationship manager, knowledge and information agent, as well as manager and strategic planner, which are similar to the three dimensions of roles of Mintzberg managerial leadership, complemented by special technical IT facilities.

### **Previous Work on Mintzberg Operationalizations**

Mintzberg based his findings on more than 1,200 observations from verbal and written contacts, which allowed him to define ten managerial roles (figurehead, leader, liaison, monitor, disseminator, spokesperson, entrepreneur, disturbance handler, resource allocator, and negotiator) (Mintzberg 1971). Based on this tremendous qualitative research, McCall and Segrist (1980) developed a survey instrument operationalizing Mintzberg's (1971, 1973) observed managerial roles. They assessed over 3,800 questionnaires to derive 46 items which could be assigned to six managerial roles. Due to Mintzberg's underlying assumption that all management roles are interrelated, for the roles figurehead, disseminator, disturbance handler, and negotiator that interrelation could not be confirmed and subsequently had to be removed. The resulting instrument became known as the Managerial Work Survey (MWS). Grover et al. (1993) adapted McCall and Segrist (1980) questionnaire for the context of IS management aiming at investigating the managerial roles specifically for CIOs, whose function gained increased importance at that time. Grover et al. intended to build on McCall and Segrist's results as they aimed at overcoming some limitations of Mintzberg's observation and methodology (such as lack of reliability and validity tests, or coding issues) by providing a comprehensive quantitative research approach that included reliability and validity tests in the area of management roles of IT leaders (Grover et al. 1993).

In the study Grover et al. provided, the aim was to compare the managerial roles of the CIO with lower IS or other general managers such as manufacturing, sale, or finance, in order to evaluate the particular importance of the different roles. Executed with a rank comparison, the results showed no significant difference between CIOs and IS middle managers or CIOs and finance executives. In a second step, the relevance was compared with the relative importance McCall and Segrist had identified in the second part of their study (McCall and Segrist 1980). In 1993, these were important findings to understand more about the relatively new position of the CIO and its influence. Likewise, the specificity of the separate roles examined in contrast to degree of maturity and the centralization of the IS management were assessed. A higher extent of interpersonal and informational roles relative to increased IS management maturity could be detected, whereas strategic or decisional roles showed no disparity (Grover et al. 1993). Besides the great impact of Grover's fundamental work for an understanding of CIOs' roles at that time and in general leadership literature (Menz 2011), the items furthermore served as basis for development in advanced item creation (Chen et al. 2010a; Preston and Karahanna 2009; Smaltz et al. 2006). Though, we could not find any re-application of the entire 46 items, possibly due to the large number. By reason of the progress in research on IT capabilities, IT alignment, and IT skills (Chakravarty et al. 2013; Coltman et al. 2015; Lu and Ramamurthy 2011), this study updates the leadership item set in order to reassess the evolving roles of CIOs after 25 years of digitization.

