Environmental Modelling of the Chief Information Officer

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Abstract

Since the introduction of the term in the 1980's, the role of the Chief Information Officer (CIO) has been widely researched. Various perceptions and dimensions of the role have been explored and debated. However, the explosion in data proliferation (and the inevitable resulting information fuelled change) further complicates organisational expectations of the CIOs role. If organisations are to competitively exploit the digital trend, then those charged with recruiting and developing CIOs now need to be more effective in determining (and shaping) CIO traits and attributes, within the context of their own organisational circumstances and in line with stakeholder expectations. CIOs also need to determine their own suitability and progression within their chosen organisation if they are to remain motivated and effective. Before modelling the role of the future CIO, it is necessary to synthesise our current knowledge (and the lessons learnt) about the CIO. This paper, therefore, aims to identify and summate the spectrum of key researched 'themes' pertaining to the role of the CIO. Summating previous research, themes are modelled around four key CIO 'dimensions', namely (1) Impacting factors, (2) Controlling factors (3) Responses and (4) CIO 'attributes'. Having modelled the CIOs current environment, and recognising the evolving IT enabled information landscape, the authors call for further research to inform the recruitment and development of the future CIO in terms of personal attributes and the measurable impact such attributes will have on their respective organisation.

Keywords: Chief Information Officer, CIO, Role, CIO Attributes, CIO Definition, CIO Capabilities

1.0 Background

CIOs were introduced as the "senior executive responsible for establishing corporate information policy, standards, and management control over all information resources." (Synott & Gruber, 1981). However, researchers soon realised that CIOs would have to continually adapt if they were to continue exploiting technological breakthroughs to meet ever increasing user demands (Benjamin, Dickinson, & Rockart, 1985). Throughout the 1980's and early 1990's, traditional management techniques were questioned. There were suggestions that line management responsibilities of CIOs would diminish as organisations demanded more attention be paid to policy and strategy (Whitlock, 1985) and that CIOs should relinquish control to provide end users with tools to solve their own problems (Fabian, 1987). Aspiring CIOs would need to select more 'suitable' education programs at major universities to develop their interpersonal skills (Sobkowiak, 1986) and CIOs would also need to establish themselves not only as executives (Stephens, Ledbetter, Mitra, & Ford, 1992) but as 'knowledgeable' executives (Hayley, 1989). However, CIOs couldn't completely ignore their technology calling in lieu of business strategy formulation; organisations demanded that CIOs improved data access whilst ensuring security (Amoroso, Thompson, & Cheney, 1989) and CIOs would always be judged, not only on the quality of the overall IS service, but also on their impact on organisational benefits (Ding, Li, & George, 2014) With the advent of large IT enabled

transformation programmes, researchers shifted focus to the CIOs influencing capabilities in developing more effective executive relationships to effect IT enabled transformation (Feeny, Edwards, & Simpson, 1992). It wasn't too long before organisations realised the potential benefits of developing intimate customer relationships, enabled by new CRM systems, and so organisations demanded that CIOs move beyond the transformation agent role and become 'partners' in the change journey (Umbaugh & Peterson, 1992).

2.0 Business Problem

Information fuelled change is prevalent. Capabilities to create, store, manage and exploit data is increasing exponentially (van der Aalst, Zhao, & Wang, 2015) citing (Hilbert & López, 2011). Enlightened business leaders can now inform and monitor the change agenda more effectively than ever before. This vortex of IT enabled change is unavoidable and inevitable. The increasing reliance on the CIO to manage and sustain this situation is perhaps demonstrated through increasing levels of board room exposure (Larson & Adams, 2010).

If CIOs are to remain effective, organisations now need to define and manage the role of the CIO so that CIOs can continue to address todays operational issues as well as those posed by tomorrows longer term strategic business imperatives. CIOs can no longer purely act as 'managers of mechanisms' (Black, 2007). Whilst shaping the digital imperative, they need to be able to flex and adapt to embrace continuous change at all levels. However, the combination of technology driven change and (increasingly) role definition ambiguity is having a negative impact on organisations as they struggle to hold onto their CIOs (Chowa, 2010).

Recruiters and/or those charged with developing the CIO (such as coaching professionals) need to remain cognisant of operational issues and strategic aspirations if they are to select the most effective CIOs. Once in post, organisations and CIOs also need to ensure effective engagement and motivation if they are to positively impact and progress IT capabilities across their respective organisations (Wu, Chen, & Sambamurthy, 2008). Previous attempts to define the role of the CIO have included labels such 'archetypes' (such as 'Functional', 'Transformational' or 'Strategists' (Dennison, 2016)), or (more usefully) defining the CIO role in terms of an organisations specific circumstance, such as 'Utility IT Director, Evangelist CIO,

Innovator CIO, Facilitator CIO, and Agility IT Director/CIO (Peppard, Edwards, & Lambert, 2011).

A reduction in role ambiguity will certainly improve a CIOs chances in setting and managing positive expectations; but broad brush role definitions continue to mask the impact of the plethora of partially defined underlying complexities presented by technology fuelled information proliferation and (hence) the changing expectations surrounding the CIOs role.

