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# An Empirical Assessment of the CIO Role Expectations Instrument Using PLS Path Modelling

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**Abstract:**

The validation of information systems research instruments has not received the attention that it deserves. Based on data obtained from 174 Australian CIOs, we use component-based structural equation modelling (PLS/SEM) to investigate the psychometric properties and possible modeling of the highly regarded CIO role expectations instrument that Smaltz, Sambamurthy, and Agarwal (2006) have developed. Results show that the CIO role expectations instrument exhibits solid validity and reliability indices despite some minor weaknesses. The results also demonstrate the possibility to model the constructs of this instrument in different null and hierarchical models, and they provide further empirical support for the validity of this instrument to measure the CIO role in different countries and different types of industries beyond the U.S. healthcare sector in which Smaltz et al. developed it. The results provide support for CIO role theory on two central issues: CIOs are fulfilling a configuration of roles not just one specific role, and the CIO roles can be grouped into two major categories: supply (operational) side roles and demand (business) side roles.

**Keywords:** Chief Information Officer Role, Configuration of CIO Roles, Duality of CIO Roles, CIO Role Expectations instrument, Partial Least Squares (PLS), Psychometric Properties, Hierarchical Models, Repeated Indicators Approach.

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# 1 Introduction

The arrival of the information age has made the role of the chief information officer (CIO) more vital than other C-suite managers (Dahlberg, Hokkanen & Newman, 2016; Peppard, Edwards & Lambert, 2011). Since the emergence of the CIO role in early 1980s, much has been written about it; however, this role remains ambiguous (Gerth, 2013; Müller, 2014; Peppard et al., 2011). This ambiguity indicates a lack of theory building regarding the CIO role in an organization. Consequently, the lack of theory leads to a lack of rigorous measurements. A review of the literature revealed a handful of instruments that researchers have used to measure the role of the CIO (e.g., Arthur Andersen & Co, 1988; Gottschalk, 2000; Karimi, Gupta, & Somers, 1996; McCall & Segrist, 1980; Smaltz, Sambamurthy, & Agarwal, 2006; Wu, Chen, & Sambamurthy, 2008).

Researchers have identified information Systems (IS) management as one of the most researched topics in IS (Palvia, Pinjani, & Sibley, 2007); however, the vast majority of literature is substantive rather than measurement oriented. Many scholars acknowledge that little IS research has paid attention to measurement validation (Baskerville & Wood-Harper, 2016; Boudreau, Gefen, & Straub, 2001; DeLone & McLean, 1992; Doll & Xia, 1997; Gefen & Straub, 2005; Ives & Olson, 1984; Jarvenpaa, Dickson, & DeSanctis, 1985; Jenkins, 1985; Klenke, 1992; McHaney, Hightower, & Pearson, 2002; Straub, 1989), and Chau (1997) pointed out that calls for methodological rigor and model testing in management information systems research are increasing and that researchers have increasingly begun to use structural equation modeling (SEM) approaches in management science. However, recent IS literature has acknowledged the absence of applied examples on how to apply SEM techniques to assess IS multidimensional or hierarchical constructs (Wright, Campbell, Thatcher, & Roberts 2012; Wetzels, Odekerken-Schröder, & Oppen, 2009). In the last two decades, we have witnessed a number of empirical examinations by IS scholars to validate previously developed measures (e.g., Chau, 1997; Chin & Todd, 1995; Doll & Xia, 1997; Klenke, 1992; Segars, 1997; Segars & Grover, 1993; Stewart & Segars, 2002). Other studies have provided guidelines for checking instrument validation (Boudreau et al., 2001; Gefen & Strau, 2005; Straub, Boudreau, & Gefen, 2004; Straub, 1989). Further examining the measurement of constructs such as the CIO role is central to both theoretical and operational perspectives of the IS discipline (Stewart & Segars, 2002).

From a theoretical perspective, re-examining the CIO role expectations instrument would reveal its rigor and guide researchers in their level of confidence in CIO role theory. From an operational perspective, re-examining the instrument would facilitate generalizability and consistency of measurements over time and context and may avoid researchers from drawing erroneous conclusions about the existence, magnitude, and direction of association between constructs (Stewart & Segars, 2002). Smaltz et al. (2006) encouraged IS researchers to validate the generalizability of the configuration of CIO roles in different industries beyond the healthcare sector in which they developed it. We chose the Smaltz et al. (2006) instrument because it has received extensive attention from IS scholars since 2006; in fact, it has received the most citations of any CIO role study based on Google Scholar (200 citations as at 10 March, 2017) and the Scopus database (115 citations as at 10 March, 2017).

In order to address this gap and respond to these calls for increased theoretical and methodological rigor, we 1) critically examine the psychometric properties of the CIO role expectations instrument (Smaltz et al., 2006) using component-based structural equation modelling (PLS/SEM) and 2) assess and compare different types of null and hierarchical models using the constructs of the CIO role expectations instrument for the best modeling fit. Specifically, we address two research questions:

**RQ1:** Is the CIO role expectations instrument valid and reliable?

**RQ2:** How can one model the constructs of the CIO role expectations instrument to gain the best validity, reliability, and model fit?

This paper proceeds as follows: in Section 2, we discuss CIO role measurement in general and the CIO role expectations instrument in particular. In Section 3, we describe and justify the research methodology we used. In Section 4, we present the results from analyzing the survey data. In Section 5, we discuss the key results of the study. Finally, in Section 6, we discuss implications of the key findings for existing theory and practice and present some suggestions for future research.

## 2 Background

An extensive review of the CIO roles' literature suggests that researchers and practitioners have used at least six survey instruments to identify the CIO roles to date (e.g., Arthur Andersen & Co, 1988; Gottschalk, 2000; Karimi, Gupta, & Somers, 1996; McCall & Segrist, 1980; Smaltz et al., 2006; Wu et al., 2008). These measures were developed specifically for the CIO role except for the instruments that McCall and Segrist (1980) and Gottschalk (2000) developed, which build on Mintzberg's ten general managerial roles (Mintzberg 1980). Table 1 summarizes the main CIO role identification instruments we identified in the literature that researchers developed specifically for the CIO role and their citation status based on Google Scholar (10/03/2017).

**Table 1. Comparison of CIO Key Roles Instruments: Roles, Items, and Citations**

| Reference | Number of roles identified | Number of items | Google Scholar citations as at 10 March, 2017 | Average no. citations per year |
|---|---|---|---|---|
| Arthur Andersen & Co (1988) | 2 | 22; 16 | N.A. | N.A. |
| Karimi et al. (1996) | 8 | 8 | 150 | 7.14 |
| Smaltz et al. (2006) | 6 | 25 | 200 | 20.00 |
| Wu et al. (20080 | 8 | 34 | 19 | 2.37 |

Based on earlier work by Smaltz (1999), Smaltz et al. (2006) developed the CIO role expectations instrument in the U.S. healthcare sector. They integrated a wide knowledge base regarding the CIO role with a comprehensive CIO role inventory that they derived from the literature along with rich data obtained from CIOs and top management team members they interviewed (Smaltz et al., 2006). Brown (2006) applied Smaltz's (1999) instrument in his study of CIOs in higher education institutes.