### **Distinct Operationalizations for CIO Roles and Managerial Leadership**

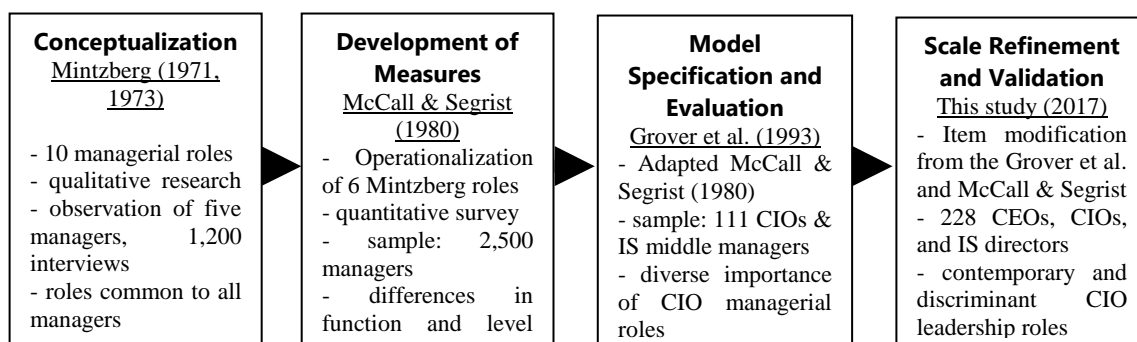
Besides the survey instrument based on Mintzberg's managerial roles, two more measurement instruments of CIO managerial roles can be found in IS literature. One completely published item set was extended by Karimi et al. (1996) to measure roles of successful IT leaders. Following quantitative testing among IT leaders in the financial services industry, Karimi et al. (1996) refined and expanded the eight initial questions from Rockart et al. (1982). The resulting eight items comprise a self-assessment scale of the CIO determining roles as the CIO sees herself or himself or is seen within the organization (corporate officer). Further, several items express the likelihood of the IT leader to be regarded as influential high-profile business manager in the organization, not being reduced to the function and the image of an IT specialist only. In summary, this item set is partially in line with the objective of the study at hand by examining the organizational integration of the CIO rather than his or her in-department functions. In the other measurement approach, Smaltz et al. (2006) carved out CIO roles by means of a two-steps method to measure CIO role effectiveness: first they exploratorily factor analyzed CIO roles by quantitative ratings of CIOs, while in a second steps CEOs were asked to assess the resulting roles with respect to their influence on CIO's role effectiveness. Although the identified CIO roles partially reflect Mintzberg's categorization (business strategist, integrator, relationship, architect, utility provider, information steward, and educator) (Karahanna and Watson 2006), some of Smaltz et al.'s items tend to be suitable especially for investigations on managerial level, being oriented towards the TMT and the IT function. Furthermore, only strategist, relationship architect, and integrator turned out to be significant on role effectiveness in the data sample that was gathered in the healthcare sector (Smaltz et al. 2006).

Besides the concept based on Mintzberg, management literature on leadership has further discussed two distinct types of leadership, namely transformational leadership and transactional leadership

(Engelen et al. 2015), that can be rooted back to the theoretical work of Burns (1978). Whereas transactional leadership mainly relates to the exchange process of rewards, efforts, and capabilities between the leader and subordinates to achieve work objectives, transformational leadership has turned out to comprise providing vision and sense of mission and trust to the subordinates, giving inspiration by setting expectations and symbols in simple communicative ways, providing intellectual stimulation by promoting intelligence and problem solving, as well as treating each individual with personal attention, coaching, and advises (Burns 1978; Podsakoff 1996). In the interest of measuring transformational and transactional leadership, Bass and Avolio (1995) presented the Multifactor Leadership Questionnaire (MLQ), originally consisting of 45 items measured on a 5-point Likert scale. More precisely, nine leadership measures comprise five transformational and three transactional factors (and one non-transactional attribute). Centered on transformational leadership, the Transformational Leadership Inventory (TLI) was developed by Podsakoff et al. (1990) which comprises measures for six dimensions of transformational leadership identified within literature. Although having been deployed several times in behavioural research, there are still some unsolved problems with item intercorrelation (Engelen et al. 2015; Podsakoff 1996).

## Scale Refinement

In order to shed light onto the diversity of leadership functions in a management and more specifically IS contexts, this research conducts a comprehensive factor analysis and subsequent validation procedures to reassess the contemporary managerial leadership roles of CIOs in knowledge-intensive industries. Based upon established scale development approaches (MacKenzie et al. 2011), we build on prior conceptualization (Mintzberg 1971), item development and model specification (McCall and Segrist 1980), as well as on a first scale refinements (Grover et al. 1993) from extent research (figure 1). Continuing this procedure, this research offers a new iteration of scale refinement and validation processes based on initial item modification (MacKenzie et al. 2011). With means of reassessing EFA as fundamental method in this study, we intend to overcome the initially conceptually limited and quantitative preexisting intercorrelation of the managerial roles of the Mintzberg based operationalization (Grover et al. 1993; McCall, JR. and Segrist 1980; Mintzberg 1973), as this is typical to other leadership measurement instruments as well (Podsakoff 1996). For this purpose, EFA offers enhanced statistical opportunities for uncovering underlying and most possible unrelated structures among variables of a data set (Hair 2010).