3.0 Aims

To inform (and refine) the definition of the role of the future CIO, given the spiralling complexity of their environments, this paper aims to:

1. Identify previous research that describes the complex organisational environments in which CIOs operate; and
2. Model this environment to identify the context or applicability of researched CIO competencies and/or attributes; and
3. Identify opportunities for future research in the development of the CIO role

4.0 Approach

The volume of available information surrounding technology leadership spans opinion arising from (say) perceived technology trends, hands-on, reflective experience (usually found in interview transcripts with CIOs of major corporations) and (in terms of volume, to a lesser degree) scientifically derived research. To ensure scientific rigour, it was therefore decided to focus a search of academically peer-reviewed literature only. Acknowledging the impact of factual and perceived technology trends on organisations (as described by globally recognised purveyors) and CIOs, it was decided that the aims of the research were best served by ensuring that only rigorously reviewed data (from academic databases) would suffice in an attempt to develop a scientifically sound model of the CIOs environment.

Table 1 summarises the literature searches conducted. Deliberately keeping the search as wide as possible (i.e. restricted search terms) ensured that the broadest sets of results could be obtained. Further, combining two perspectives on the role of the CIO (i.e. the definition of the role and perceptions of measuring the performance of effectiveness of the CIO) would also help identify research based on perceptions of

performance from the CIOs peer group (sometimes referred at the top management team or 'TMT').

Research Question		Data Base	Search String	Relevant Articles/ Results
RQ1	What is the role of the CIO?	SCOPUS	(all(chief information officer OR cio) AND all(role)) AND schol(yes) AND peer(yes)	106/ 474
		ABI-INFORM	(all(chief information officer OR cio) AND all(role)) AND schol(yes) AND peer(yes)	118/353
RQ2	How have CIO 'attributes' previously been assessed?	SCOPUS	TLE-ABS-KEY(Assessing) OR TITLE-ABS-KEY(measuring) OR TITLE-ABS-KEY(defining) AND TITLE-ABS-KEY(executive) OR TITLE-ABS-KEY(c-suite) OR TITLE-ABS-KEY(CIO) OR TITLE-ABS-KEY(leader) AND TITLE-ABS-KEY(competency) OR TITLE-ABS-KEY(skills) OR TITLE-ABS-KEY(attributes) OR TITLE-ABS-KEY(traits)) AND SUBJAREA(MULT OR ARTS OR BUSI OR DECI OR ECON OR PSYC OR SOCI) AND (LIMIT-TO(SUBJAREA,"BUSI") OR LIMIT-TO(SUBJAREA,"ECON") OR LIMIT-TO(SUBJAREA,"ENGI") OR LIMIT-TO(SUBJAREA,"DECI"))	23/211

Table 1. Initial search of peer-reviewed literature into the role and performance of the CIO

Each paper was assessed over four passes or reviews:

- Review 1: Review of abstracts and conclusions to identify relevance of paper to the research aims
- Review 2: review of the singular core message (and/or most relevant conclusion) presented by each author; and
- Review 3: categorisation of each paper in the context of a CIOs environment; and
- Review 4: more detailed read through of each paper, in the context of the identified category, to determine CIO environmental interdependencies

Review 1 resulted in a substantial reduction in the number of relevant papers from a total of 1038 to 247; such a dramatic reduction in selected papers was expected due to the wide nature of the search terms. Review 2 (of the remaining 247 papers) was a process of distillation as key messages(s) or findings from each publication were

revealed and then compared. Review 3 enabled the identification/proposal of a smaller number of (single worded) categories. The production of the messages/ conclusions and categories provided confidence that a representative and consistent set of categories and attributes had been identified. The aim of Review 4 was to refine any subtext and/ or interdependencies between the categories identified from Review 3 that described the CIOs environment and / or related attributes.

5.0 Results

The results of Review 3, as detailed in Appendix 8.0, showed that a relatively small number of unique but recurring 'categories' had been explored since the inception of the term 'CIO' in 1980's. However, the listing of categories still fell somewhat short in meeting the aims of this research. Completion of the more detailed review (Review 4) yielded a much deeper insight into the complexities of the CIOs environment.