Smaltz et al. (2006) used the CIO role expectations instrument to identify the perceived importance of six key CIO roles. These six roles are defined from an organizational perspective and are desirable for a CIO to be effective in their position in an organization (Smaltz et al., 2006):

1) Strategist: the CIO should be an effective business partner and help their organization leverage valuable opportunities for IT-based innovation and business process redesign.
2) Relationship architect: the CIO can build relationships both across the enterprise as well as outside the enterprise with key IT service providers.
3) Integrator: the CIO can provide leadership in enterprise-wide integration of processes, information, and decision support.
4) Educator: the CIO should be an IT missionary who provides insight and understanding about key information technologies to raise top management savviness, awareness, and appreciation of IT and help them to make appropriate judgments about the business value of IT and wise IT investment decisions.
5) Utility provider: the CIO is a builder of sustainable, solid, dependable, and responsive IT infrastructure services.
6) Information steward: the CIO can be an organizational steward for high-quality data and operationally reliable systems.

Note that Smaltz et al. (2006) classified these six roles into two high-level categories of roles as follows: 1) supply-side roles (i.e., the operational or technical roles: utility provider, information steward, and educator) and 2) demand-side roles (i.e., the strategic or business roles: integrator, relationship architect, and strategist).

The final CIO role expectations instrument that Smaltz et al. (2006) used included 25 items identified to measure the CIO role. They operationalized this instrument using exploratory factor analysis and principal component extraction in order to examine the dimensionality of its indicators. From the results, they found six-dimensional factors that reflected six roles for CIOs: strategist (five items), relationship architect (four items), integrator (four items), educator (three items), information steward (four items), and utility provider (three items). They found that the factor loadings for 23 out of 25 items analyzed were acceptable (i.e., in the range from 0.4 to 0.82). They omitted two items due to lower factor loadings (Stra1: develop and implement a strategic IT plan that aligns with the organization's strategic business plan; and UtPr4:

establish electronic linkages to external entities (customers, suppliers, partners, etc.)). To our knowledge, subsequent empirical studies have not validated this instrument; hence, we use a confirmatory approach to validate it and test the categorization of its constructs based on previous literature.

# 3 Methodology

## 3.1 Data Collection

We collected data for this research through a large-scale cross-sectional survey carried out in Australia in early to mid-2012. Prior to data collection, we slightly modified the instrument that Smaltz et al. (2006) used because they initially developed it for the healthcare sector and we intended to collect data from CIOs across a wide range of industries. Appendix A presents the statements we used in the survey questionnaire for this study. We modified the wording of eight of the 25 items (i.e., UtPr2, UtPr3, Edu1, Edu2, Edu3, Integ3, Integ4, and Stra1) to be more generic than the initial ones. Also, we also used a seven-point Likert scale in contrast to the five-point likert scale initially used in this instrument to increase the instrument reliability (Alwin & Krosnick, 1991; Barnes, Christensen, & Hansen, 1994; Churchill & Peter, 1984). Then, we pre-tested an initial draft of the instrument with an expert panel of academics with extensive experience in survey design. We made some minor changes to the wording of some items in the light of the expert panel’s feedback. Next, we asked one former healthcare CIO and the CTO of a university to complete the pilot survey and comment on any issues that might impair one from completing the questionnaire or generate a poor response rate. Based on their comments, we made further minor changes to finalize the survey questionnaire for data collection.

We administered the survey questionnaire in three waves: two postal mail outs followed by an email with an online version of the survey questionnaire. The target population for this research was Australian private sector IT executives. A list of postal addresses for senior IT executives in Australian private sector firms purchased from Dun and Bradstreet, Australia (see www.dnb.com.au), in 2011 provided the sampling frame for this study. We sent a cover letter along with a copy of the survey questionnaire and pre-paid reply envelope to all of the 954 Australian senior IT executives listed in the sampling frame in early 2012. To increase the response rate, we conducted follow-up phone calls and sent emails in early July, 2012, to motivate more responses after the second mail out.

We received undeliverable messages for 113 questionnaires due to invalid addresses and emails from 19 firms who indicated that they were not willing to participate in this survey for different reasons. With 174 complete and usable responses (161 hardcopy and 13 online), the response rate was 20.68 percent (174/ (954 -113) = 20.68%). Such a result is reasonable for survey research compared to similar studies that have involved CIOs: Preston, Karahanna, and Rowe (2006) report that such response rates have ranged from seven to 20 per cent. We realize that the targeted respondents were senior IT executives who are busy people and tend to be over-surveyed.

## 3.2 Data Analysis

We analyzed the data using partial least square structural equation Modelling (PLS / SEM). We used the software package PLS-Graph Alpha (Version 03.12 build 01) (Chin, 2001) to analyze the data. PLS/SEM is variance based, prediction oriented, distributional free, and can treat reflective and formative constructs in highly complex structural models (Chin & Newsted, 1999). We used the results of the PLS/SEM analysis to assess the reliability and validity of the CIO role expectations instrument.

# 4 Research Results

We prepared the survey data for data analysis by correcting errors, checking and treating outliers, checking for normal distribution and multicollinarity based on the guidelines that Tabachnick and Fidell (2007) provide. Next, we assessed non-response bias. We compared early respondents ($n = 21$) and late respondents ($n = 13$) in terms of the six CIO roles included in this instrument. From conducting the Mann-Whitney U test on the 25 items of this instrument, we found statistically significant differences between early respondents and late respondents in only one item (ReAr1). Thus, we can conclude the early and late respondent CIOs had no major differences and that non-response bias did not appear to be an issue in this research.

We also checked for common method bias (CMB) in the measurement model for the CIO role expectations instrument. Common method bias is the variance attributable to the measurement method rather than to the measures that represent the constructs of interest in a study (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Common variance bias is a major systematic contributor to measurement error in survey research (Bagozzi & Yi 1991). To test for the extent of bias caused by common methods variance (CMV) in the CIO role expectations instrument, we conducted Harman's single factor test using an exploratory factor analysis in IBM SPSS version 23 (Podsakoff et al., 2003). Researchers have argued that, if there is a detrimental level of common method bias, "(a) a single factor will emerge from exploratory factor analysis (unrotated) or (b) one general factor will account for the majority of the covariance among the measures" (Podsakoff et al., 2003, p. 889). As six factors emerged from an exploratory factor analysis (unrotated) to explain the variance in the CIO role expectations instrument, we can infer that common methods bias was not an issue in this study.

## 4.1 Psychometric Properties of the CIO Role Expectations Instrument

Smaltz et al. (2006) modeled the six CIO roles in the instrument as reflective constructs; hence, we needed to test five major areas to ensure measurement validity (Henseler, Ringle, & Sinkovics, 2009): reliability at the construct level, reliability at the indicators level, convergent validity, discriminant validity at the construct level, and discriminant validity at the indicators level.