**Figure 1. Research History and Modified Procedure (based on MacKenzie et al. 2011)**

Whereas a high degree of research results on CIOs' TMT oriented behaviors, communication skills, and mental alignment already exists (Preston and Karahanna 2009; Smaltz et al. 2006), this research focusses on the CIO leadership roles relevant towards the business-side employees in particular. With means of a contemporary refined and reduced IT specific set of managerial leadership roles, we aim at a scale with potential to be evaluated by business-side employees instead of self evaluation of his or her behavior by the CIO himself or herself. Therefore, we base our research basically on the McCall and Segrist instrument (1980) building on the convincing high validity and reliability of this quantitative conversion of Mintzberg's managerial roles (Grover et al. 1993). As already remarked in the leadership section, generally the concept of Mintzberg offers great potential to modifications due to its broadly assessed and generic qualities. Further, we decided to build upon the McCall/Grover scale due to its basic meaning to IS research (Grover et al. 1993). We modified the items relying on a comparison of both the original McCall and Segrist (1980) items and the Grover et al. (1993) adaption (table 2), constantly keeping the adjustment towards business-employees in mind. Based on comprehensive literature review regarding IT leadership, IT management, and organizational psychology, we mainly aimed at specifying several items to the contemporary IT context, to concretize

the item expressions to respondents, and to make them potentially assessable by business-side employees in further research. For instance, to be up to date for the item liason 1, we added “social media” to the already mentioned ways of contact via visits or phone calls. Further, we decided for a five-point Likert scale instead of seven-point (Grover et al. 1993; McCall, JR. and Segrist 1980) to assess the survey instrument in expectation of increased reliability due to reduced complexity and range for participants (Lissitz and Green 1975). Analogously to the previous studies, respondents were asked to “rate the importance of the following tasks as they are related to your job”.

### **Data Collection and Sample Characteristics**

<b>Knowledge Intensive Industry Sectors (n&gt;10)</b>					
Computer (Hardware, Software, Services)	42	18.42%	Healthcare / Medical	18	7.89%
Banking, Financial Services, Insurance	35	15.35%	Advertising, Consulting	13	5.70%
Industrial Manufacturing	35	15.35%	Others	52	22.82%
Education, Training	33	14.47%	<b>Total</b>	<b>N=228</b>	<b>100%</b>

**Table 1. Firm characteristics**

A study sample of 228 senior IT decision makers in the U.S. was collected in a quantitative, questionnaire based survey. During December 2016 and January 2017, 1,015 participants of a CIO panel operated by a large international market research institute were invited to participate in the online survey conducted on our behalf. To investigate which challenges CIOs are facing in the ongoing digital transformation, we focussed on knowledge-intensive organizations, as classified by the OECD (2013) and refer to these categorizations recently applied in the field of IS (Wunderlich and Beck 2017). Table 1 reveals how these categorizations outperform in our sample. Before the actual questionnaire, we screened for industry sector (to guarantee for knowledge-intensive organizations), firm size of at least 50 employees or more, and IT departments with more than two employees. Within the questionnaire, items were presented randomly to avoid order bias. To enhance data quality, we already implemented several plausibility checks within the online questionnaire, posed three track questions to scan for consistent answers, and checked for plausibility such as reasonable relations between age and IT experience. By these procedures, we again removed 49 respondents from the sample. Measured by the well established scale of Sharma and Rai (2015), we recognize 53 CEOs acting additionally as CIOs in personell union (24%), 86 CIOs (37%), and 89 IT managers at director level (39%) among the respondents. The average CIO in the sample is 46.2 years old, has an organizational tenure of 12.5 years, an IT experience of 15.5 years, and is in 70% of the cases male. Analyzing firm characteristics, the average firm in our sample was founded in 1973, has 28,708 employees, and an IT department supported by 4,976 IT employees. Respondents cover 29 of 50 U.S. states (58%). Summing up, the sample provides a well dispersed view on CIOs in knowledge-intensive industries in the U.S. in order to evaluate the CIO roles to a contemporary state-of-the-art.

### **Exploratory Factor Analysis (EFA)**

In order to reassess the item set revisited to the IS context (table 2), we executed an EFA with IBM SPSS Statistics version 21. We chose factor extraction based on the principal component method and a varimax rotated component matrix, which in combination allow to identify a statistically as much as possible independent factor structure (Hair 2010). We ensured appropriate sample size for EFA with means of five times the number of 46 items (n=228). Due to the Kaiser Gutman eigenwert criterion and the screeplot, we decided for six of the instantly computed eight factors for the following reasons. The screeplot showed two considerable knees, one after two factors and a second after the sixth factor (eigenwert of the factor six = 1.266). The communality of the first six factors amounted for 57%. Factor 7 showed high overlap with regard to content to previous factors, factor 8 consisted of one item only. As result of the eigenwert, screeplot, and communality analyses, factors 7 and 8 (1.096 and 1.020) were dropped as being only shortly above 1. Within the factors, we only accepted items with factor loadings higher than 0.5 and excluded items with cross loadings to other factors higher than 0.4. Table 3 shows the resulting factor structure and the remaining crossloadings higher than 0.3 underlining the clear factor structure. Only for item liason role 1 in the last factor relationship, we decided to accept a slightly lower factor loading and regard this as minor issue, as the quantity of three items is recommendable for further use of the construct in SEM. The reliability for this factor still kept acceptable above 0.7 (Cronbach’s alpha table 3) and CFA states proper factor loading for this item.