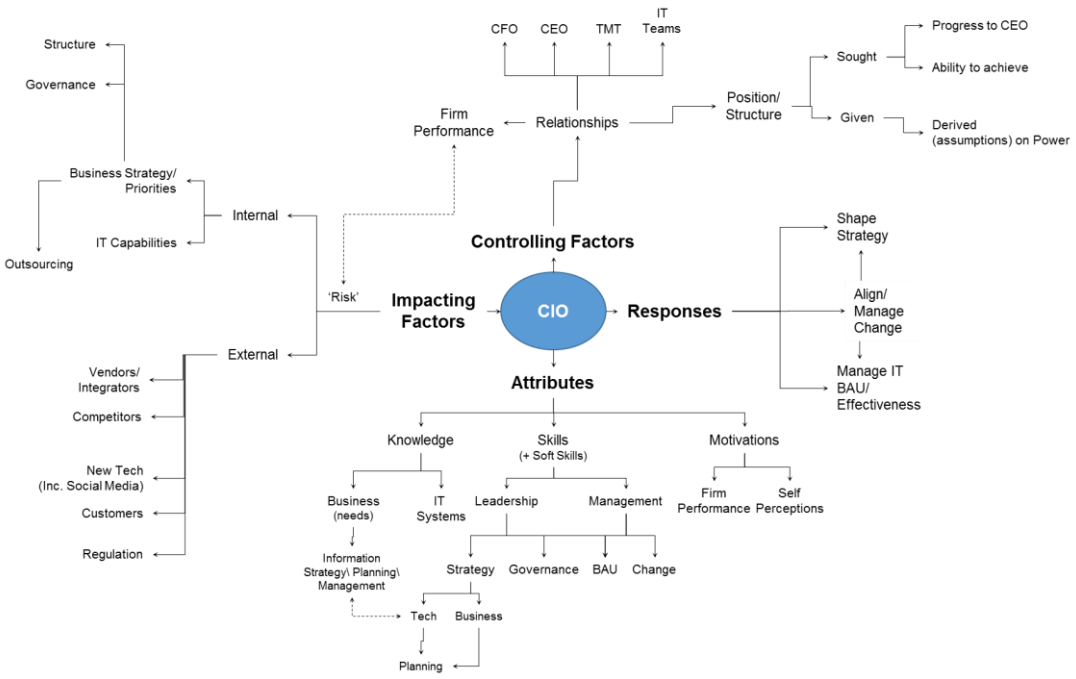


Figure 1: The CIOs Environment

The results from Review 4 are described in Figure 1. This depicts a refinement of the categories modelling the relationships between the CIO, their environment and their key 'attributes'. The next sections of this paper explore the branches (or 'themes') as depicted in Figure 1.

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5.1 Impacting Factors

CIOs respond to a mix of external and internal impacting factors. External factors are usually unexpected and/ or uncontrollable factors that impact CIOs. Alternatively, internal factors may be (relatively) expected and/ or controllable factors that CIOs can – to a degree – exert a measure of control or influence.

5.1.1 External Impacting Factors

External impactors factors comprise external risk and sub-factors. The pervading risk factor, in terms of responding to firm performance and/ or other perceived factors (such as competition) impacts the behaviour of the CIO. Contingency planning and adoption of risk management technologies require CIOs to determine the exact nature of threats, vulnerabilities and countermeasures (Orlandi, 2005).

External sub-factors that impact the CIO range from changes in regulation (Sutton & Arnold, 2005), (Gendron, Banks, & Millerc, 2009); the changing habits of customers (Saldanha & Krirshnan, 2011) and customer trends, such as social networking (Kiron, Palmer, Phillips, & Kruschwitz, 2012); the impact of global technology trends (Briggs, 2014) and (Kappelman et al., 2015) and to the impact of new technologies, such as analytics (Kiron & Ferguson, 2012), (Cognini, Corradini, Polzonetti, & Re, 2014) and (Gudfinnsson, Strand, & Berndtsson, 2015). Additionally, arguably also an aspect of internal impacting factors is the trend towards outsourcing (enhanced through Cloud technologies (Mahon et al., 2011) and its impact on both the IT function and the CIO; this has been diligently reviewed in terms of changing (internal) attitudes towards the role of IT leadership, such as from service provider towards business integrator (Gefen, Licker, & Stern, 2011), the need for the CIO to ensure effective management of an ever growing pool of offshored resources (Luftman et al., 2015) and for the CIO to then reconcile their role with the CEO (Thite, 2012) and the TMT.

5.1.2 Internal Impacting Factors

CIOs are also impacted by internal factors. Continued IT alignment with evolving strategic business objectives require CIOs to continuously juggle priorities (Cumps, Viaene, & Dedene, 2006).

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Effective IT governance can offset the alignment challenge given that CIOs are pre-requisite to effective IT expenditure (Pang, 2014). However, appointing a CIO to effect capable IT governance across different business units is rarely straight forward (Wilbanks, 2008). As IT capabilities develop across business units and functions (e.g. marketing) responsibilities can become blurred (Deans, 2011). However, businesses must embrace new IT governance practices (Rau, 2004) that enable centralised and/or decentralised information management capabilities to foster (Laplante & Costello, 2006). A note of caution is offered; diversification and (resulting) decentralisation has a detrimental effect on the CIOs role (Larson & Adams, 2010). Irrespective of the changing strategic priorities, effective IT governance, in the pursuit of strategic business alignment and/ or IT effectiveness, must deliver effectively whilst maintaining the quality of the IT function through effective practice and audit (Li, Lim, & Wang, 2007).

CIOs must also take account of the impact of their IT resource capability. Effective management (Lane & Koronios, 2007) and development of IT resources (say, in terms of technical and management skills) positively impacts the CIOs brand and (hence) ability to act (Y. C. Chen & Wu, 2011). However, any weakness in IT resources that are heavily engaged in change is not only detrimental to the end user (Willcocks & Sykes, 2000), but results in difficult peer group relationships for the CIO. However, this can be somewhat offset if the CIO and their IT resources can learn to attract top-management support (Štemberger, Manfreda, & Kovačič, 2011).