Smaltz et al. (2006) and Smaltz (1999) modeled the constructs as reflective (correlated constructs) when they surveyed CIOs. However, when they used the same instrument to obtain top management team (TMT) judgment about CIO effectiveness, they modeled the constructs as formative (non-correlated). Smaltz (1999) originally developed the instrument in his doctoral dissertation in which he modeled constructs and items as reflective. Other IS scholars have also modeled the constructs and items of this instrument as reflective (e.g., Chen & Wu, 2011; Wu et al., 2008).

Following the common criteria that Chin (2010) and Henseler et al. (2009) suggest, we examined the inter-construct correlations, composite reliabilities of each construct, average variance extracted for each construct, item loadings for each construct, and the cross-loadings on other constructs to ensure that the instrument had adequate reliability and adequate discriminant and convergent validity. Tables 2 and 3 present these statistics.

One checks reliability at the indicators level by examining the item loadings on their respective constructs (see Table 2). Henseler et al. (2009) suggest 0.7 as a rule of thumb as a standardized outer loading to ensure that the indicator has captured at least half of the variance. The item loadings and cross-loadings we present in Table 2 provide evidence of discriminant validity at the indicators level because all items except four were strongly related (load) to the constructs we intended them to measure and they did not have a stronger connection with another construct (cross-load). We eliminated the four weak items (ReAr4: interact often with non-IT managers throughout the organization; Info.S1: keep key systems operational; Integ2: migrate organization from legacy department applications to cross-department, integrated applications; and UtPr1: establish and maintain an IT department that is responsive to user requests/problems). We did so systematically by rerunning the PLS/SEM analysis and rechecking item loadings after dropping each of these items one by one, starting with the item with the weakest loading. Subsequently, we excluded these four weak items from further statistical analysis. Two of these four weak items (ReAr4 and Info.S1) overlapped with other constructs because we found them to have stronger connection (cross-loading) with two other constructs that we did not intend them to measure (ReAr4 overlapped with strategist with cross-loading equal to 0.49; Info.S1 overlapped with utility provider with cross-loading equal to 0.43). Furthermore, all four weak items that we removed had loadings on their respective construct that were less than the required 0.7 (Henseler et al., 2009).

As one can see in Table 3, the composite reliability (CR) for all constructs exceeded the satisfactory level of 0.7, which supports internal consistency reliability (Werts, Linn, & Jöreskog, 1974). We also confirmed discriminant validity at the construct level because the square roots of the average variances extracted (AVE) values of all constructs (shown in the diagonal in Table 3) were larger than the inter-correlation of the constructs in the model, which means that all constructs shared more variance with their own measures than with others. We also found sufficient convergent validity because the average variances extracted (AVE) for all research constructs exceeded the acceptable 0.5 cut-off that Fornell and Larcker (1981) propose.

**Table 2. CIO Role Expectations Item Loadings and Cross-loadings**

| Item | Strategist | Relationship architect | Integrator | Educator | Information steward | Utility provider |
|---|---|---|---|---|---|---|
| Stra1 | **0.71** | 0.27 | 0.32 | 0.32 | 0.11 | 0.35 |
| Stra2 | **0.75** | 0.26 | 0.53 | 0.39 | 0.25 | 0.35 |
| Stra3 | **0.76** | 0.25 | 0.48 | 0.38 | 0.25 | 0.29 |
| Stra4 | **0.76** | 0.36 | 0.54 | 0.54 | 0.24 | 0.41 |
| Stra5 | **0.80** | 0.23 | 0.26 | 0.43 | 0.05 | 0.35 |
| Stra6 | **0.76** | 0.17 | 0.20 | 0.40 | 0.30 | 0.29 |
| ReAr1 | 0.25 | **0.79** | 0.26 | 0.13 | 0.20 | 0.28 |
| ReAr2 | 0.33 | **0.89** | 0.32 | 0.30 | 0.30 | 0.37 |
| ReAr3 | 0.29 | **0.83** | 0.26 | 0.22 | 0.30 | 0.45 |
| ReAr4 | 0.49 | **0.35** | 0.11 | 0.22 | 0.19 | 0.09 |
| Integ1 | 0.45 | 0.21 | **0.78** | 0.25 | 0.49 | 0.42 |
| Integ2 | 0.37 | 0.25 | **0.65** | 0.46 | 0.24 | 0.26 |
| Integ3 | 0.27 | 0.22 | **0.78** | 0.33 | 0.31 | 0.26 |
| Integ4 | 0.46 | 0.31 | **0.85** | 0.42 | 0.28 | 0.24 |
| Edu1 | 0.41 | 0.21 | 0.48 | **0.83** | 0.28 | 0.43 |
| Edu2 | 0.55 | 0.24 | 0.4 | **0.88** | 0.10 | 0.35 |
| Edu3 | 0.48 | 0.23 | 0.36 | **0.90** | 0.18 | 0.37 |
| Info.S1 | 0.15 | 0.10 | 0.05 | 0.11 | **0.37** | 0.43 |
| Info.S2 | 0.36 | 0.41 | 0.41 | 0.30 | **0.71** | 0.40 |
| Info.S3 | 0.44 | 0.36 | 0.33 | 0.43 | **0.79** | 0.29 |
| Info.S4 | 0.26 | 0.24 | 0.19 | 0.28 | **0.85** | 0.31 |
| UtPr1 | 0.11 | 0.25 | 0.23 | 0.11 | 0.29 | **0.67** |
| UtPr2 | 0.17 | 0.21 | 0.37 | 0.22 | 0.33 | **0.85** |
| UtPr3 | 0.08 | 0.24 | 0.31 | 0.13 | 0.34 | **0.76** |
| UtPr4 | 0.33 | 0.27 | 0.45 | 0.19 | 0.35 | **0.76** |

Note: shaded rows show weak items.

**Table 3. Inter-construct Correlation and Reliability Measures**

| Construct* | CR | AVE | Strategist | Relationship architect | Integrator | Educator | Information steward | Utility provider |
|---|---|---|---|---|---|---|---|---|
| Strategist | 0.89 | 0.57 | **0.75**** | | | | | |
| Relationship architect | 0.88 | 0.70 | 0.35 | **0.83** | | | | |
| Integrator | 0.84 | 0.64 | 0.49 | 0.29 | **0.80** | | | |
| Educator | 0.90 | 0.76 | 0.54 | 0.26 | 0.40 | **0.87** | | |
| Information steward | 0.83 | 0.62 | 0.46 | 0.42 | 0.37 | 0.47 | **0.78** | |
| Utility provider | 0.84 | 0.63 | 0.22 | 0.26 | 0.42 | 0.20 | 0.39 | **0.79** |

* Seven-point Likert scale, ** square root of AVE in diagonal.
CR = composite reliability, AVE = average variance extracted.

Overall, these results indicate two important facts: 1) the psychometric properties of the CIO role expectations instrument exhibit adequate reliability and validity, which increases confidence in this instrument and CIO role theory; and 2) this instrument is valid for a range of industries in another country other than solely the U.S. healthcare sector because the data we collected the data we used from senior IT leaders from a range of different Australian industries.