Planning and implementing change in the organization's IT.	<b>E 1</b>
Initiating controlled change by means of IT.	<b>E 2</b>
Solving problems by instituting needed changes with the help of IT.	E 3
Evaluating the quality of business-side employees' IT performance.	<b>LE01</b>
Integrating business-side employees' goals (e.g., career goals, work preferences) with the company's IT requirements.	LE02
Keeping in touch with and helping business-side employees with IT problems (maintaining their trust and confidence).	LE03
Resolving conflicts between business-side employees concerning IT.	LE04
Keeping track of business-side employees' training and special skills as they relate to IT assignments so as to facilitate their personal growth and development.	LE05
Allocating manpower to IT specific jobs or tasks.	LE06
Providing new business-side employees with adequate training for the introduction to the IT related job tasks at hand.	<b>LE07</b>
Seeing to it that business-side employees are alert to IT problems that need attention.	LE08
Using your authority to ensure that business-side employees accomplish important IT tasks.	LE09
Maintaining supervision over changes in IT in your organization.	LE10
Providing guidance to business-side employees on the basis of your understanding of IT in the organization.	LE11
Giving negative feedback (criticizing business-side employees' IT actions when appropriate).	LE12
Directing the work with IT of the business-side employees.	LE13
Forwarding important IT relevant information to the business-side employees.	LE14
Maintaining your personal network of contacts through visits, phone calls, or social media.	<b>LI 1</b>
Attending social functions which allow you to keep up your contacts.	<b>LI 2</b>
Attending conferences or meetings to maintain your contacts.	LI 3
Attending social functions as an IT representative of your organization.	<b>LI 4</b>
Joining boards, organizations, clubs, etc., which might provide useful work- and IT-related contacts.	LI 5
Staying attuned to the grapevine.	LI 6
Developing new contacts by answering requests for information.	LI 7
Developing personal relationships with people outside your unit who feed you work or services (e.g., purchasing, suppliers, consultants, inspectors, etc.).	<b>LI 8</b>
Developing contacts with important people outside your immediate organization.	<b>LI 9</b>
Assessing political events as they may affect your work.	<b>M 1</b>
Keeping up with market changes and trends that might have an impact on your organization.	<b>M 2</b>
Keeping up with information on the progress of operations in the company.	<b>M 3</b>
Keeping up with technological developments related to your work or to the company.	M 4
Gathering information about IT trends outside your organization.	<b>M 5</b>
Gathering information about customers, competitors, associates, etc. applying IT	M 6
Touring facilities for observational purposes of IT use.	M 7
Learning about new ideas originating outside of your department.	<b>M 8</b>
Reading reports on activities in your own or others' Information System departments.	M 9
Distributing budgeted IT resources.	<b>R 1</b>
Making decisions about time parameters for up-coming IT projects.	R 2
Preventing the loss or threat of loss of IT resources valued by your organization.	R 3
Allocating monies within your unit.	<b>R 4</b>
Deciding for which IT supported programs to provide resources (manpower, material, etc.).	<b>R 5</b>
Allocating IT equipment or related materials.	<b>R 6</b>
Presiding at meetings as a representative of your organization's IT.	<b>S 1</b>
Serving as an IT expert to people outside of your immediate department.	<b>S 2</b>
Informing others of your organization's future IT plans.	S 3
Answering letters of inquiries on behalf of your organization.	S 4
Keeping other people informed about your organization's IT activities and plans.	S 5
E= Entrepreneur, LE= Leadership, LI= Liason Role, M= Monitor, R= Resource Allocator, S= Spokesperson	