5.1.3 Constraints (or Controls)

In responding to impacting factors CIOs are either restricted and/ or impeded by a this huge variety of real/ imagined controlling factors; researched controlling factors can be categorised in terms of: (1) Relationships and (2). Structural positioning (i.e. reporting line or positional power). The relationship a CIO has with their peer group is critical if CIOs are to be given leeway to respond to impacting factors. Perceptions of performance enhances and/or detracts from many relationships between the TMT, CFO, CEO and the CIO. There is a view that the mere appointment of a new CIO positively impacts organisational performance by increasing (albeit temporarily) share price and hence TMT favour (Chatterjee, Richardson, & Zmud, 2001). However, this is rarely enough to satisfy the appetite of even the most tactical CEO. Organisations

must be mindful of motivating CIO protégés through effective compensation if the CIO is to deliver (Yayla & Hu, 2014). For newly appointed CIOs intending a positive impact in their first 100 days, TMT trust and leeway can be achieved by developing an improved shared understanding of ITs purpose and role (Preston, Karahanna, & Rowe, 2006) and (Reinhard & Bigueti, 2013). Assuming this shared view is accepted, CIOs can reduce the impact of controlling influences by addressing continued business strategy and IT alignment (Preston & Karahanna, 2009) through, say, enhanced demand planning capabilities, that impress their TMT (Alonso, Verdún, & Caro, 2008) and/ or the CEO (Alonso, Verdún, & Caro, 2009). CIOs can also curry favour by tackling the 'IT productivity paradox' (the negative relationship between IT investment and business gain). This would do nothing to detract from reputations and could enhance executive relationships (Shao, Feng, Choudrie, & Liu, 2010) and temper controlling factors further.

However, CIOs should not be complacent when it comes to their relationship with the TMT; the impact of TMT support on successful strategic information systems planning cannot be understated (Kearns, 2006)**.**

Improved CIO/ TMT relationships can also arise from improving measures of contribution to corporate innovation (Song, Li, & Qiu, 2010), but executives exerting CIO control to impact firm performance should remain cognisant of the limitations of their own IT knowledge when effecting CIO control. The positive impact of a CIOs technical knowledge, strategic business knowledge and their positional/structural power on an enterprises ability to more effectively 'assimilate' enterprise systems has been established (Shao, Wang, & Feng, 2016), but tensions arising between corporate (level) and business unit level CIOs (Wood & Thorogood, 2007) underscores some of the more practical issues on a day to day basis. However, there are other relationships that represent controlling factors. Consider the CIO-CFO dynamic.

CFOs need a real understanding of the IT function if they have the last say on IT expenditure. CFOs must understand the impact of new technology on company finances as well as the impact of costly business change and expected benefits (Mclaughlin, 2007). Compared with other TMT relationships, the perceptions that CFOs and CIOs tend to have about each other's role informs influence and control that if not checked can 'lead to effective or adversarial relationships with individual and firm-level outcomes' (Denford & Schobel, 2011). If the control exerted by CFOs

is important, then the controlling effects of the CEO is critical. When addressing complex IT questions, CEOs may feel that they only have to create ‘context’ to enable IT benefit (Watts, 2001). However, CEOs that control from a distance must still be effective communicators. If the frequency and quality of communication between the CIO and the CEO is sufficient, then the likelihood of successful IT deployments increases (Johnson & Lederer, 2006). However, failure to secure the attention of the CEO can result in poor IS performance (Ranganathan & Kannabiran, 2004) and even the most technically evasive CEOs will need to improve their understanding of IT if they are to secure the strategic options it presents them; education of the CEO could even fall to the CIO (Peppard, 2010). However, CEO-CIO controlling effects may eventually dissipate if the two roles do in fact continue to ‘converge’ (Johnson & Lederer, 2010).

Reduced peer control, arising from (improving) performance informed peer relationships can increase the CIOs chances of self-determination. Power and influence can be assumed as well as earned; however, most organisations seek CIOs because they recognise the intrinsic value of effectively managed IT and the competitive advantages that such roles present. So how do employers decide where best to place new or aspiring CIOs? Should the CIO report directly to the CEO or the CFO? For markets, role placement implies a measure of strategic intent. So perhaps the CIOs placement should be determined by the firms strategic positioning (Banker, Hu, Pavlou, & Luftman, 2011)? Once this decision is reached, the recruitment or promotion and placement of a CIO needs close attention if effective relationships are to endure and the CIO is to flourish.

Earned power (for incumbent staff promoted to CIO) may have arisen from a history of performance informed effective peer relationships, but this doesn’t necessarily hold true for newly appointed CIOs. Once in place a CIO will only be able to maintain power and credibility as a result of their perceived level of competence (Cohen & Dennis, 2010). Research has indeed highlighted that combinations of technical credibility, decisional and interpersonal traits can often override positional power (Carter, Grover, & Thatcher, 2011). For newly appointed CIOs justifying their position, a good place to start could involve having a positive impact on end users (Drury, 2005). Some CIOs may have to overcome issues of self-perception as well as perceptions of peers (and in some cases academics!) if they are to uphold their

positions (Teubner, 2007). Alternatively aspiring CIOs could ‘emanate information leadership’ by ‘establishing an equilibrium between inspiring and innovating the business and informing and architecting it’(Maes & De Vries, 2008). But once the CIO has justified and upheld their (earned or assumed) position on the ‘outskirts’ of the board (Costello & Laplante, 2009), where do they go next? Given the growing importance of IT in business strategy, CIOs should avoid obsolescence (Maruca, 2000) and should indeed consider setting their sights on the CEO role (Moghaddasi & Sheikhtaheri, 2010).