## 4.2 Alternative Models for the CIO Role Expectations Instrument Based on Theory

In this section, we critically examine the alternative null and hierarchical models for the CIO role expectations instrument. First, we assess the factorial nature of this instrument using three possible null (also known as measurement) models supported by existing CIO literature. In contrast to the hierarchical models that specify relationships between the first-order, second-order, and third-order factors that model CIO roles, the three null models (one first-order factor, two first-order factors, six first-order factors) do not specify any structural relationships between each set of factors. These three null models represent three different factorial structures based on the CIO role expectations instrument. Estimation of the possible null models allows researchers to formally assess convergent validity and the factorial structure or the dimensionality of the construct. We then examine the second-order hierarchical structure, which deals with the CIO role as a multidimensional construct that involves more than one dimension. Examining the hierarchical models in this study might provide four benefits:

1) Hierarchical models may provide more theoretical parsimony because multidimensional constructs are general constructs that combine specific dimensions and may be more theoretically useful than their dimensions
2) A hierarchical model can reduce model complexity, which allows one to test broad questions associated with multidimensional constructs
3) Hierarchical models can provide matching levels of abstraction for predictor variables and outcome variables because outcome variables that are factorially complex require predictor variables that are also factorially complex, and
4) Multidimensional constructs are better treated as hierarchical latent variables in SEM models in terms of reliability and validity because doing so corrects for measurement error in the construct and its dimensions (Edwards, 2001).

Furthermore, Stewart and Segars (2002, p. 37) emphasize the importance of testing higher-order models rather than only examining a set of correlated first-order factors:

> *The theoretical implication of higher-order models is that each first-order factor and the implied second-order factor is important in capturing the domain of the construct. Further, the second order factor may be a more important mediator between a consequent and predictor variable than the first order construct*.

### 4.2.1 Underlying Factorial Structure of CIO Role Expectations Instrument

In operationalizing the CIO role expectations instrument, Smaltz et al. (2006) used the 25 items in two ways. First, they modeled them as one first-order reflective factor CIO effectiveness to assess the CIO effectiveness from the perspective of the top management team. Second, they modeled them as six first-order reflective factors (strategist role, relationship architect role, integrator role, educator role, information steward role, and utility provider role) to assess the dimensionality of role expectations from the CIO's point of view. Smaltz et al. (2006) also theoretically classified the six factors (roles) into two groups (supply side and demand side) on the basis of existing CIO literature (e.g., Broadbent & Kitzis, 2005; Mark & Monnoyer, 2004). We assessed the factorial-structure and psychometric properties of three null models specified based on the theory with no structural relationships and present the results in this section. Table 4 compares the psychometric properties for the suggested three null models. The results presented in Table 4 confirm the uni-factorial (one first-order factor), the bi-factorial (two first-order factors), and the multi-factorial (six first-order factors) of the CIO role expectations instrument, yet the quality of these three models varied. In this respect, one could order the properties of the three null models in sequence of increasing quality: multi-factorial, bi-factorial, and uni-factorial.

**Table 4. Null Models Psychometric Properties**

| Uni-factor null model One first-order factor | | | Bi-factor null model Two first-order factors | | Multi-factor null model Six first-order factors | |
|---|---|---|---|---|---|---|
| **Items** | **Factor** | **Loadings** | **Factors** | **Loadings** | **Factors** | **Loadings** |
| Stra1 | CIO role effectiveness CR = 0.91 AVE = 0.32 | 0.59 | Demand-side roles CR = 0.88 AVE = 0.39 | 0.67 | Strategist role CR= 0.84 AVE= 0.63 | 0.71 |
| Stra2 | | 0.68 | | 0.74 | | 0.75 |
| Stra3 | | 0.66 | | 0.74 | | 0.76 |
| Stra4 | | 0.76 | | 0.78 | | 0.76 |
| Stra5 | | 0.62 | | 0.65 | | 0.80 |
| Stra6 | | 0.54 | | 0.58 | | 0.76 |
| ReAr1 | | 0.40 | | 0.46 | Relationship architect role CR = 0.83 AVE = 0.62 | 0.79 |
| ReAr2 | | 0.53 | | 0.53 | | 0.89 |
| ReAr3 | | 0.51 | | 0.50 | | 0.83 |
| Integ1 | | 0.60 | | 0.61 | Integrator role CR = 0.90 AVE = 0.76 | 0.78 |
| Integ3 | | 0.49 | | 0.47 | | 0.78 |
| Integ4 | | 0.61 | | 0.65 | | 0.85 |
| Edu1 | | 0.63 | Supply-side roles CR = 0.85 AVE = 0.39 | 0.73 | Educator role CR = 0.84 AVE = 0.64 | 0.83 |
| Edu2 | | 0.65 | | 0.65 | | 0.88 |
| Edu3 | | 0.62 | | 0.71 | | 0.90 |
| Info.S2 | | 0.58 | | 0.58 | Information steward role CR = 0.88 AVE = 0.70 | 0.71 |
| Info.S3 | | 0.61 | | 0.70 | | 0.79 |
| Info.S4 | | 0.50 | | 0.65 | | 0.85 |
| UtPr2 | | 0.40 | | 0.55 | Utility provider role CR =0.89 AVE = 0.57 | 0.85 |
| UtPr3 | | 0.31 | | 0.44 | | 0.78 |
| UtPr4 | | 0.49 | | 0.50 | | 0.76 |

### 4.2.2 Assessment of the Hierarchical Models

By applying the repeated indicators approach that Lohmöller (1989) suggests and following the guidelines that Wetzels et al. (2009) and Wright et al. (2012) provide, we now examine the hierarchical model that CIO role theory also supports in terms of the psychometric properties. To estimate the structural model goodness of fit (GoF) of the hierarchical models, we used the global criterion of goodness of fit (GoF) that Tenenhaus, Vinzi, Chatelin, and Lauro (2005) propose. Goodness of Fit (GoF) represents an operational solution for validating the PLS-SEM model globally (Guenzi, Georges & Pardo, 2009). Global goodness of fit represents a geometric mean of 1) average communality, which one can calculate based on the measurement model results; and 2) average of $R^2$ for the endogenous variables in the structural model. To determine the quality of the GoF of the overall PLS-SEM model, Witzels et al. (2009) suggest the following criteria: GoF small (0.10), GoF medium (0.25), and GoF large (0.36). Wetzels et al. (2009) suggest that PLS-SEM is a more suitable approach than co-variance SEM for estimating the parameters in hierarchical latent variable models. With PLS-SEM, one can specify a higher-order latent variable using the same manifest variables that specified a lower-order latent variable. Hence, in the hierarchical approach we followed, we used the manifest variables twice: for the first-order latent variables (i.e., six CIO roles) and for the second-order latent variables (i.e., supply-side and demand-side CIO roles). As a result, we modeled the CIO demand-side role as a function of three roles (strategist, relationship architect, and integrator) and the CIO supply-side role as a function of the other three roles (educator, information steward, and utility provider). The CIO role according to this view is a multidimensional construct of type superordinate because the relationships flow from the construct to its dimensions (Wright et al., 2012).