**Table 2. Managerial IT Leadership Item Refinement 2017 (bold: remains in the final scale)**

<b>Factor 1: Leadership</b> Cronbach $\alpha = 0.833$ ; $\theta = 3.922$ ; $\sigma = \text{s.d.} = 0.8677$						<b>Factor 4: Resource Allocator</b> Cronbach $\alpha = 0.755$ ; $\theta = 3.974$ ; $\sigma = \text{s.d.} = 0.8584$						
LE 07	0.692					R 4				0.709		
LE 01	0.649					R 1				0.616		
M 5	0.554	0.300	0.319			M 2			0.349	0.507		
R 6	0.525				0.340							
M 8	0.522											
<b>Factor 2: Liason Role</b> Cronbach $\alpha = 0.763$ ; $\theta = 3.557$ ; $\sigma = \text{s.d.} = 1.0497$						<b>Factor 5: Entrepreneur</b> Cronbach $\alpha = 0.734$ ; $\theta = 4.051$ ; $\sigma = \text{s.d.} = 0.8420$						
LI 2		0.730			0.325	M 3					0.721	
M 1		0.722				R 5			0.311		0.652	
LI 4		0.677				E 2					0.577	
<b>Factor 3: Spokesperson</b> Cronbach $\alpha = 0.765$ ; $\theta = 3.958$ ; $\sigma = \text{s.d.} = 0.8637$						<b>Factor 6: Relationship Builder</b> Cronbach $\alpha = 0.702$ ; $\theta = 3.806$ ; $\sigma = \text{s.d.} = 0.9$						
S 1			0.692			LI 9						0.729
E 1			0.672	0.304		LI 8						0.725
S 2			0.516			LI 1			0.370			0.477

**Table 3. Results of the EFA: Rotated Component Matrix**

All in all, we found five factors with content similarity to the six roles contained in McCall and Segrist (1980) and Grover et al. (1993), but in contemporary and rearranged compositions. Table 4 shows the final assignments as well as the initial variable name for “before and after” comparison. Remarkably, the items of the monitor role consistently dispersed to nearly each resulting role, which removed the substance for an own remaining factor. The dispersing of the monitor role, on the one side, underlines the stated interrelatedness of the roles (Grover et al. 1993; McCall, JR. and Segrist 1980; Mintzberg 1973), on the other hand suggests that the monitor role must be seen integrated to the particular role definition in contemporary knowledge-intensive industries. For the first four factors, the majority of items of the original role setting served as identification for the factor’s character and naming. The leadership role is supplemented by two monitor items and one initial resource allocator item (R 6) The latter finding stresses the technical, IT specialized item modification as well as the relevance of IT supply by the CIO to business-side employees. The liason role was reassessed with one monitor item. The determination of the spokesperson role typically describes the representation of the IT function and deals with information outside the IT department, but within the organization (Grover et al. 1993; Mintzberg 1989). Consequently, the complementing entrepreneur item (E 1) in this study expresses the importance of changes in the IS of the organization implemented by the CIO, revealing IT’s contribution to business success and subsequent organizational representation. The resource allocator role, which is closely associated to budget responsibility, underlines the importance of staying up-to-date with changing markets and IT trends. Consequently, a corresponding monitor item (M 2) completes this role. For factor five, we decided to keep the entrepreneur designation, as these items articulate the explicit business planning capabilities of the CIO: being informed about business operations, deciding to which operations distribute IT resources to, as well as enforcing organizational change by means of IT; whereas the latter clearly distinguishes from item E 1 which rather focusses on the change of IS than supporting organizational change with means of IT (E 2). Considering that the Mintzberg definition of the initial liason role is closely related to motivation of subordinates and acting as kind of “transfer point” for information within an organization (Mintzberg 1989), for factor six we detected a greater tendency to outward orientation - outside the IT unit, outside the organization - and to more progressive activities, thus, claimed this “relationship builder” respectively.