Constrained by controlling factors, how have researchers described CIO responses to the described impacting factors?

5.1.4 CIO Responses

CIOs help shape strategic business goals. They manage IT services (or business as usual) and monitor how their products and services support planned strategic goals. They identify the gap between current and desired performance and they assist in monitoring and closing that performance gap through innovative application of appropriate technological capabilities.

We have illustrated some important aspects of performance informed peer relationships, but how do CIOs respond to requests to inform business strategy? If the role of the CIO is increasingly important (Polansky, Inuganti, & Wiggins, 2004) and has become more strategically centred (Chun & Mooney, 2009) then the CIO certainly has a role in shaping strategy. Researchers have illustrated the need for CIOs to move away from the ‘supply’ side of the IT equation, towards shaping the ‘demand’ side (D. Q. Chen, Preston, & Xia, 2010). However, delivering strategic imperatives requires strong leadership. Calls for further research into developing appropriate leadership styles has started to unveil opportunities for CIOs to enhance their departments problem solving capabilities (Jablokow, Jablokow, & Seasock, 2010), or to adopt a particular leadership style to embed an information centric culture (Kettinger, Zhang, & Marchand, 2011). However, no matter which leadership style a CIO adopts, one thing is certain, organisations will continue to rely on the CIO to effect change. CIOs can adopt several positions for influencing change. Creating a ‘burning platform’ is one option. For technology laggards, CIOs can create a sense of urgency by triggering collaborative discussions to change strategically important

business processes (Kohli & Johnson, 2011). CIOs can also trigger change by initiating strategic discussions on the basis of competitive standing through technological innovation (Lang & Amberg, 2010). Alternatively, CIOs can share their own experiences of (say) completing their own new information strategy (Mocker & Teubner, 2005) to inform and influence the change agenda. Similarly, CIOs can also foster strategically impactful change by demonstrating best practice. For example, by focusing on business models, business pain or by being more effective at self-promotion (Andriole, 2007). More formally, CIOs can even inform the change agenda through executive education (Earl & Feeny, 2000) and (Kanter, 2001).

Unfortunately, informing change by demonstrating the value of IT and the strategic advantages it brings can sometimes 'polarize' executives who may perceive IT as either a cost or a strategic asset (M. J. Earl & Feeny, 1995). To reassure themselves that IT can indeed be viewed as a strategic asset, many organisations look to more visible and tangible parts of the business – such as operations. Operationally, CIOs can exploit discussions around IT alignment planning with the business (Peak, Guynes, Prybutok, & Xu, 2011). In response to calls for operational efficiency, CIOs can also collaborate with operations to ensure that the capabilities required to capture business value arising from IT investments are developed and embedded (Peppard, Lambert, & Edwards, 2000).

Alternative routes for making the case to change reside in CIOs being able to demonstrate the impact of addressing shortfalls in IT capability performance. Before taking this route, CIOs must be confident in both their IS planning (Philip, 2007) and business continuity planning processes (Iwasaki, 2009), else tactical (or daily business) distractions could distract from strategic intentions. Highlighting shortfalls in IT performance could include measures of the effectiveness of enterprise architectures (Simonsson et al., 2003), or processes and services (Gibb, Buchanan, & Shah, 2006), or perhaps by even by establishing an all-encompassing IS performance scorecard (Chang & King, 2005). However, as a note of caution, prior to making any declaration in IT shortfalls, CIOs should make sure that they are seen to be practising what they preach by embracing new tools that help them become more effective (Cherinka, Miller, & Prezzama, 2009).

If CIOs decide to lead by example, say by establishing a more efficient IT function, then CIOs must demonstrate they can continue to 'bridge the gap' between IT,

functional areas and external entities (Stephens et al., 1992). This isn't straight forward. In the absence of effective delegation, for busy CIOs with complex and time consuming day jobs (Zhang, 2010), (Laplante & Bain, 2005), time commitment to strategic imperatives may become limited. But there may be hope for the busy CIO; the advent of available and ready to use IT packages in tandem with outsourcing opportunities could either set the CIO free or relegate them to the 'dustpan of history' (Gefen et al., 2011).

