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A New Dualistic CIO Toolbox: Towards Ambidexterity in the Digital Business Transformation

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Abstract

By transferring organizational learning concepts into the IT context, this paper provides a new behavior oriented foundation for managing IT organizations in the digital business transformation. As a practical contribution, the paper introduces a new management toolbox which supports Chief Information Officers (CIOs) to lead their Information Technology (IT) organizations towards ambidexterity in the digital business transformation. The organizational ambidexterity is required for the digital business transformation in order to contribute innovativeness while simultaneously assuring effective operational IT environment. The toolbox is constructed using the systematic concept analysis and the concept derivation methods to convert the organizational learning concepts into the dualistic CIO toolbox. The toolbox includes a set of traditional Key Performance Indicators (KPIs) to assure operational effectiveness and a set of leadership principles to enable an innovative and experimental organizational behaviour. The application of the new dualistic CIO toolbox is illustrated through hypothetical cases.

Keywords: CIO; IT Management; Ambidexterity; Digital Business Transformation

1. INTRODUCTION

The ongoing use of new digital technologies is bringing entirely new types of management challenges to Chief Information Officers (CIOs). These new management challenges are closely related to the CIO's changing role in the organizations. "No longer are CIOs responsible solely for the stewardship of the organization's technology base, ensuring that the computers and telecommunications continue to function; they are now strongly encouraged to become drivers of business transformation and innovation" (Peppard, 2010, pp. 73-74). The CIOs and their IT organizations are now expected to spend less time managing IT and more time co-inventing and co-implementing new business innovations enabled by the new digital technologies (Leidner & Mackay, 2007; Peppard, Edwards, & Lambert, 2011; Carter, Grover, & Thatcher, 2011; Kettinger, Zhang, & Marchand, 2011; Weill & Woerner, 2013; Korhonen, 2015). To manage these rather contradictory expectations in the period of the digital business transformation, the CIOs must be able to expand their IT organizations' traditional IT gatekeeper role which protects the technology base of the IT environment to include an active IT contributor role.

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IT organizations have traditionally used the IT gatekeeper role for two purposes. By measuring, correcting and improving the technology base of the IT environment, they have assured it is constantly as effective and stable as possible and have hence suspiciously guarded it by strictly controlling which business innovations are to be implemented into the IT environment and which not. In the new IT contributor role, they will instead learn to co-operate with other organizational unit members, such as, business strategists, process managers, business managers and production managers. They will start actively contributing to the company's intellectual IT capabilities by co-planning and co-creating new business innovations (such as new services, products and work practices) as well as assisting that these new innovations will be properly used.

To succeed with this role expansion, the CIOs will need to motivate their IT organizations to step into both of these roles, that is, to behave ambidextrously. An organizational ambidexterity is an organization's ability to both exploit and explore (Tushman & Reilly, 1996) by delivering efficiency, control, and incremental improvements, while simultaneously embracing flexibility, autonomy, and experimentation (Baskarada, Watson, & Cromarty, 2016). In other words, the IT organization's traditional gatekeeper role corresponds to exploitative behaviour in the IT environment (to ensure the effectiveness, stability and accuracy of their existing IT environment), whereas the new IT contributor role corresponds to explorative behaviour in the IT environment (to subversively develop the IT environment).

The earlier Information Systems (IS) studies on the CIO role have traditionally focused, inter alia, on the CIO's own efficiency (Smaltz, Sambamurthy, & Agarwal, 2006; Wu, Chen, & Sambamurthy, 2008; Chun & Mooney, 2009; Peppard, 2010; Chen & Wu, 2011) and the CIO's contribution to the firm's efficiency (Li & Ye, 1999; Johnson & Lederer, 2005, 2010; Hu, Yayla, & Lei, 2014; Taylor, Sahym, & Vithayathil, 2015). Only a few IS studies have been conducted on the CIOs dualistic role (such as Carter et al., 2011; Kalgovas, van Toorn, & Conboy, 2014), although the ever-increasing digitization of business has generated new contradictory requirements for CIOs (Weill & Woerner, 2013) and although organizational ambidexterity has been widely studied in management science (Gibson & Birkinshaw, 2004; Jansen et al., 2008; Nemanich & Vera, 2009; Carmeli & Halevi, 2009; O'Reilly & Tushman, 2011; Rosing, Frese, & Bausch, 2011; Chang & Hughes, 2012; Turner, Swart, & Maylor, 2013; Li, Lin, & Tien, 2015; Baskarada et al., 2016). The few IS studies conducted on the CIO's dualistic role have, however, not examined the CIO's dualistic role in the digital business transformation, but concentrated on studying various CIO skills needed to create business opportunities (Carter et al., 2011) and different barriers which CIOs must overcome to create an ambidextrous IS function (Kalgovas et al., 2014). Moreover, Tilson, Lyytinen and Sörensen (2010), have proposed that, due to the ongoing digitalization, IS research should move in new directions, such as focusing on the paradoxes of change and control as significant IS phenomena.

Clearly, there is need for additional IS studies on the CIO's dualistic role. However, these studies should be closely connected to the challenges of digitalization and conducted through the lens of an entire company's digital success. In this sense, studying the challenges, which the CIOs have in combining their IT organization's traditional gatekeeper role with the IT contributor role, is essential, as solving this paradox will boost the entire company's digital success. Therefore, the primary research objective of this study is to fill the gap of inadequate IS research on the CIO's dualistic role in the digital business transformation and also to contribute to the new IS research direction relating to the paradoxes of change and control (Gregory, Keil, & Muntermann, 2015) by aiming to answer to the following research question: *"What kinds of steering practices do CIOs need during the digital business transformation to motivate their IT organizations to behave both exploitatively and exploratively?"*

To answer to the research question, we construct a new management tool for CIOs. We select specific learning concepts derived from the organizational learning theory of Argyris and Schön (1974) and then convert these concepts into the IT context (as CIOs' operational targets and leadership principles). The methodology we use to construct the tool, includes two phases. In Phase 1, the systematic concept analysis methodology of Nuopponen (2010) is used to select and describe a set of learning concepts derived from the theory of Argyris and Schön (1974). In Phase 2, the selected learning concepts are converted into the IT context by using the concept derivation method of Walker and Avant (2011). We call this new managerial tool, which supports the CIOs new dualistic role in the digital business transformation, *the dualistic CIO toolbox*. The toolbox itself is divided into two parts to support both the exploitative IT gatekeeper role and the explorative IT contributor role.