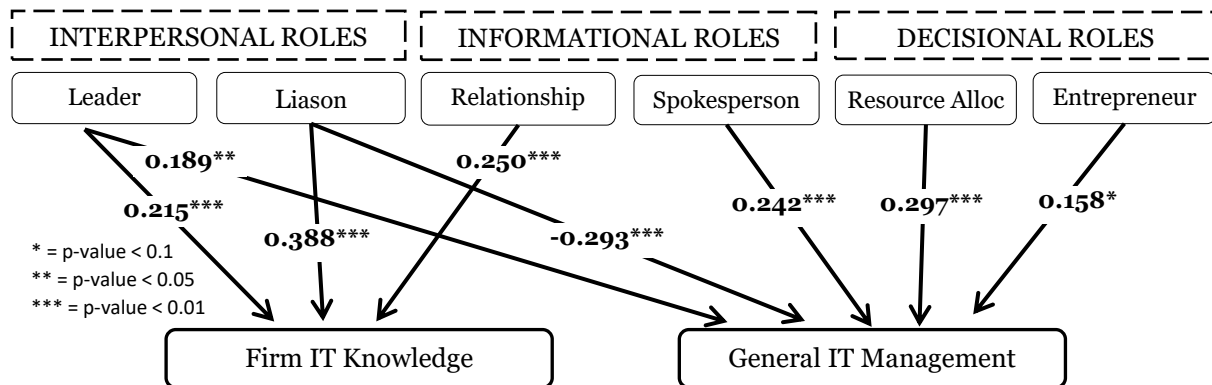
### **Confirmatory Factor Analysis (CFA)**

To confirm the identified multidimensional factor structure more deeply (MacKenzie et al. 2011), a CFA was conducted with means of the R Studio software version 0.99.902. using the lavaan package version 0.5-20 for latent variable analysis. The overall fit of the six factor model of the data applied to required goodness indices very well, likewise the ratio of chi-square (286.52) to degrees of freedom (155.00) turned out to be lower than two (1.848). RMSEA (0.061) was significant at 0.05-level, as well as the comparative fit index (CFI) and Tucker-Lewis index (1973) were found above 0.9. We standardized one item per factor to one (Hair 2010) and found all factor loadings at least at 0.7 or mostly higher, even for item LI 1, which had performed a bit weak in EFA and, thus, confirm to keep this item for factor six (relationship). In order to assess the discriminant power of the factor structure, the computed covariance matrix implicates that each construct’s AVE is notably lower than its



correlation with all other roles (Fornell and Larcker 1981). Thus, we found good support for the exploratory generated factor structure to continue the analysis.

### Nomological Validity: Structural Equation Modeling (SEM)



**Figure 2. Results of SEM Testing: Nomological Validity**

To test the multifactorial structure of the constructs, we conducted a procedure for nomological validity of the multidimensional structure (MacKenzie et al. 2011). Therefore, we tested the impact of the six identified CIO roles on two probable consequences, namely two credible outputs of leadership: organizational knowledge and strategic IT management. As literature supposes, knowledge is influenced by leadership behavior (Nonaka 1994; Škerlavaj et al. 2010). Therefore, we apply a set of three items describing strategic IT knowledge of the business-side employees (Wunderlich and Beck 2017, modified from Preston and Karahanna 2009), accordingly to our item adaption towards regarding business-side employees as subordinates of the CIO. Second, we insert experience in general management of IT of the CIO (Wunderlich and Beck 2017, adapted from Bassellier et al. 2003) to analyze strategic outputs of the managerial roles of the CIO as well. To test the proposed relationships, we converted the identified roles into six reflective constructs within a structural equation model (SEM) using SmartPLS v.3.2.3 (Ringle et al. 2016), employing a components based approach with a 500 sample bootstrapping technique for model assessment. Test results are displayed in figure 2, we deleted all arrows with insignificant test results to keep the table clear. Prior to analyzing the path relations, the quality criteria show very good properties for the reflective measurement constructs: for construct reliability, Cronbach's alpha revealed for all constructs between the desirable Nunally minimum of 0.7 and 0.895, for construct validity the average variance extracted (AVE) lied between 0.6 and 0.86, which is explicitly higher than the postulated threshold of 0.5 (Chin 1998), and composite reliability (CR) between 0.832 and 0.935. For discriminant validity, we found the Fornell and Larcker criterion as achieved by identifying the AVE of each construct as higher than the square root of the correlation to every other construct. The R<sup>2</sup> values of both dependent constructs (0.391 and 0.472) indicate strong amount of variance explained (Chin 1998).