5.1.5 CIO Attributes

A relatively small number of peer reviewed papers describing 'attributes' of a CIO were identified (25) from research question 2 (see Table 1). However, across the remaining 222 papers, many researchers eluded to several key facets (or competencies) likely required of the successful CIO. References to a CIOs role as either a 'trusted senior executive' or a 'chief technology mechanic' (Seddon, Walker, Reynolds, & Willcocks, 2008) abound. However, they (Seddon et als) argue that broad classifications like these still short of helping CIOs and CIO recruiters identify and (hence) articulate specific CIO attributes. Alternative descriptions of the CIOs attributes centre on aspects of 'knowledge,' in terms of business knowledge (Lane & Koronios, 2007) and technical or IT knowledge (Kwak, 2001) and (Karahanna & Watson, 2006). When defining a CIOs business knowledge, some researchers have distinguished between a CIOs role of managing ICT and their role as an 'orchestrator' of business information (Maes & De Vries, 2008). However, in order for CIOs to be effective in improving the businesses relationship with its data and information CIOs have a role to play in shaping the information strategy (Mocker & Teubner, 2005) and then ensure effective business information usage (Kettinger et al., 2011)

In addition to business/ technical know-how, CIOs are also expected to display a wide variety of skills. The ability to solve problems (Jablokow et al., 2010), exert influence (Joia & Vreuls, 2010), ensure innovation (Lang & Amberg, 2010) and to manage uncertainty by establishing IT 'flexibility' (Patten, Fjermestad, & Whitworth, 2009) are all deemed 'core' attributes. Additionally, perhaps as a sub-set of influencing skills (Enns, Huff, & Golden, 2003), CIOs need 'soft-skills' (Portela, Carvalho, Varajão, & Magalhães, 2010). They also need to demonstrate leadership (Andriole, 2007) not only in terms of strategy formulation (Y. C. Chen & Wu, 2011), but also in

terms of (centralised and decentralised) governance (Andriole, 2015). Other attributes include decision making capabilities. For example, being able to establish and then react to performance indicators (Riempp & Gieffers-Ankel, 2007) and for CIOs to make effective decisions whilst managing risk (Villarreal, Ozuna, & Tanguma, 2009). In addition to leadership and decision making capabilities, CIOs are also expected to be effective managers. Both in terms of managing day to day operations, say as an effective 'spokesman' and 'resource allocator' (Grover, Jeong, Kettinger, & Lee, 1993) as well as managing change in IT (Sojer, Schläger, & Locher, 2006) to maintain business alignment (Lee, Lee, Na, & Baek, 2007) and (Marques, 2013).

With so many barriers to overcome and so many 'calls' on a CIOs time (Varajão, Trigo, Bulas-Cruz, & Barroso, 2008) to manage all these aspects of the role, an additional CIO 'attribute' surely must stem from personal motivation. Two key themes arise in this domain; that of performance informed motivation, such as the relationship between a CIOs competence and the organisations performance (Shao et al., 2010) and that of the CIOs increasing exposure to 'external' customers' (as opposed to internal customers) (Polansky et al., 2004), reminiscent, perhaps, of the hype surrounding the launch of CRM systems in the early 2000's.

6.0 Discussion

The results of this research have started to unveil the breadth, depth and complexity of those 'attributes' required (partially summarised in Figure 1) of the modern and (potentially) the future CIO.

Interestingly, this research did *not* reveal:

1. Significant attention to (potential) differences between the size/ type of organisation (e.g. global and SME, or by industry/sector groupings) and the impact this might have on those attributes required of a CIO. The most closely related statements to this were those differences between attributes of a corporate CIO (policy focused) and a business unit CIO (operationally focused), where the corporate CIO is likely to experience a measure frustration due to the relatively diminished size of budgets (in comparison to the business unit CIO who is likely to control more significant budgets)
2. Significant attention to new and/ or specific attributes arising from the adoption of specific technologies (such as Cloud, IoT, Social Networking, etc.). Again, the

nearest statements to technology specifics in relation to CIO attributes focused on broader themes such as IT security (requiring elements of technical knowledge) and the uptake of (say) Cloud or analytics, etc. In most cases, technology take-up centred on a combination of improved relationship skills (i.e. salesmanship) based on a newly evolving technical knowledge; and

3. Significant emphasis on how CIOs can be motivated, especially given the rigors of their evolving roles. Some work touched on compensation and performance measurement, but virtually nothing was found that described how CIOs can address personal development as/ when new issues and challenges arise.

The lack of evidence around these three points may have arisen from the lack of more specific searches, however, it is interesting to note that even a broad approach to a literature review did not significantly evidence any of the above three points.

7.0 Conclusions

The original research aims have been partially met. A comprehensive (and partially complete) description of a CIOs environment has been modelled from a literature review of CIO relevant research. A view of key (CIO) environmental interdependences has been defined and this model is sufficient to inform further discussion and research around the attributes required of the modern CIO. However, this research also raises new questions for those wishing to further develop the role of the CIO, given the predicted rise in CIO environmental complexity. If researchers and practitioners can agree on what enhanced and/or new attributes will be required, then further work would require the ‘proving’ of the application of any such attributes and their positive effect on organisational performance. Addressing these two questions will not only help aspiring CIOs improve their overall impact on their organisations, but will also help recruiters improve the selection and development of this increasingly important strategic role.