The paper is organized as follows. Section 2 describes CIOs' traditional ways to steer IT organizations. It also reviews the literature on the organizational learning principles of Argyris and Schön (1974) – used as "building blocks" to create the dualistic CIO toolbox. Section 3 describes the two-phase methodology for designing the dualistic CIO toolbox. Section 4 describes how the dualistic CIO toolbox can be used in practice via a hypothetic case example. Section 5 concludes the paper.

2. THEORETICAL FOUNDATION

Section 2.1 describes CIOs' traditional ways of steering IT organizations. Section 2.2 introduces the organizational learning principles of Argyris and Schön (1974), which are later (in Section 3) used as "building blocks" to create the new dualistic management toolbox for CIOs.

2.1. CIOs' traditional steering practices

Over the years, several IT frameworks have been created to guide CIOs and their IT organizations on how to build and run their IT operations (Rozemeijer, van Bon, & Verheijen, 2007). These IT management frameworks, such as, ITIL (IT Infrastructure Library) and Cobit (Control OBjectives for Information and related Technologies) describe the best practices to design, deliver, manage and improve the ways in which information technology and services are used within an organization. They include, for instance, rules for setting up pre-defined business processes, establishing IT roles with responsibilities and a set of Key Performance Indicators (KPIs) to secure high quality services in the IT environment. These KPIs are attached to various activities, procedures and processes and can reveal, for example, if the IT organization (their own or outsourced) operates these processes, procedures and activities as required.

As IT systems have become more ubiquitous, heterogeneous, networked, and complex to manage (Lyytinen & King, 2006), IT management frameworks have become increasingly critical for CIOs and their IT organizations. Many IT organizations have also become overly fanatic over these frameworks and seen them as their ultimate salvation (Rozemeijer et al., 2007). As these frameworks mainly focus on delivery processes (assuring effectiveness, stability and accuracy of the existing IT environment) and not on business outcomes, which would require IT organization to collaborate and co-innovate with business units, the IT organizations have developed rather hostile attitudes towards innovativeness and experimenting. They have learned that experimenting would only jeopardize them achieving their "real" goals, namely, assuring effectiveness, stability and accuracy in their existing IT environment. Indeed, they have developed "methods" to protect their IT environments against "useless and hazarding" business experiments by claiming that certain changes to the IT environment (i.e. process, technology or infrastructure changes) would be too risky to implement, e.g., due to the increased security threats. The unwillingness to change the IT environment has therefore been "camouflaged" into the technical explanations.

To succeed in the digital business transformation, however, requires that the IT organization is willing to experiment with new technologies and practices; and most of all, willing to experiment in collaboration with other organizational units. Therefore, this paper aims at creating a new management tool (in Section 3), which CIOs can use to motivate their IT organizations to behave more innovatively and collaboratively, but at the same time assuring the "sufficient" effectiveness, stability and accuracy of their existing IT environment.

2.2. Organizational learning theory

The authors selected the organizational learning theory of Argyris and Schön (1974) to derive suitable learning concepts to construct the dualistic CIO toolbox. The theory by Argyris and Schön was chosen for several reasons. Firstly, the theory was developed to take into account the

complexity and variety of organizational environments as it describes two different types of such environments (Model I and II). Secondly, the theory included organizational learning concepts (i.e. single-, double- and triple-loop learning concepts) that have been empirically tested multiple times over several decades by Argyris and Schön. Therefore, the learning concepts were well-suited (reliable) to be used as "building blocks" to construct the dualistic CIO toolbox. Thirdly, the theory also describes (in detail) how organizational norms and values affect learning behaviour. This is especially important for the organizations that are about to enter the digital business transformation as these organizations must learn to question and if necessary alter their current goals, norms, limitations and practices – to truly succeed in the digital business transformation.

Argyris and Schön (1978) created the learning-loop concept, which describes an organization's ability to learn from its mistakes via recursive loops. They constructed three learning-loop methods (see Figure 1): (1) single-loop learning, (2) double-loop learning, and (3) deutero learning (triple-loop), originally created by Bateson (1972).