As already discussed in the EFA section, we identified five of the six role characteristics of the Grover et al. item set in the extracted factor structure and were able to preserve these role designations accordingly. Thus, we assigned these roles to the three rubics supposed by Mintzberg apparently (figure 2, table 4). The newly defined relationship role shows tendence to outwards orientation of the information exchange process a leader is daily involved in. Being part of information transfer related to operations, Mintzberg's liason role is more directed inwards the actual unit (Mintzberg 1989), which led us to assign the newly extracted relationship role to the informational roles, relating this role more to the character of maintaining contacts than to operational actions. Regarding the test results in figure 2, we detect the interpersonal roles loading highly significant on firm IT knowledge, which confirms theoretical considerations and empirical findings in the management literature (Nonaka 1994; Škerlavaj et al. 2010). Likewise, the contact related relationship builder role influences the IT knowledge of business-side employees as well. The more the roles gain decisional or representative character, the more we find loadings on the CIO's general management of IT. This may be caused by the strategic character of the related tasks described within the construct items. Remarkably, we find a highly significant impact of the leadership role on strategic issues as well, which underlines the central character of this role. Surprisingly, we detected a negative impact of the liason role on general IT management. This supposes, concentrating on social functions and attending political events hinders the CIO from executing decisions, which is reasonable but an unexpected finding of this study.

## Conclusion

The purpose of this research was to gather first insights how roles of the CIO tend to influence firm IT capabilities, more precisely IT capabilities relying on IT skills of business-side employees as well. As argued in the introduction, new infrastructural and technical opportunities comprise both chances and challenges in managing IT and invite to rethink traditional organizational structures (Henfridsson et al. 2014; King 2011; Tilson et al. 2010). The study at hand offers first results to answer these questions by presenting a well extracted and validated factor structure of IT leadership roles (table 4). Based on six of the ten Mintzberg original roles, we present six partially newly conceptualized CIO roles in guiding the IT leader's area of responsibility. Having conducted a further iteration of item modification, scale refinement, and validation processes (MacKenzie et al. 2011), this research presents a validation of a conceptualization of Mintzberg's managerial leadership roles on a third level, resulting in a 20 item questionnaire especially adjusted to the IS context. Above all, we emphasize the relevance of the leader role for managing and strategic planning, the increased importance of monitor functions for each distinct role, and the CIO's position as "nerve center" (Mintzberg 1989, p.17), or as we state "transfer point", for information and organizational knowledge.

<b>INTERPERSONAL</b>	<b>Leadership Role</b>	
	Providing new business-side employees with adequate training for the introduction to the IT related job tasks at hand.	<b>LE07</b>
	Evaluating the quality of business-side employees' IT performance.	<b>LE01</b>
	Gathering information about IT trends outside your organization.	<b>M 5</b>
	Allocating IT equipment or related materials.	<b>R 6</b>
	Learning about new ideas originating outside of your department.	<b>M 8</b>
	<b>Liason Role</b>	
	Attending social functions which allow you to keep up your contacts.	<b>LI 2</b>
	Assessing political events as they may affect your work.	<b>M 1</b>
	Attending social functions as an IT representative of your organization.	<b>LI 4</b>
<b>INFORMATIONAL</b>	<b>Relationship Builder</b>	
	Developing contacts with important people outside your immediate organization.	<b>LI 9</b>
	Developing personal relationships with people outside your unit who feed you work or services (e.g., purchasing, suppliers, consultants, inspectors, etc.).	<b>LI 8</b>
	Maintaining your personal network of contacts through visits, phone calls, or social media.	<b>LI 1</b>
	<b>Spokesperson</b>	
	Presiding at meetings as a representative of your organization's IT.	<b>S 1</b>
	Planning and implementing change in the organization's IT.	<b>E 1</b>
	Serving as an IT expert to people outside of your immediate department.	<b>S 2</b>
<b>DECISIONAL</b>	<b>Resource Allocator</b>	
	Allocating monies within your unit.	<b>R 4</b>
	Distributing budgeted IT resources.	<b>R 1</b>
	Keeping up with market changes and trends that might have an impact on your organization.	<b>M 2</b>
	<b>Entrepreneur</b>	
	Keeping up with information on the progress of operations in the company.	<b>M 3</b>
	Deciding for which IT supported programs to provide resources (manpower, material, etc.).	<b>R 5</b>
Initiating controlled change by means of IT.	<b>E 2</b>	
E= Entrepreneur, LE= Leadership, LI= Liason Role, M= Monitor, R= Resource Allocator, S= Spokesperson		