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8.0 Appendices

#	Key Message/ Conclusion	Category
1	The role of the CIO can be described through the issues they deal with	Environment
2	The role of the CIO has changed significantly because of advances in technology	Environment
3	Decentralisation has diminished the role if the CIO (leaving them to focus on people, infrastructure and strategy	Environment
4	CIOs must be both business orientated and technically knowledgeable	Experience
5	CIOs must move away from solving technical problems and focus on providing tools that enable users to solve their own problems	Capabilities
6	CIOs must move way from solving operational issues and become more strategic (including strategic planning of resources)	Capabilities
7	The role of the CIO is contingent on the organisations circumstances	Environment
8	Successful CIOS are those viewed as a transformation agent	Capabilities
9	CTO role is uniquely broad and will evolve as new technology reveals new insights/ opportunities	Environment
10	CEOs and CIOs have different/ Competing perspectives on the importance/ relevance of IS	Stakeholder Management
11	Closer working relationships between CEOs and CIOs can impact a firm's performance	Stakeholder Management
12	The role of the CIO is viewed as a senior management position	Reporting Line
13	IT departments are centralising/ merging or being acquired	Environment
14	CEOs see IT either as a cost OR providers of strategic advantage (i.e. Differentiators)	Stakeholder Management
15	The role of the CIO can be described through their required capabilities	Capabilities
16	CIOs/ Equivalents play a dominating/ crucial role in initiating/ making IS outsourcing decisions	Responsibilities
17	CIOS conduct the majority of formal IS strategic planning	Responsibilities
18	We have measured the effectiveness of the CIOs role	Effectiveness
19	IT planning and business planning are separate and the CIO bridges the gap	Responsibilities
20	The role the CIO has evolved to deal with bau, but at a much faster rate	Responsibilities
21	Part of the CIO role is to manage the gap between the CIO and the Top Management Team	Stakeholder Management
22	The role of the CIO complements the role of the C-suite	Responsibilities
23	The concerns of the CIO determine their role development/ focus	Responsibilities
24	We have mapped the role of the CIO	Capabilities
25	The role of the CIO maybe described through their influencing capabilities/ behaviours	Capabilities

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#	Key Message/ Conclusion	Category
26	CIOs will focus less on internal customers and more on external customers and/ or value chain partners	Responsibilities
27	We have identified tools enabling CIOs to improve alignment with business value and hence impact value creation	Capabilities
28	IS Leadership is critical due to organisational dependency on operational enablement as well as innovation management	Capabilities - Leadership
29	The role of the CIO is uniquely broad/ IS leadership is distinctive	Responsibilities
30	A shift in technology has brought about a shift in the role of the CIO	tbc
31	CIOs biggest challenge for the future is to manage CEO expectations	Stakeholder Management
32	CIOs face ethical dilemmas which are unique to their role (wrt managing data privacy)	Responsibilities
33	Shared understanding between CIO and TMT positively impacts IS/ business strategy alignment	Stakeholder Management
34	Women do not aspire to be CIOs	tbc
35	The size of the company does NOT affect the role of the CIO (>1000 employees)	Environment
36	A strong technical background enhances a CIOs ability to influence peers	Capabilities
37	The role of the CIO is to know what information will be needed by the business and to ensure value is derived from that information by the business	Capabilities
38	CEOs need to be coached by CIOs to improve there is literacy	Coach
39	CIOs must ensure IT governance is embedded within the business (or IT resources embedded in business governance processes)	Capabilities
40	The CIO must build a unique relationship with the CFO. As such the CFO, must also be IT literate	Stakeholder Management
41	Traditional/ incumbent technology leaders focus on operational issues, whereas newly appointed ones are more strategic in outlook	Capabilities
42	For CEOs driving IT decisions, we have defined the role of the CEO in terms of technology leadership	tbc
43	The role of the CIO and the CFO maybe merging	tbc
44	There are cultural differences between CIOS when they interpreted the importance of new Tech and its impact on their resulting strategies	Environment
45	In the public sector, CIOs perceive that stakeholders negatively impact technology diffusion efforts	Stakeholder Management
46	CIO decision making is reliant on availability of multiple viewpoints concerning current EA	Stakeholder Management
47	CIOs should be used as business partners (as opposed to over the wall techies)	Responsibilities
48	New technology has increased the type/ scale/ frequency of risks (cyber-attack etc.) The CIO needs to understand/ address these	Capabilities
49	We have identified determinants in affecting outsourcing decisions in the public sector	tbc