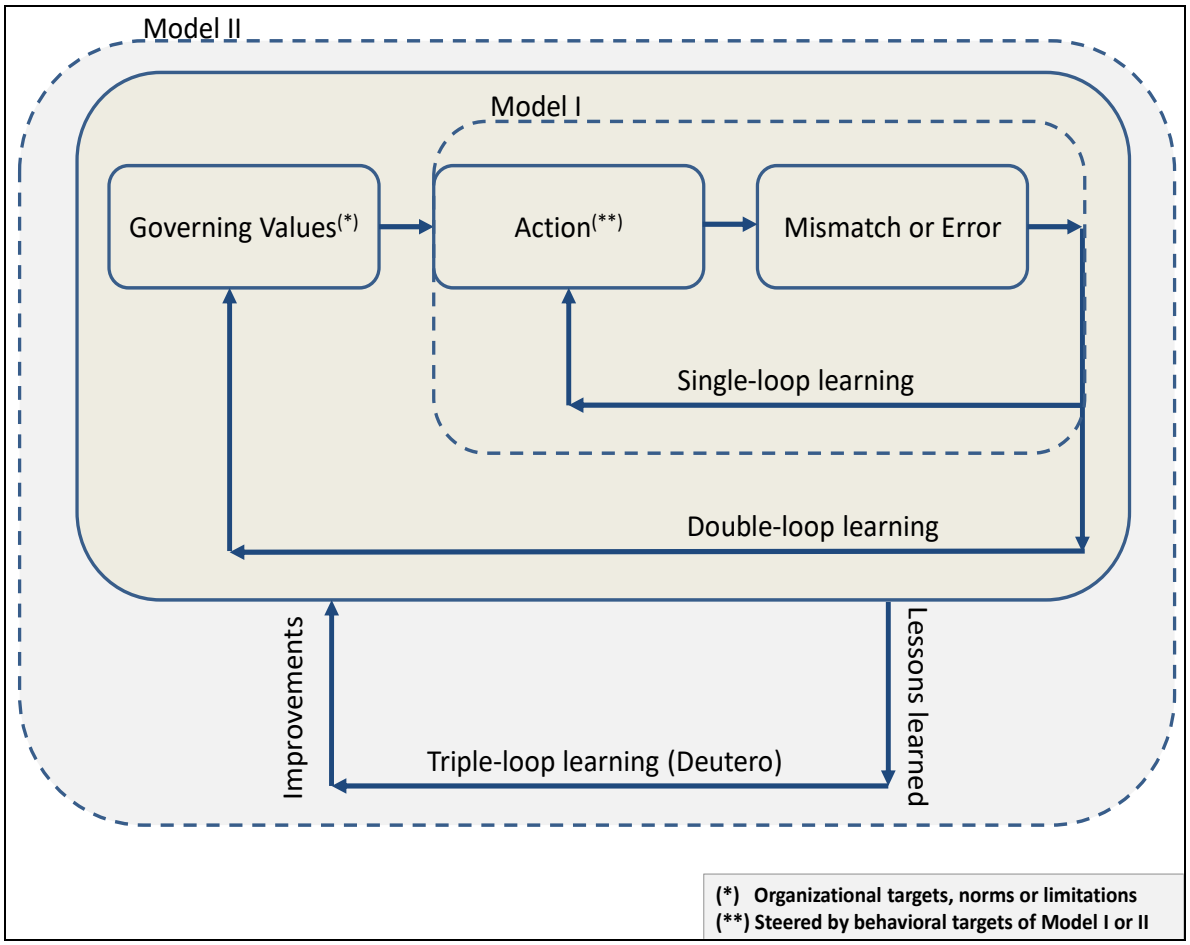

Figure 1 - Models I and II (adapted of Argyris & Schön, 1978, pp. 142–143 by adding deutero learning).

Argyris (2002) described, "*single-loop learning occurs when errors are corrected without altering the underlying governing values*" (p. 206). By underlying governing values, Argyris meant organizational policies, targets and limitations (Argyris, 1977) related to products, processes, tasks, or quality, for example (Argyris & Schön, 1978). Single-loop learning therefore remains within the accepted routines (Argyris, 1976). Furthermore, single-loop learning is "concerned primarily with effectiveness - that is, with how best to achieve the existing goals and objectives and how best to keep organizational performance within the range specified by existing norms" (Argyris & Schön, 1978, p. 21).

Although single-loop learning provides stability in the organization, it also inhibits learning in fundamental organizational issues, goals and activities (Argyris, 1976). The organization is in single-loop mode (in Model I), when the organization only allows single-loop learning. Model I describes a traditional organizational behavioural environment in which the organizational members:

- possess Model I behavioural targets (see Figure 1) to (1) define the goals and try to achieve them, (2) maximize winning and minimize losing, (3) minimize the generation or expression of negative feelings and (4) act rationally (Argyris & Schön, 1974); and
- are encouraged to undergo a routinized type of learning (single-loop learning) but not to question the fundamentals of governing values (company policies, targets or limitations) (Argyris & Schön, 1978) and therefore not allowed for "out-of-the-box" thinking (double-loop learning).

As the members in the Model I environment are not allowed to question the fundamental aspects, the development will be more or less correcting the existing and fine-tuning already functioning solutions. In the IT context, the IT organization operates in the Model I environment, when the IT organization is mainly measured on its ability to achieve single-loop specific targets. In other words, the IT organization is measured on its ability to secure the following aspects (without changing the given organizational policies, targets or limitations):

- routine corrections to fix the detected errors in the existing IT environment;
- effectiveness and stability of the existing IT environment (either measured after the process execution or audited in advance); and
- incremental improvements to increase the effectiveness or stability of the existing IT environment.

Argyris (2002) described, "*double-loop learning occurs when errors are corrected by changing the governing values and then the actions*" (p. 206). This means that double-loop learning requires that new routines must first be created to match a different conception of the world, as shown in Figure 1 (Argyris, 2003). Deutero learning, in turn, occurs when an organization learns how to optimize

single-loop learning or improve double-loop learning (Argyris, 2003) based on their prior experience of learning situations, as shown in Figure 1.

Schön (1975) described the following five improvement activities enabling deutero learning (Figure 1: lessons learned and improvements), which the whole organization should continually carry out: (1) Members should integrate scattered perceptions of organizational phenomena so that a problem situation affecting the organization as a whole does not become a crisis. (2) Members should name and test interpretations of problematic or taboo phenomena and bring them into open discussion for confirmation or refutation (via direct feedback). (3) New structures and policies designed to correct dysfunctions should be developed and implemented in the organization (based on shared commitment and experience in the past). (4) Members should together respond to conflicts through inquiry and shared commitment rather than through bargaining (i.e., via mini versions of previously decided solutions), so that those working on the problem can build on one another (via decision-making networks and with the help of experts). (5) Members should experiment new structures and policies, even if the experiment cannot be fully justified beforehand, with the aim of obtaining valid information (both positive and negative) on the results of the experiment.