Table 5 presents the path estimates, predictive power ($R^2$), and model goodness of fit (GoF) for the second-order, reflective, hierarchical CIO role model that models the first-order latent variables as six roles and second-order latent variables as two higher-level roles (i.e., demand side and supply side). The second-order I hierarchical model showed acceptable properties in terms of reliability (CR), convergent validity (AVE), path coefficients (β), substantial explained variance ($R^2$), and a large model fitting (GoF).

**Table 5. PLS Results for Second-order I Hierarchical Model**

| First order | | | | | Second-order I | | |
|---|---|---|---|---|---|---|---|
| **Construct** | **Item** | **Loadings** | **β** | **$R^2$** | **Construct** | **Item** | **Loadings** |
| Strategist role CR = 0.84 AVE = 0.80 | Stra1 | 0.71 | 0.90* | 0.89 | Demand side CIO roles CR = 0.88 AVE = 0.62 | Stra1 | 0.65 |
| | Stra2 | 0.76 | | | | Stra2 | 0.73 |
| | Stra3 | 0.78 | | | | Stra3 | 0.72 |
| | Stra4 | 0.77 | | | | Stra4 | 0.77 |
| | Stra5 | 0.76 | | | | Stra5 | 0.62 |
| | Stra6 | 0.72 | | | | Stra6 | 0.54 |
| Relationship architect role CR = 0.87 AVE = 0.84 | ReAr1 | 0.78 | 0.62* | 0.38 | | ReAr1 | 0.48 |
| | ReAr2 | 0.89 | | | | ReAr2 | 0.55 |
| | ReAr3 | 0.82 | | | | ReAr3 | 0.51 |
| Integrator role CR = 0.89 AVE = 0.76 | Integ1 | 0.79 | 0.75* | 0.55 | | Integ1 | 0.61 |
| | Integ3 | 0.75 | | | | Integ3 | 0.49 |
| | Integ4 | 0.85 | | | | Integ4 | 0.66 |
| Educator role CR = 0.90 AVE = 0.87 | Edu1 | 0.85 | 0.79* | 0.64 | Supply side CIO roles CR = 0.84 AVE = 0.62 | Edu1 | 0.72 |
| | Edu2 | 0.86 | | | | Edu2 | 0.63 |
| | Edu3 | 0.89 | | | | Edu3 | 0.69 |
| Information steward role CR = 0.83 AVE = 0.79 | Info.S2 | 0.71 | 0.83* | 0.68 | | Info.S2 | 0.59 |
| | Info.S3 | 0.80 | | | | Info.S3 | 0.70 |
| | Info.S4 | 0.83 | | | | Info.S4 | 0.65 |
| Utility provider role CR = 0.84 AVE =0.80 | UtPr2 | 0.85 | 0.65* | 0.41 | | UtPr2 | 0.56 |
| | UtPr3 | 0.75 | | | | UtPr3 | 0.46 |
| | UtPr4 | 0.76 | | | | UtPr4 | 0.51 |
| Model goodness of fit (GoF) = 0.67, * significant at P > 0.01. | | | | | | | |

Figure 1 depicts the structure and estimated parameters of the CIO role expectations as a second-order I hierarchical model. Table 6 presents the path estimates, predictive power ($R^2$), and model goodness of fit (GoF) for another second-order, reflective, hierarchical CIO role model that models the first-order latent variables as six roles and with one second-order latent variable that represents the CIO role expectations. The second-order II hierarchical model also shows acceptable properties in terms of reliability (CR), path coefficients (β), substantial explained variance ($R^2$), and a large model fitting (GoF). However, the convergent validity (AVE) of the second-order II was questionable because it was below the acceptable 0.50 cut-off that Fornell and Larcker (1981) propose, which raises concern about whether its blocks of items were truly a homogenous set that primarily captured the phenomenon of interest.

Figure 2 depicts the structure and estimated parameters of the CIO role expectations as a second-order II hierarchical model. We again checked the stability of the psychometric properties of the CIO role expectations instruments in a third-order, reflective, hierarchical CIO role model. Table 7 exhibits the path estimates, predictive power (R2), and model goodness of fit (GoF) for that model. The third-order hierarchical model also shows acceptable properties in terms of reliability (CR), path coefficients (β), substantial explained variance (R2), and a large model fitting (GoF). However, the convergent validity (AVE) of the third order hierarchical model was questionable because they were below the acceptable 0.50 cut-off that Fornell and Larcker (1981) propose. Likewise, the second-order II hierarchical model raises concern about the homogeneity of their blocks of items and their ability to capture the phenomenon of interest. It is also noticeable that the reliability at the indicators level decreased when we added more factor order levels. The loadings on some items decreased to less than the acceptable 0.70 cut-off that Henseler et al. (2009) suggest Based on the results, we can order the three hierarchical models according to their decreasing quality as follows: first-order I, second-order II, and third order.