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#	Key Message/ Conclusion	Category
50	CIO role may absorb the role of the CKO in hard times	Responsibilities
51	Changes in data protection laws imply that CIOs have/ need more authority than ever before to react/ prevent incursion on data privacy	Responsibilities
52	CIOs have identified factors influencing tech adoption	Capabilities
53	CIOs must ensure ongoing business-IT alignment if they are to be successful	Responsibilities/ Capabilities
54	There is a link between a CIOs reporting structure and the firms strategic positioning (in terms of performance)	Reporting Line
55	There is a link between a CIOs Strategic Business Knowledge, Strategic IT knowledge and their structural power on ES assimilation and firm performance	Capabilities
56	Development of a shared understanding (model) between the CIO/ TMT enhances strategic alignment of IS	Stakeholder Management
57	CIOs can transition from supply-driven leadership through to demand driven leadership	Capabilities
58	Mutual understanding of the role of IT between the CIO and CEO leads to greater IT strategic alignment	Stakeholder Management
59	Mutual understanding of the role of IT between the CIO and business managers helps improve chances of achieving business objectives	Stakeholder Management
60	We have identified the PERSONAL traits/ competencies of effective CIOs	Capabilities
61	CIO compensation, impacting firm performance, is based on TMT tech savviness and not on firm / role structures	Stakeholder Management
62	The appearance of new tech (e.g. big data analytics requires new c-suite role; this undermines the role of the CIO	Responsibilities
63	CIO skill level influences likelihood of IT outsourcing decisions involving accounting executives	Capabilities
64	We have shown the importance of the impact of the CIOs vision on technology adoption	Capabilities
65	IT enabled business performance is always a matter of Cxx perception. CIOs therefore secure IT investment through leadership/ influencing skills and sense making to their peers	Capabilities/ Stakeholder Management
66	In terms of new tech adoption, more intense integrated IS planning reduces the need for a professional CIO	Environment?
67	CEOs make outsourcing decisions	Stakeholder Management
68	CIOs provide 'insight'	Capabilities
69	CEOs defer decisions pertaining to technology to their TMT more than any other decisions	Stakeholder Management
70	IT Personnel and CIOs are more likely to secure TMT support if they have both adequate roles (based in business) and knowledge (business/ managerial)	Reporting Line/ capabilities
71	Technical knowledge does not impact the effectiveness of a CIO to successfully influence peers	Capabilities
72	A company's perception of IT greatly impacts the CIOs ability to be successful - particularly at the top management level	Stakeholder Management
73	CIOs must be able to drive the standardisation of architectures, metrics and value creation	Capabilities

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#	Key Message/ Conclusion	Category
74	CIOs and Top managers disagree on the importance of business objectives and IT infrastructure needs	Stakeholder Management
75	Sarbanes-Oxley impacts the skills required of a CIO	Capabilities
76	OSS user groups apply pressure to CIOs to change their behaviours	Stakeholder Management
77	The process of developing an information strategy enables the CIO to develop close working relationships between different disciplines	Capabilities/ Stakeholder Management
78	CIOs (must?) promote IT as a Service Provider to the business	Stakeholder Management
79	CFOs must engage with CIOs in developing information security capabilities	Stakeholder Management
80	Senior IT managers tend to be more task focused than strategy/ people focused	Capabilities
81	CIOs will become CKOs	Capabilities
82	Based on the attributes of CIOs in the private sector, we have identified CIO attributes for the public sector	Capabilities
83	We have shown how CIOs play an important role in IT governance/ shown attributes of most effective IT governance	Capabilities
84	More experienced CIOs have better control over internal financial reporting (as required by SOX)	Capabilities
85	The CIO is the executive best positioned to manage the creative-destructive power of technology as outlined by Schumpeter and effect firm sustainability	Capabilities
86	Acting as a fully-fledged individual, a CIO is able to give the idea of information leadership its full content and form. The CIO has the future but only if s/he believes in that future! (does this mean force of personality ??)	Capabilities
87	The role of the CIO is defined by the barriers they must overcome (adaptiveness?)	Environment/ Capabilities
88	We have identified the required attributes for CIOs to become CEOs	Capabilities
89	A core skill of CIOs is managing uncertainty by being flexible	Capabilities
90	Risk propensity and risk perception influences CIO risk behaviour (and hence impacts influence over peer group?)	Capabilities
91	There are increasing demand s on the CIO to increase their coordination demands	Capabilities
92	We have compared the traits of CIOs and CTOs	Capabilities
93	We have shown a positive impact on IT innovation/ effectiveness through the presence /combination of the CIO on the TMT	Capabilities/ Role/ Stakeholder Management
94	We have mapped the development\ evolution of CIO skills during their tenure	Capabilities
95	We have established HOW Tech Leaders remain abreast of tech developments and new service provision	Capabilities
96	We have shown that CIOs have a positive impact on firm performance following IT security breeches	Capabilities
97	The type of CIO needed depends on the inherent company views of the importance of IT	Environment
98	IT-enabled business innovation is more likely when the CIO reports to the Chief Executive Officer, has more interactions with the firm's customers and is more involved in new product development	Reporting line/ Capabilities

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#	Key Message/ Conclusion	Category
99	CIO may act as a leader, a follower or a nonpayer in developing the company's information orientation to achieve its strategic focus	Capabilities
100	The role of the CIO is impacted by social media	Environment
101	We have assessed evidenced based approach to assessing leadership competencies	CIO Performance
102	We have compared standard models that evaluate leadership behaviours	CIO Performance
103	We have catalogued inter-cultural competencies	CIO Performance
104	A method for measuring the quality of leadership?	CIO Performance
105	Example of applying TQM to leadership selection	CIO Performance
106	We have defined a dynamic competency model for the CIO	CIO Performance
107	We have shown that insourcing requires new CIO skills	CIO Performance
108	We have measured leadership performance and compared it to firm performance	CIO Performance

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