The organization operates in the Model II environment, when the organization is allowed for single-loop, double-loop and deutero learning. Model II describes an innovative organizational behavioural environment in which the members of the organization:

- possess Model II behavioural targets (see Figure 1) to (1) always seek valid information, (2) provide information about their choices and (3) be responsible for monitoring the implementation of their choices and correcting them if necessary (Argyris & Schön, 1974); and
- are encouraged for both routine and innovative learning as the members are allowed to question the fundamental governing values, since the organizational rules can be changed and conclusions can be publicly tested (Argyris & Schön, 1978).

Model II produces more valid information when errors occur as failures can be communicated openly and the organization can learn from the feedback (Argyris, 1976). Therefore, the organization that is allowed to think outside of the existing norms and boundaries will be more effective in solving problems and finding new innovative ways of working. In the IT context, the IT organization operates in the Model II environment, when the IT organization is measured on its ability to achieve both single-loop and double-loop specific targets and is also encouraged to learn from its past behaviour and to change its behaviour if required (deutero learning). In other words, the IT organization:

- is assessed on its ability to ensure the correct, continuously improved, effective and stable IT environment as well as on its ability to question and alter the current work practices via co-inventing and co-deploying (outside of the given organizational targets, policies or limitations): new practices, processes, services, policies or technologies (which can, but do need to, correct a failure or a deviation in the existing IT environment); and
- is encouraged, via open discussions (and surveys) to learn from its past behaviour to manage conflicting organizational targets, taboos, unclear roles or responsibilities related to decision making, information sharing, expertise sharing and experimenting.

3. RESEARCH METHODOLOGY

Sections 3.1-3.2 describe a two-phase research methodology used in this study to compose the dualistic CIO toolbox. Phase 1 describes the selection process of the learning concepts and Phase 2, the conversion logic.

3.1. Phase 1: selecting the learning concepts

The systematic concept analysis of Nuopponen (2010) was chosen as a mean to select the learning concepts which later would be used as "building blocks" to construct the dualistic CIO toolbox. The analysis method of Nuopponen (2010) is a further modification of the Terminological analysis method of Picht and Draskau (1985) and it emphasizes clarification of the relations between concepts, locating these concepts in concept systems (Nuopponen, 2010). The systematic concept analysis method outlines the steps to analyze concepts for various purposes and it can be used as part of a wider study (Nuopponen, 2010) as is done in this study.

The systematic concept analysis starts with a selection of the literature domain (Step 1: defining a goal). The authors selected the organizational learning theory of Argyris and Schön (1974) (see the reasoning in Section 2.2). In Steps 2 and 3 (gaining knowledge), a knowledge foundation was created by acquiring and compiling the material from Argyris and Schön published during the period 1974–2002 (Table 1). As more knowledge was accumulated, a list of important references to various learning concepts was constructed. In Steps 4 and 5 (creating a framework), a preliminary learning concepts framework was created including Model I principles (single-loop and behavioral targets of Model I) and Model II principles (double-loop, deutero enablers and behavioral targets of Model II). In this stage, those concepts which could not logically be later converted into the IT context, were deleted. Those, that could be converted, were elaborated simultaneously to find their differences and mutual relations. The relations and differences between the selected learning concepts were then visualized as in Figure 1. Finally, in Step 6 (concluding), the final selection of learning concepts and their characteristics were presented in the tabular format (Table 1) to further facilitate the conversion process in Phase 2.

ID: CONCEPT	DEFINITION	SOURCE
S1: Single-loop learning #1	"Single-loop learning occurs when errors are corrected without altering the underlying governing values."	Argyris, 2002, p. 206
S2: Single-loop learning #2	Single-loop learning is "concerned primarily with effectiveness - that is, with how best to achieve the existing goals and objectives and how best to keep organizational performance within the range specified by existing norms".	Argyris & Schön, 1978, p. 21
D1: Double-loop learning #1	"Double-loop learning occurs when errors are corrected by changing the governing values and then the actions."	Argyris, 2002, p. 206
D2: Double-loop learning #2	"Double-loop learning is concerned primarily with resolving conflicts related to incompatible organizational norms by setting new priorities and weightings of norms or by restructuring the norms themselves together with associated strategies and assumptions."	Argyris & Schön, 1978, p. 24
DE1: Deutero learning enabler #1	Members should integrate scattered perceptions of organizational phenomena (so that a problem situation affecting the organization as a whole does not become a crisis).	Schön, 1975, p. 14
DE2: Deutero learning enabler #2	Members should name and test interpretations of the problematic or taboo phenomena and bring them into open discussion for confirmation or refutation (via direct feedback).	Schön, 1975, p. 14
DE3: Deutero learning enabler #3	Members should create (conjure up) new structures and policies (to correct dysfunctions) based on past experience.	Schön, 1975, pp. 14–15
DE4: Deutero learning enabler #4	Members should together respond to (solve) conflicts through inquiry and shared commitment rather than through bargaining (i.e., via mini versions of previously decided solutions) and build on one another while working on the problem.	Schön, 1975, p. 15
DE5: Deutero learning enabler #5	Members should experiment new structures and policies by enabling the organization to commit beforehand to experiment, even if the experiment cannot be fully justified beforehand, with the aim of obtaining valid information (both positive and negative) on the results of the experiment.	Schön, 1975, p. 15
M-I: Model I behavioural targets	(1) Define the goals and try to achieve them. (2) Maximize winning and minimize losing. (3) Minimize generating or expressing negative feelings. (4) Be rational.	Argyris & Schön, 1974, pp. 66-67
M-II: Model II behavioural targets	Members shall seek valid information, provide information about their choices, and be responsible for monitoring the implementation of their choices and correcting them if needed.	Argyris & Schön, 1974, pp. 85-93

Table 1 – The selected learning concepts.