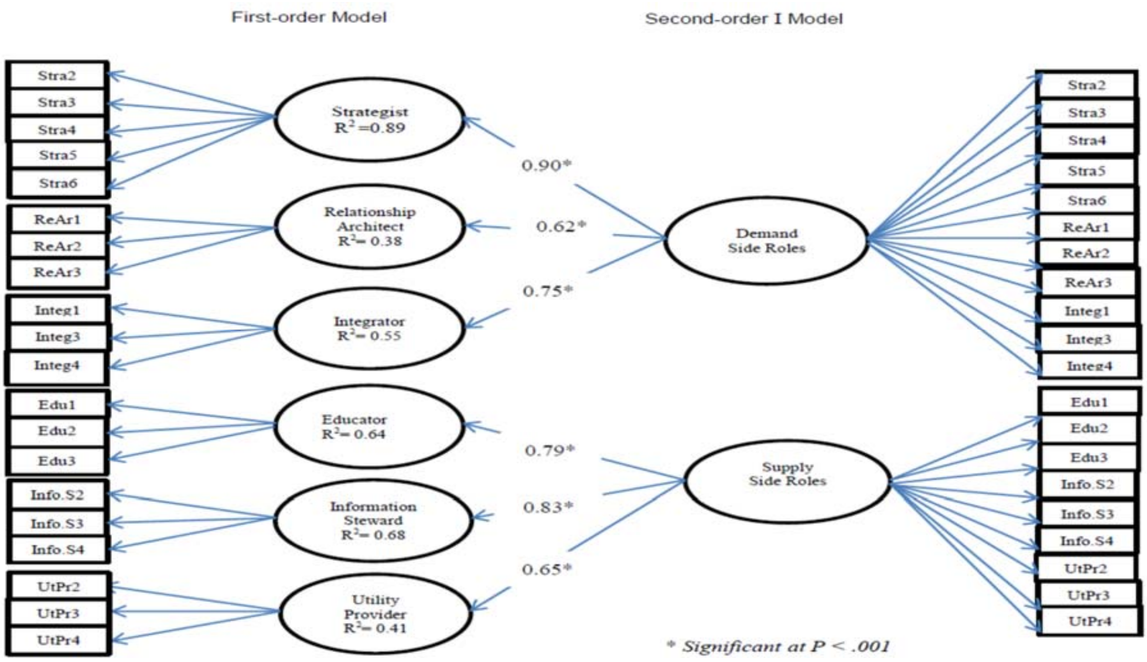



**Figure 1. Second-order I Hierarchical Model of CIO Role Expectations Instrument**

**Table 6. PLS Results for Second-order II Hierarchical Model**

| First order | | | | | Second-order II | | |
|---|---|---|---|---|---|---|---|
| **Construct** | **Item** | **Loadings** | **β** | **$R^2$** | **Construct** | **Item** | **Loadings** |
| Strategist role<br>CR = 0.89<br>AVE = 0.57 | Stra1 | 0.71 | 0.84* | 0.83 | CIO role expectations<br>CR = 0.91<br>AVE = 0.32 | Stra1 | 0.58 |
| | Stra2 | 0.76 | | | | Stra2 | 0.67 |
| | Stra3 | 0.78 | | | | Stra3 | 0.65 |
| | Stra4 | 0.79 | | | | Stra4 | 0.75 |
| | Stra5 | 0.77 | | | | Stra5 | 0.60 |
| | Stra6 | 0.73 | | | | Stra6 | 0.51 |
| Relationship architect role<br>CR = 0.87<br>AVE = 0.70 | ReAr1 | 0.76 | 0.59* | 0.38 | | ReAr1 | 0.40 |
| | ReAr2 | 0.90 | | | | ReAr2 | 0.53 |
| | ReAr3 | 0.84 | | | | ReAr3 | 0.52 |
| Integrator role<br>CR = 0.84<br>AVE = 0.64 | Integ1 | 0.80 | 0.72* | 0.55 | | Integ1 | 0.61 |
| | Integ3 | 0.76 | | | | Integ3 | 0.50 |
| | Integ4 | 0.84 | | | | Integ4 | 0.61 |
| Educator role<br>CR = 0.90<br>AVE = 0.76 | Edu1 | 0.84 | 0.72* | 0.64 | | Edu1 | 0.63 |
| | Edu2 | 0.88 | | | | Edu2 | 0.64 |
| | Edu3 | 0.89 | | | | Edu3 | 0.62 |
| Information steward role<br>CR = 0.83<br>AVE = 0.62 | Info.S2 | 0.75 | 0.74* | 0.68 | | Info.S2 | 0.59 |
| | Info.S3 | 0.80 | | | | Info.S3 | 0.62 |
| | Info.S4 | 0.81 | | | | Info.S4 | 0.51 |
| Utility provider role<br>CR = 0.84<br>AVE =0.63 | UtPr2 | 0.83 | 0.54* | 0.41 | | UtPr2 | 0.42 |
| | UtPr3 | 0.72 | | | | UtPr3 | 0.33 |
| | UtPr4 | 0.82 | | | | UtPr4 | 0.50 |
| Model goodness of fit (GoF) = 0.59, * significant at P > 0.01. | | | | | | | |

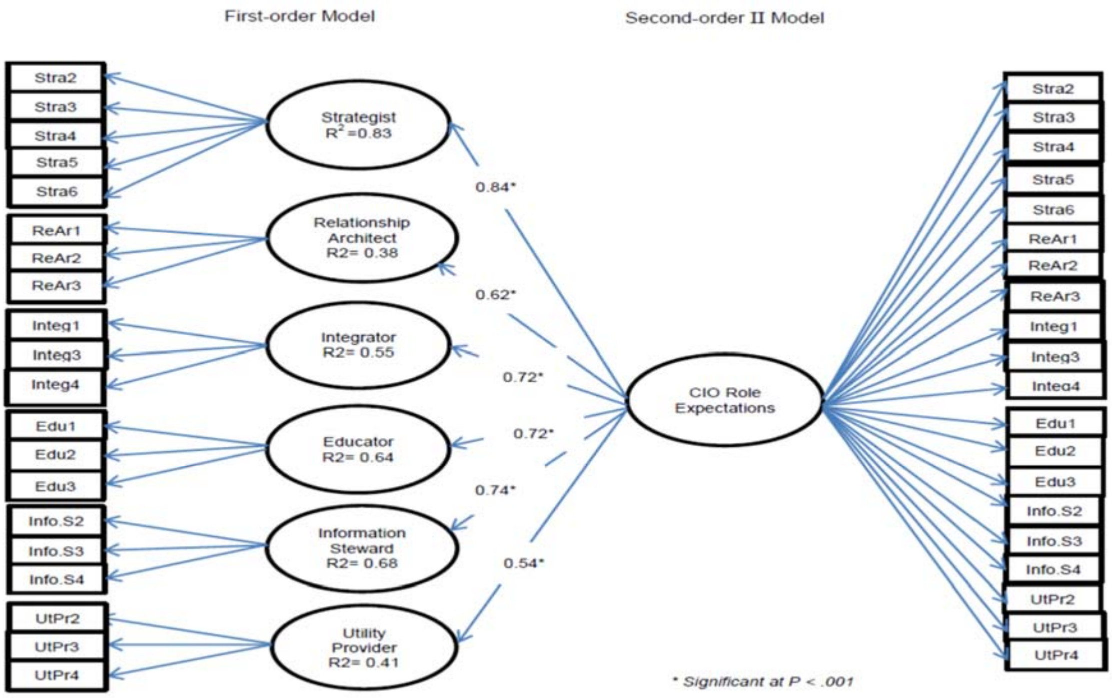
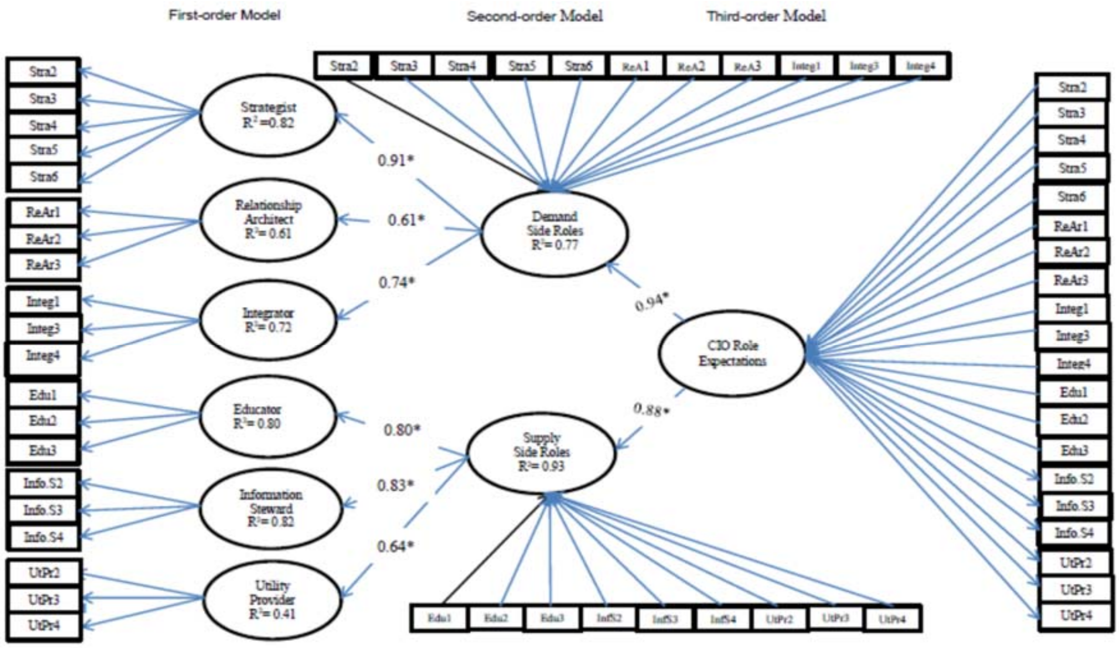