**Table 4. Managerial IT Leadership 2017: Resulting Construct**

### Implications and Discussion

As a result of the clear and discriminative factor structure of the IT leadership roles, we shed light into the partially confusing definition of managerial leadership (Karahanna and Watson 2006). For the special case of the CIO as highest IT manager in an organization, this research clarifies the assignment of the six identified CIO leadership roles to two organizational consequences: Three of the roles (leader, liason, relationship builder) are directed towards business-side employees as they impact business-side strategic IT knowledge. This is in line with the prior findings and the initial definition by Mintzberg which claims the interpersonal roles and partially the informational roles as directed

towards the regarded subordinates, in our case business-side employees. The three remaining roles (spokesperson, resource allocator, entrepreneur) turned out to be closely related to strategic IT management tasks fulfilled by a CIO, which is consistent with the definition of the informational and the decisional roles in particular (Mintzberg 1989). Since our nomological results suggest two main separate attributions for the managerial CIO roles, we constitute IT leadership consisting of managing (leader, liason, relationship builder) and planning (spokesperson, resource allocator, entrepreneur).

Regarding the extracted discriminative CIO roles, the leadership role turned out to be a central aspect of the IT leadership artefact, as it is the only role which relates to the business-side and to strategic IT decision making simultaneously, according to our nomological validity tests. The initial monitor role was found to spread to nearly all other resulting roles, which underlines the relevance of information supply in contemporary work surroundings in knowledge-intensive industries. Continuously monitoring ideas, market changes, IT trends, and information sources appears to be a further central function of the CIO to gain value from IT investments and keep the organization competitive in contemporary digitized market environments, at most to accomplish competitive advantage (Chen et al. 2010b; Peppard and Ward 2004). According to these challenges, the newly found relationship builder role emphasizes the relevance for CIOs of maintaining a solid network of contacts within and outside the organization. An unexpected but potentially relevant finding, fulfilling the liason role extensively seems to hold the CIO from strategic decision making, probably due to a conflict in terms of time which would result in a trade-off problem the CIO has to solve.

By the proved influence of three of the IT leadership roles on firm IT knowledge, we can assume that these roles are central to achieve increased firm-wide IT capabilities, as the latter build on each employee's individual knowledge, whereas mediated by IT competencies (Peppard and Ward 2004). We propose this to be further investigated in future research. We mainly aimed at specifying several items further to the IT context to sharpen the item expressions to respondents and therefore make them assessable by business-side employees in further research. Three of the six identified CIO roles bear potential to be assessed by business-side employees in future research because they are significantly related to firm IT knowledge. We demand further verification if the more strategically oriented roles could be evaluated in the same way as well. With means of the validated and newly composed item structure, this study may stimulate to rethink the commonly affirmed high intercorrelation of leadership roles (Grover et al. 1993; McCall, JR. and Segrist 1980; Mintzberg 1973). Especially with regards to future quantitative studies, we present an IT leadership scale with as discriminant dimensions as feasible. Likewise, the consecutive reduction of items has led to a useful and comprehensive scale which can be applied in quantitative nomological networks such as SEM.

### ***Limitations and Future Research***

There are some minor limitations that have potential to be overcome by future research. We present our results based on the collected sample data. Despite dealing with goodness indices as well as validity and reliability tests, more studies could contribute to further validate the leadership roles of CIOs evaluating our proposed factor and item structure. The validation of the multidimensional structure of our findings could be extended by testing for second-order structures either for the three rubrics Mintzberg suggests (interpersonal, informational, decisional) or the two identified directions (managing and planning) our nomological validation results imply. For this purpose, a second sample arising from another quantitative survey would seem to be an appropriate next step (MacKenzie et al. 2011).

According to the further questions Grover et al. (1993) regarded as well, future research shall investigate the possibility of varying importance of the different CIO leadership roles the study at hand has identified. In previous research, this had been explored by means of rank comparison (Grover et al. 1993; McCall, JR. and Segrist 1980). Likewise, the Grover et al. results about the interrelation between IS maturity and IS centralization could be reassessed on basis of the presented reconceptualized IT leadership questionnaire. In the same line of argument, relations of the decisional or IT planning roles towards the TMT could be further assessed. We would appreciate other researchers to utilize the presented items in these contexts. Further, investigations about the employee oriented roles bear potentials to be applied in studies analyzing organizational cultures and, for statistical reasons, to avoid method bias in contrast to a self-evaluation of IT leadership by the CIO himself or herself.

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