3.2. Phase 2: converting the concepts into the dualistic CIO toolbox

The concept derivation method of Walker and Avant (2011) was chosen to convert the selected learning concepts (Table 1) into the IT context (Table 2). Walker and Avant introduced the first version of their concept derivation method in 1983 in the nursing field (Jonas-Simpson, 2006). However, the method has been applied also in other fields, such as, social sciences including IS/IT (Sprott, 1994; Fletcher, 1999; Mäkinen and Huotari, 2004; Broom, 2006; Hansen, 2006; Lahdesmaki, 2016). This indicates its broad applicability. The concept derivation is distinguished from traditional concept analysis in that the concept derivation employs an analogy or metaphor to

transpose concepts from one field of inquiry to another and that it has no exact rules for selecting a field from which to derive concepts (Walker & Avant, 2011). The purpose of the concept derivation is to generate new ways of thinking about and looking at a given phenomenon (Walker & Avant, 2011), and it "has the advantage of letting the theorist avoid beginning from scratch" (Walker & Avant, 2011, p. 80). In this study, the adoption of the concept derivation method to the IT context comprised two steps. Step 1 included the conversion process itself and Step 2 the peer-review discussions to ensure the validity and usability of the constructed dualistic CIO toolbox. During the conversion and peer-review process, a whole new concept system (the dualistic CIO toolbox) was created including both operational targets (to be measured with KPIs) and leadership principles (to create innovative working environment).

In Step 1, the first author's extensive practical and theoretical knowledge of IT management frameworks and IT governance helped significantly to convert the selected learning concepts (of Argyris and Schön, 1974) into the IT context. The following learning concepts were converted into the IT context:

- Single-loop learning was converted as it could identify the CIO's traditional operational targets (in the IT gatekeeper role) to assure the error-free, effective, stable and incrementally improved IT environment. *However, none of the behavioural targets of Model I were converted*, since they identified types of organizational behaviour that could not be operational targets or leadership principles for the CIO in any situation;
- Double-loop learning was converted as it could identify the CIO's new target (in the IT contributor role) to co-plan and co-invent completely new services, products or ways of working;
- The five tasks enabling deutero learning (Schön, 1975) were converted into the CIO's new leadership principles as they provided transparency, openness and experimenting; and
- Also the behavioural targets for Model II were converted into the CIO's new leadership principles as they provided valid information and responsible decision making.

	TARGETS / PRINCIPLES, EXAMPLES FOR USAGE AND ORIGIN (*) Organizational targets (governing values) include any existing organizational goals, norms or limitations assigned to processes, routines, structures, plans, services, products, projects or artefacts in the existing IT environment.
EXPLOITATIVE IT	**Correction-target:** Measure the number of corrections made to fix the deviations in the existing IT environment without changing the current organizational targets(*). **Example:** ITIL metric: "Number of implemented preventive measures, e.g. for security". **Origin:** S1 in Table 1.
	Stable-effectiveness-target: Measure the number of completed actions or achieved results to assure the stability and/or effectiveness of the existing IT environment without changing the current organizational targets(*). **Note:** The actions being measured can also be pre-activities such as tests, simulations, reviews, audits etc. to assure stability or effectiveness. The measurement can also measure anti-effectiveness or anti-stability (violating current organizational targets). The measurement differs from the Correction-target measurement since it does not measure the number of corrective actions, but instead actions assuring effectiveness or/and stability. **Example:** ITIL metric: "Number of weaknesses which were identified during a process evaluation, to be addressed by improvement initiatives". **Origin:** S2 in Table 1.
	Improvement-target: Measure the number of improvement proposals (related, e.g. to services, products, processes or artefacts) to increase the effectiveness and/or stability of the existing IT environment without changing the current organizational targets(*). **Example:** ITIL metric: "Number of service issues identified in an improvement plan". **Origin:** S2 in Table 1.
EXPLORATIVE IT	**Innovation-target:** Measure the number of innovation proposals (new processes, services, products etc.) to be implemented into the IT environment without obeying the current organizational targets(*). **Note:** Innovation proposals can also correct an existing deviation or failure in the IT environment. **Example:** ITIL metric: "Percentage of new services developed without triggered by strategy". **Origin:** D1 in Table 1.
	Conflict-principle: Arrange surveys or open discussions of conflicts between various relationships and collect ideas or solutions generated to correct these conflicts. **Note:** The idea is to collect information of the conflicts, e.g. among various departments escalated to a higher level because no common solution was found jointly. The ideas and solutions for correcting these conflicts are related to changing/re-prioritizing common organizational targets. **Example:** See Table 3: Items #1 and #2. **Origin:** D2 in Table 1.
	Transparency-principle: Arrange surveys or open discussions of the current or future organizational targets and collect ideas or solutions generated through these surveys or discussions. **Note:** The idea is to ensure that current or future targets, e.g. for various departments fit together. **Example:** See Table 3: Items #2 and #4. **Origin:** DE1 in Table 1.
	Taboo-principle: Arrange surveys or open discussions the major organizational difficulties or taboos and collect the solutions, confirmations or refutations obtained during these surveys or discussions. **Example:** See Table 3: Item #1. **Origin:** DE2 in Table 1.
	Lessons-learned-principle: Arrange surveys or open discussions of the previous organizational targets or experiences and collect lessons learned obtained through these surveys or discussions. **Note:** The idea is to collect lessons learned to evaluate, e.g. whether experiences (related to projects, processes, services, etc.) could be used to create future organizational strategies, policies or structures. **Example:** See Table 3: Item #6. **Origin:** DE3 in Table 1
	Expertise-principle: Arrange surveys or open discussions of the expert role to ensure that the valuable expert knowledge is available to various decision-making networks. **Example:** See Table 3: Item #3. **Origin:** DE4 in Table 1.
	Prediction-principle: Arrange surveys or open discussions to collect information of tests or simulations of any type of solutions and valid test results (positive or negative) obtained during these experiments to explore possible impacts in advance. **Note:** The solution can be any type of application, plan, forecast, estimate, verification, etc. related to projects, processes, policies, structures, services, products or artefacts. **Example:** See Table 3: Item #5. **Origin:** DE5 in Table 1.
	Data-access-principle: Arrange surveys or open discussions of events or actions that failed owing to restricted access to valid information in the organization at the time information was required. **Note:** The failure happened when events or actions could not be implemented correctly, not at all or needed later to be changed. **Example:** See Table 3: Item #1. **Origin:** M-II in Table 1.
	Decision-follow-up-principle: Arrange surveys or open discussions of decision-making practices to ensure the consequences of decisions are followed up by decision makers (and corrected if necessary). N**ote:** The decision maker is any organizational member, who is responsible for the decision. **Example:** See Table 3: Item #4. **Origin:** M-II in Table 1.