**Figure 2. Second-order II Hierarchical Model of CIO Role Expectations Instrument**

**Table 7. PLS Results for Third-order Hierarchical Model**

| First order | | | | | Second order | | | | | Third order | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Construct | Item | L | β | R² | Construct | Item | L | β | R² | Construct | Item | L |
| Strategist role CR = 0.90 AVE = 0.57 | Stra1 | 0.72 | 0.91* | 0.82 | Demand-side roles CR = 0.88 AVE = 0.39 | Stra1 | 0.66 | 0.94* | 0.77 | CIO role expectations CR = 0.91 AVE = 0.32 | Stra1 | 0.58 |
| | Stra2 | 0.76 | | | | Stra2 | 0.73 | | | | Stra2 | 0.67 |
| | Stra3 | 0.78 | | | | Stra3 | 0.73 | | | | Stra3 | 0.66 |
| | Stra4 | 0.78 | | | | Stra4 | 0.76 | | | | Stra4 | 0.70 |
| | Stra5 | 0.77 | | | | Stra5 | 0.63 | | | | Stra5 | 0.56 |
| | Stra6 | 0.73 | | | | Stra6 | 0.59 | | | | Stra6 | 0.48 |
| Relationship architect role CR = 0.87 AVE = 0.70 | ReAr1 | 0.78 | 0.61 | 0.61 | | ReAr1 | 0.47 | | | | ReAr1 | 0.40 |
| | ReAr2 | 0.89 | | | | ReAr2 | 0.55 | | | | ReAr2 | 0.53 |
| | ReAr3 | 0.83 | | | | ReAr3 | 0.51 | | | | ReAr3 | 0.51 |
| Integrator role CR = 0.84 AVE = 0.46 | Integ1 | 0.80 | 0.74* | 0.72 | | Integ1 | 0.61 | | | | Integ1 | 0.60 |
| | Integ3 | 0.75 | | | | Integ3 | 0.49 | | | | Integ3 | 0.49 |
| | Integ4 | 0.86 | | | | Integ4 | 0.66 | | | | Integ4 | 0.60 |
| Educator role CR = 0.90 AVE = 0.76 | Edu1 | 0.85 | 0.80* | 0.80 | Supply-side roles CR = 0.85 AVE = 0.39 | Edu1 | 0.73 | 0.88* | 0.93 | | Edu1 | 0.63 |
| | Edu2 | 0.87 | | | | Edu2 | 0.65 | | | | Edu2 | 0.64 |
| | Edu3 | 0.89 | | | | Edu3 | 0.70 | | | | Edu3 | 0.62 |
| Information steward role CR = 0.83 AVE = 0.62 | Info.S2 | 0.72 | 0.83* | 0.82 | | Info.S2 | 0.59 | | | | Info.S2 | 0.59 |
| | Info.S3 | 0.81 | | | | Info.S3 | 0.70 | | | | Info.S3 | 0.62 |
| | Info.S4 | 0.83 | | | | Info.S4 | 0.65 | | | | Info.S4 | 0.51 |
| Utility provider role CR = 0.84 AVE = 0.63 | UtPr2 | 0.86 | 0.64* | 0.41 | | UtPr2 | 0.55 | | | | UtPr2 | 0.42 |
| | UtPr3 | 0.75 | | | | UtPr3 | 0.45 | | | | UtPr3 | 0.32 |
| | UtPr4 | 0.77 | | | | UtPr4 | 0.51 | | | | UtPr4 | 0.50 |
| Model goodness of fit (GoF) = 0.64, * significant at P > 0.01. | | | | | | | | | | | | |

Figure 3 depicts the structure and estimated parameters of the CIO role expectations as a third-order hierarchical model.




* *Significant at P < .001*

**Figure 3. Third-order Hierarchical Model of CIO Role Expectations Instrument**

# 5 Discussion

Our results indicate that the CIO role expectations instrument is valid and reliable (which answers RQ1) and that the constructs of the CIO role expectations instrument can be modelled most reliably and validly with best model fit as a first-order six factor (six CIO roles) and second-order two factor (demand, supply) hierarchical model (which answers RQ2).

Our results demonstrate several important points. First, overall, the CIO role expectations instrument exhibited solid psychometric properties, and, therefore, researchers can use this instrument with confidence in future research. Second, we identified four weak items in this instrument (i.e., ReAr4: interact often with non-IT managers throughout the organization; Info.S1: keep key systems operational; Integ2: migrate organization from legacy, department applications to cross-department, integrated applications; and UtPr1: establish and maintain an IT department that is responsive to user requests/problems), which indicates the need to pay more attention to verifying the relationship architect, information steward, integrator, and utility provider roles and to suggest some other relevant items that can measure them precisely or consider revising their wording. Recall that the exploratory factorial validity conducted on the original instrument by Smaltz et al. (2006) led to their omitting two different items (Stra1: develop and implement a strategic IT plan that aligns with the organization's strategic business plan, and UtPr4: establish electronic linkages to external entities (customers, suppliers, partners, etc.)).

Furthermore, one can possibly model the constructs of this instrument in three different factorial structures (i.e., multi-factorial with six factors, bi-factorial with two factors, and uni-factorial with one factor) as the CIO role theory suggests, yet the three null models exhibited different psychometric properties. The factor loadings for some items and consequently the AVEs of the constructs of the two- and one-factor null models decreased to below the acceptable cut-off (0.50), which indicates questionable convergent validity and gives preference to a six-factor null model against two- and one-factor null models. One can order these three null models according to their quality as follows: six factors, two factors, and one factor. This result supports the views of previous studies that have found the CIO performs a configuration of roles (e.g., Peppard et al., 2011; Smaltz et al., 2006). In practice, senior management could effectively measure the performance of a CIO by assessing their competency across these six roles.