Table 2 – The dualistic CIO toolbox.

In Step 2 the converted learning concepts were given different names and discussed with two fellow investigators in the field to evaluate whether the operative targets and leadership principles were understandable and to modify them (in Step 1), if necessary. Approximately 15 peer-review sessions were conducted, each lasting from 30 minutes to two hours.

The final end-product of Phase 2, the dualistic CIO toolbox, is presented in Table 2. Table 2 is divided into the exploitative and explorative parts. The exploitative part includes operational targets (Model I principles), whereas the explorative part includes leadership principles and one operational target (Model II principles). Table 2 lists examples of how to use the tool. Examples are either comparable metrics of ITIL (v.2011) or hypothetical case examples (further explained in Table 3). Table 2 also links the targets/principles to the learning concepts (described in Table 1) from which they were originally converted from. The details of the conversion logics are explained in Appendix 1.

4. THE DUALISTIC CIO TOOLBOX USED IN PRACTICE

To crystalize how CIOs should use their new dualistic CIO toolbox in practice, we have created six hypothetical case examples of diverse challenging work situations (Table 3).

HYPOTHETICAL CASE VIGNETTE
Description: A company Hypo is a medium-sized industrial company with own IT department. Lately, the company has experienced growing global competition in their established market segments. In order to keep their existing market shares with adequate profits, the company's leadership has turned to the firm's CIO (Alex Smith) to look for new digital innovations to strengthen the competitive position. Alex Smith, who has until now been responsible only for the operational IT environment, is now facing new types of expectations and challenges coming directly from the leadership team. He soon realizes that the "excellent operative IT results" he has accomplished until now will not be sufficient in the future. Alex also realizes that he has to take a stronger role in creating the whole company's digital future. He cannot only focus on his own IT organization (IT department) anymore. He understands that he cannot accomplish this digital journey alone, but needs to start co-operating with Hypo's different business departments, clients and other new stakeholders outside of his traditional IT environment. Along this journey, he meets various types of challenges. Below we present examples of these challenging situations and how Alex would be able to solve them by using the new dualistic CIO toolbox.
Hypothetical situation with possible solution:
Situation #1: There seem to be many failing activities as a result of outdated, corrupted or unavailable information preventing some activities from being carried out or necessitating their later reversal. **Possible solution:** Alex understands that there is a need for a comprehensive training program to increase communication between various departments, teams and other parties to remove the unconstructive attitude towards information sharing. He knows that the organization sometimes camouflages failures (when the given targets could not be achieved), blockades access to information when they believe that is beneficial for their own purposes and forgets to update information which they believe is no longer needed by them but could be needed by others. Alex starts solving the situation by taking into use the *Data-access-principle, Conflict-principle* and *Taboo-principle*. He arranges surveys (and open discussions) of events and actions which failed due to the restricted access to valid information (at the time the information was required). The target of these surveys is also to collect information of possible organizational conflicts or taboos behind the failing activities and also to collect solutions regarding how to correct these conflicts or taboos in order to change the organization's faulty attitudes related to the information sharing.

Situation #2: The IT organization seems to have constantly conflicting interests with other organizational units regardless of the existence of a unified company strategy. **Possible solution:** Alex decides to take into use both the *Transparency-principle* and *Conflict-principle.* Therefore, Alex arranges surveys (and open discussions) to identify possible issues behind these conflicts. The solutions proposed in these surveys (to correct the conflicting situations) might require changes to the current and future organizational targets (e.g. incompatible targets between departments).
Situation #3: The company Hypo (with its surrounding business networks) seems to have the required expertise for creating new business improvements and innovations, but no innovations seem to be created. **Possible solution:** Alex activates *Expertise-principle*. He arranges surveys (and open discussions) of expert roles to ensure that the valuable expert knowledge is available for experimenting new business improvements and innovations. Alex starts also creating knowledge-sharing networks where new ideas can be actively shared. Alex allocates time to the IT organization to share their expertise (and asks the permission for other units as well). He also promotes a new practice which does not "punish" this type of knowledge sharing behaviour (e.g. by altering the traditional incentive practices based primarily on effectivity targets.)
Situation #4: Innovative ideas are proposed but no progress seems to follow. **Possible solution:** There can be several reasons for a lack of progress. First, the process for allocating and scheduling the work, once created, is treated as permanent and no changes (due, for example, to customer commitments) are subsequently allowed. Second, the members of the organization might not want to be responsible for carrying the innovation proposals further, perhaps, due to the incentive policy or because of a lack of empowerment. Third, the members can simply resist innovative ideas for personal reasons (e.g. they fear of losing their jobs). In all of these cases, Alex needs to deploy drastic changes to current organizational norms (governing values), for example, by allowing room for adjustments to existing plans and empowering people regardless of their status within the organization. Alex starts solving the situation by taking into use the *Transparency-principle.* Alex arranges surveys (and open discussions) of the current and future organizational targets and starts collecting information (generated through these surveys) in order to find out whether current organizational targets (assigned to specific individuals) do not support innovation. For example, the employees are only being rewarded for performing routine work. Furthermore, Alex takes into use the *Decision-follow-up-principle* to ensure that the consequences of decisions are followed up by initial decision makers.
Situation #5: The IT organization is not allowed to try and fail, but is expected to do the right thing at once. **Possible solution:** Alex activates the *Prediction-principle* by allocating time for the IT organization (and asks the permission for other units as well) to trial new business improvements and innovations. He also allows open access to the ongoing trials to increase collaboration between various (internal and external) actors. Failures encountered during the trials are openly discussed and positively promoted, since to try and to fail are understood to be essential stepping stones in the process of developing new business innovations.
Situation #6: The IT organization seems to repeat the same mistakes. **Possible solution:** Alex decides to take into use the *Lessons-learned-principle* by starting systematically to gather and share previous experiences related to various projects, experiments and other activities. This might require changing existing attitudes towards failing and information sharing of negative experiences.

Table 3 – The dualistic CIO toolbox used in practice.

5. DISCUSSION AND CONCLUSIONS

5.1. Discussion

The objective of this study was to fill the gap of inadequate IS research regarding the CIOs dualistic role in the digital business transformation and also to contribute to the new IS research direction regarding the paradoxes of change and control. We were able to answer to the research question: "What kinds of steering practices do CIOs need during the digital business transformation to motivate their IT organizations to behave both exploitatively and exploratively?" by developing a

new dualistic CIO toolbox (see Table 2), which CIOs can use during the digital business transformation to motivate their IT organizations to behave ambidextrously.

The development of the toolbox followed a two-phase methodology including the systematic concept analysis and the concept derivation methods. The created instrument opens a new fresh CIO management approach enabling both operative and strategic targets to be fulfilled. As a practical contribution, the dualistic CIO toolbox helps CIOs (a) to ensure both an effective and innovative working environment and (b) to internalize their new, rather contradictory, dualistic roles in a rapidly changing organizational environment.

5.2. Conclusions

Overall, it can be concluded that factors, such as reduced access to valid information or various conflicts arising in the organization, inhibit creation of accurate problem descriptions (Argyris, 1976) and hence slow down the creation of new services, products or work practices. Therefore, CIOs should start systematically eliminating these inhibiting factors via open discussions and surveys. By using Model II principles (the leadership principles of the toolbox in Table 2) CIOs can eliminate these inhibiting factors as these principles allow an organization to question its targets and norms and since the organizational rules and failures can be openly communicated (Argyris, 1976). Model II principles also crystallize the common targets throughout the organization. This is especially important in the digital business transformation when the products and services will be developed collaboratively with expertise from different fields. Indeed, by using Model II principles, CIOs will not only contribute in the area of Information Technology, but also in areas such as organizational culture, know-how and the company's strategic direction. Also, the value of CIOs and their IT organizations will no longer be based on their ability to increase organizational effectiveness or decrease mandatory IS/IT expenses, but rather on their ability to generate revenue by enabling new innovations and speeding up digital business growth.

5.3. Limitations and future research

The results of this study (the dualistic CIO toolbox) is limited to the use of CIOs, but can also be used by other IT executives, business managers and digital managers (such as Chief Digital Officers). Future research could, for example, include empirical studies related to current CIO practices to examine whether some of the leadership principles are already in use in some organization, and if so, whether they work as expected.

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APPENDIX 1: THE CONVERSION LOGICS OF LEARNING CRITERIA

Criteria for organizational learning (Argyris & Schön, 1974)	**Conversion logic => Converted operational target/leadership principle** **Note (*)**: Current organizational targets (governing values) include any existing organizational goals, norms, or limitations assigned to processes, routines, structures, plans, services, products, projects, or artefacts in the existing IT environment.
Single-loop learning #1: "*Single-loop learning occurs when errors are corrected without altering the underlying governing values*" (Argyris, 2002, p. 206).	"*The underlying governing values"* were translated into IT context as current organizational targets including any organizational goals, norms, or limitations assigned to processes, routines, structures, plans, services, products, projects, or artefacts. => **Correction-target:** Measure the number of corrections made to fix the deviations in the existing IT environment without changing the current organizational targets.(*)
Single-loop learning #2: Single-loop learning is "*concerned primarily with effectiveness - that is, with how best to achieve the existing goals and objectives and how best to keep organizational performance within the range specified by existing norms*" (Argyris & Schön, 1978, p. 21).	The target is combined to measure both effectivity and stability either simultaneously or separately. "*Concerned primarily with effectiveness*" was translated to measure any kind of effectiveness achieved within existing organizational targets. Whereas "*... how best to keep organizational performance within the range specified by existing norms*" was translated to measure the stability of events, issues, or actions achieved within existing organizational targets. **=> Stable-effectiveness-target -** Measure the number of completed actions or achieved results to assure the stability and/or effectiveness of the existing IT environment without changing the current organizational targets.(*) **Note:** The actions being measured can also be pre-activities such as tests, simulations, reviews, audits etc. to assure the stability or effectiveness. The measurement can also measure anti-effectiveness or anti-stability (violating current organizational targets). The measurement differs from the Correction-target measurement since it does not measure the number of corrective actions, but actions assuring effectiveness or/and stability
	The target was added to emphasize that "*how best to achieve the existing goals…"* can also mean producing new ideas or improvement proposals related to existing products, services, processes or artefacts. The target differs from Innovation-target that measures the amount of new innovation proposals to be implemented outside of the current organizational targets. **=>Improvement-target:** Measure the number of improvement proposals (related, e.g., to services, products, processes, or artefacts) to increase the effectiveness and/or stability of the existing IT environment without changing the current organizational targets.(*)
Double-loop-learning #1: "*Double –loop learning occurs when errors are corrected by changing the governing values and then the actions*" (Argyris, 2002, p. 206).	The Innovation-target measurement generalizes the meaning of *"…changing the governing values*…" to mean new innovation proposals to be implemented outside of (without obeying) the current organizational targets, but not necessarily correcting any detected errors. => **Innovation-target:** Measure the number of innovation proposals (new processes, services, products etc.) to be implemented into the IT environment without obeying the current organizational targets.(*) **Note:** Innovation proposals can, but do not necessary need to, correct an existing deviation or failure in the IT environment.
Double-loop learning #2: Double-loop learning is concerned primarily with resolving conflicts related to "*incompatible organizational norms by setting new priorities and weightings of norms or by restructuring the norms themselves together with associated strategies and assumptions"* (Argyris &	"*Resolving conflicts related to incompatible organizational norms*" is nearly impossible to measure as such in the organizational environment. It is, however, possible to survey or have open discussions of conflicting situation between various organizational units which are caused by incompatible organizational targets. => **Conflict-principle:** Arrange surveys or open discussions of conflicts between various relationships and collect ideas or solutions generated to correct these conflicts. **Note:** The idea is to collect information of the conflicts, e.g., among various departments escalated to a higher level because no common solution was found jointly. The ideas and solutions for correcting these conflicts are related to changing/re-prioritizing common organizational targets.