Moreover, one can also model the constructs of this instrument in three different hierarchical models: two second-order models and a third-order model. The three hierarchical models showed different psychometric properties. One can see that the reliability at the indicators level decreased when we added more orders to the hierarchical model because the items loading of some items became lower than the acceptable 0.70 cut-off suggested by Henseler et al. (2009). Consequently, one can question the convergent validity (AVE) of the second-order II hierarchical model and the third-order hierarchical model because they were below the acceptable 0.50 cut-off that Fornell and Larcker (1981) propose, which raises concerns about the homogeneity of the blocks of items and their ability to captures the phenomenon of interest. Accordingly, these indices give preference to the second-order I hierarchical model against the second-order II and third-order hierarchical models. One can order these three hierarchical models according to their quality as follows: second-order I, second-order II, and third order.

Further, the results confirm the instrument's validity (after we made some minor changes to some items' wording) to measure the CIO role in different types of industries such as finance, mining, and manufacturing rather than solely for the healthcare sector in which its creators developed it. That finding concurs with the results that Seddon, Walker, Reynolds, and Willcocks (2008) and Brown (2006) found.

The broad range of industries that our respondents represent enhances the generalizability of the CIO role instrument. Establishing that one can reliably and validly model the CIO roles as six distinct first-order factors and two distinct second-order factors provides greater clarity on how the CIO might perform their duties. This research provides support for the notion that the CIO role is actually a configuration of distinct roles (or multidimensional construct) that are split between the operational and strategic IT needs of an organization. This research also supports the concept of a duality of high-level roles, categorized as supply- and demand-side roles (Broadbent & Kitzis, 2005; Li, Ding, & Wu, 2012; Mark & Monnoyer, 2004).

This finding implies that, as it concerns the recruitment of CIOs and their professional development, organizations need to balance the focus between operational versus strategic roles. Newly appointed CIOs need to establish their credibility and "keep the lights on" and to secure the trust of senior management. Only then can they drive strategic objectives for IT to add value to their organizations. This finding may support Beatty, Arnett, and Liu's (2015) and Strickland's (2011) proposals to split the IT leadership into two positions: a CIO who looks after the strategic aspects and a chief technology officer (CTO) who manages the operational side of IT. Furthermore, organizations that provide professional development for CIOs need to incorporate both technical/operational and strategic/business knowledge and skills in their programs.

This study contributes empirical evidence to CIO role theory and practice. From the theoretical perspective, we validate a recent CIO role measure so that IS researchers can use this instrument in different contexts with confidence. We also add another example of how to use SEM as a contemporary method to validate and test the hierarchical models of IS instruments. In addition, our results provide evidence on the configuration of roles that the CIO performs and the nature of these roles (technical/supply vs. strategic/demand), which contributes to clarifying the ambiguity surrounding this central role. We also identify some gaps in the literature in terms of the need to clarify the CIO's information steward and the relationship architect roles. One of the relationship architect role items (i.e., interact often with non-IT managers throughout the organization) overlapped with the strategist role, while one of the information steward role items (i.e., keep key systems operational) overlapped with the utility provider role.

# 6 Conclusion, Limitations, and Future Research

To summarize, the analysis we present in this paper proves that the CIO role expectation instrument exhibited solid validity and reliability despite some minor weaknesses. The results also demonstrate the possibility to model the constructs of this instrument in different null and hierarchical models and the validity of this instrument to measure the CIO role in different types of industries not just the healthcare sector in which its creators developed it.

Our study has several limitations. The findings that represent the perceptions of Australian CIOs might not match the perceptions of CIOs in other countries. Since the perceptions we report here are only from CIOs and do not include the views of other senior managers (e.g., from other members of the top management team), one can expect some level of self-reporting bias. Although we considered internal validity and reliability, we did not address construct validity. For example, Cronbach and Meehl (1956) suggest nomological validity (Cronbach & Meehl, 1956), which requires linking the instrument's constructs with an exogenous construct in a nomological network and then assessing its construct validity in a structural model. We did not assess nomological validity due to the lack of data that measured a suitable endogenous variable that we could use to test the relationship between the two constructs. The nomological network could comprise other personal and/or organizational factors such as the CIO's capability, productivity, firm performance, and firm profitability.

With this study, we identify some gaps that warrant further research. Future research needs to re-examine the four roles of the CIO as a relationship architect, integrator, information steward, and utility provider. Such studies could help to improve the CIO role measurement in regards to those four specific CIO roles as ICT use constantly changes and has become increasingly important with the digitalization of the economy. Future research also needs to identify whether new role expectations for the CIO may have become relevant in recent times as Smaltz et al. (2006) developed the original instrument more than 10 years ago.

To conclude, in this paper, we critically examine the psychometric properties of the CIO role expectations instrument and assess and compare different types of null and hierarchical models for the CIO roles. We hope that our operationalization of a configuration of CIO roles and our findings will encourage other researchers to pay more attention to the vital roles of the CIO and that practitioners will find the results relevant.

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# Appendix A

**Table A. Instrument Used in this Study**

| Item | Item statement* | 1 Strongly disagree | 2 | 3 | 4 | 5 | 6 | 7 Strongly agree |
|---|---|---|---|---|---|---|---|---|
| Stra1 | Develop and implement a strategic IT plan that aligns with the organization’s strategic business plan | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Stra2 | Develop/maintain metrics that measure the value of IT to the organization | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Stra3 | Direct IT-enabled business process restructuring/ reengineering | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Stra4 | Provide expertise on multidisciplinary business process improvement teams | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Stra5 | Be intimately involved in shaping the mission/vision of the organization | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Stra6 | Be intimately involved in business strategic planning and decisions | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| ReAr1 | Provide executive oversight for all IT contracts with external vendors | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| ReAr2 | Negotiate with vendor IT organizations on new external contract proposals | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| ReAr3 | Ensure IT contracts with external vendors remain within scope and budget | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| ReAr4 | Interact often with non-IT managers throughout the organization | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Integ1 | Direct efforts to build an integrated delivery system. | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Integ2 | Migrate organization from legacy, department applications to cross-department, integrated applications | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Integ3 | Develop/acquire an electronic document management capability throughout the organization | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Integ4 | Develop an understanding of the industry delivery process | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Edu1 | Champion digital literacy throughout the organization | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Edu2 | Provide insight to the top management team /executives staff on new emerging technologies | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Edu3 | Assist top management team/executives staff in improving their digital literacy | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Info.S1 | Keep key systems operational | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Info.S2 | Build and maintain an IT staff with skill sets that match your current and planned technology base | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Info.S3 | Provide oversight for quality assurance of organizational data | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| Info.S4 | Ensure confidentiality and security of organizational data | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| UtPr1 | Establish and maintain an IT department that is responsive to user requests/problems | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| UtPr2 | Establish electronic linkages throughout the organization | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |

**Table A. Instrument Used in this Study**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| UtPr3 | Ensure the organization’s users have adequate workstations (PCs/Laptops/Tablets) to accomplish their jobs | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| UtPr4 | Establish electronic linkages to external entities (customers, suppliers, partners, etc.) | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ | ❒ |
| * Adopted from Smaltz et al. (2006) with minor changes made to some items’ wording based on the outcome of the pre-test step. | | | | | | | | |

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