Schön, 1978, p. 24).	
Deutero learning #1: Members should integrate scattered perceptions of organizational phenomena (so that a problem situation affecting the organization as a whole does not become a crisis) (Schön, 1975, p. 14).	"*Scattered perceptions of organizational phenomena"* was translated as "Arrange surveys or open discussions of the current or future organizational targets…". => **Transparency-principle:** Arrange surveys or open discussions of the current or future organizational targets and collect ideas or solutions generated through these surveys or discussions. **Note:** The idea is to ensure the targets, e.g., for various departments fit together.
Deutero learning #2: Members should name and test interpretations of the problematic or taboo phenomena and bring them into the open discussion for confirmation or refutation (via direct feedback) (Schön, 1975, p. 14).	"*Members should name and test interpretations of the problematic or taboo phenomena*" was translated as "Arrange surveys or open discussions of the major organizational difficulties or taboos …" => **Taboo-principle:** Arrange surveys or open discussions of the major organizational difficulties or taboos and collect solutions, confirmations, or refutations obtained during these surveys or discussions.
Deutero learning #3: Members should create (conjure up) new structures and policies (to correct dysfunctions) based on past experience (Schön, 1975, pp. 14-15).	It is difficult (or even meaningless) to measure the structural or policy changes of the organization correcting dysfunctions such as "*Conjure up new structures and policies (to correct dysfunctions)…"*, but it is possible to "Arrange surveys or open discussions of the previous organizational targets or experiences…" in order to improve organizational processes, policies or structures.=> **Lessons-learned-principle:** Arrange surveys or open discussions of the previous organizational targets or experiences and collect lessons-learned obtained through these surveys or discussions. **Note:** The idea is to use the experience achieved in future organizational strategies, policies, or structures.
Deutero learning #4: Members should together respond to (solve) conflicts through inquiry and shared commitment rather than through bargaining (i.e. via mini versions of before-hand-decided solutions) and build on one another while working on the problem (Schön, 1975, p. 15).	"*Members should together respond to solve conflicts through inquiry*" was translated to measure the quantity of events (or the effective time) used for supporting problem solving (i.e. resolving conflicts). "…*and build on one another while working on the problem*" was translated as "…supporting the problem solving in an expert role or as a participant in a decision making network". => **Expertise-principle:** Arrange surveys or open discussions of expert role to ensure that the valuable expert knowledge is available to various decision-making networks.
Deutero learning #5: Members should experiment new structures and policies, even if the experiment cannot be fully justified beforehand, with the aim of obtaining valid information (both positive and negative information) on the results of the experiment (Schön, 1975, p. 15).	"*Members should experiment new structures and policies*" was translated to measure the quantity of events or actions used for testing or simulating any type of (new) solution. Whereas "… *obtaining valid information (both positive and negative information) of the results of the experiment*" was translated to measure the output of the tests. => **Prediction-principle:** Arrange surveys or open discussions to collect information of tests or simulations of any type of solutions and valid test results (positive or negative) obtained during these experiments to explore possible impacts in advance. **Note:** The solution can be any type of application, plan, forecast, estimate, verification, etc. related to projects, processes, policies, structures, services, products, or artefacts.

Model I behavioural targets: (1) Define the goals and try to achieve them ("at all costs"). (2) Maximize winning and minimize losing ("do not let others to win"). (3) Minimize generating or expressing negative feelings ("manipulate and save your face"). (4) Be rational ("never show your feelings") (Argyris & Schön, 1974, pp. 66-67).	**None of the behavioural targets of the Model I were converted** into the new dualistic CIO toolbox, since these behavioral targets identified types of organizational behaviour that could not be used as CIO's operational targets or leadership principles in any situation. Indeed, the Model I targets would only prevent the organization from openly sharing their organizational goals, know-how and ideas.
Model II behavioural targets: Members shall seek valid information, inform of their choices and be responsible to monitor the implementation of their choices and correct them if needed (Argyris & Schön, 1974, pp. 85-93).	"*Members should seek valid information and inform of their choices*" is nearly impossible to measure as such. It is, however, possible to arrange surveys or open discussions of failed issues, events, or actions that failed owing to restricted access to valid information. As failing the decision or action indicates a failure of the organization. => **Data-access-principle:** Arrange surveys or open discussions of events or actions that failed owing to restricted access to valid information in the organization at the time the information was required. **Note:** The failure happened when events or actions could not be implemented correctly, not at all or needed later to be changed.
	"*Members should … be responsible for monitoring their choices and correct them if needed*" was translated to "…open discussions of decision-making practices to ensure the consequences of decisions were followed up by decision-makers". => **Decision-follow-up-principle:** Arrange surveys or open discussions of decision-making practices to ensure the consequences of decisions are followed up by decision makers (and corrected if necessary). **Note:** The decision maker can be any member of the organization who is responsible for the decision.