



Positioning the role of Chief Technology Officer in an organisation

Vejaykumaran Reddy

Student Number: 29602794

A research project submitted to the Gordon Institute of Business
Science, University of Pretoria, in partial fulfilment of the
requirements for the degree
of

MASTERS OF BUSINESS ADMINISTRATION

8th November 2010

ABSTRACT

The technology landscape has changed dramatically over the past three decades. Organisations encounter extreme difficulty in managing their core capabilities which are enabled by technology. In light of this, organisations require strategic individuals who can continually carry the organisation to the new s-curve which will afford them the competitive advantage.

The purpose of this study is to assist the Chief Technology Officer (CTO) and the c-level suite executives to effectively and appropriately position the CTO in an organisation. This will prevent Chief Information Officer (CIO) / CTO distortion and ensure that the CTO is being evaluated fairly.

The findings of academics, as is evident in the literature review, underscore the essence of my finding that the position of the CTO in an organisation is not fully understood. The researcher has revised the current CTO models to develop the new 'CTO TIE model'. This research highlights the viewpoint that the positioning of the CTO role will be influenced by two key variables; whether the CTO reports to the CIO or CEO? and whether the company is internally or externally technology focused?

KEYWORDS: CTO CIO Role Position

DECLARATION

I Vejaykumaran Reddy, student number 29602794, declare that this research project is my own work. It is submitted in partial fulfilment of the requirements of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination at any other university.

Mr. Vejaykumaran Reddy

Signature:

Date:

ACKNOWLEDGEMENTS

I would like to acknowledge and express my sincere thanks to the following people;

- The CTOs I interviewed for this research, for affording me their time and valuable input.
- My organisation IBM, more importantly Ms. Tselane Hiine for her support and confidence in me and giving me the opportunity to explore the MBA program.
- Mr. Clifford Foster (IBM Distinguished Engineer) for initially guiding me through the thought process of this research project.
- Mr. Roy Page-Shipp, my supervisor, for his guidance.
- My editor, Dr. S. Govender, for sharing his expertise and valuable input.
- My wife, Vaneshree for her understanding and guidance whenever it was required.
- My children, Nakeisha and Jayden, who were robbed of valuable time that could have been spent with them during this period.

This research is dedicated to the memory of my late dad, Mr. Munsamy Narinsamy Reddy, who played an instrumental role in my life and gave me the opportunity to study and pursue my dreams. I know he was by my side through this journey of discovery and always will be there in my future endeavours.

ABBREVIATIONS

Abbreviations	Description
CAPEX	Capital Expenditure
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CIO	Chief Information Officer
COO	Chief Operating Officer
CTO	Chief Technology Officer
GM	General Manager
IBM	International Business Machines
ICT	Information Communications and Technology
IS Manager	Infrastructure Services Manager
IT	Information Technology
Ops Managers	Operations Managers
R&D	Research and Development
SCT	Strategic Contingencies Theory (p. 10 of thesis)
TIE	This relates to the ‘CTO TIE model’ developed in this research where TIE refers to; T echnology I nternal E xternal or chief T echnology officer, chief I nformation officer, chief E xecutive officer.
TMT	Technology, Media & Telecommunications

CONTENTS

Contents	Page
Abstract	i
Keywords	i
Declaration	ii
Acknowledgements	iii
Abbreviations	iv
Contents	v
Table of Contents	vi
List of Tables	ix
Chapters	1-62
Appendices	63-71
References	72-76

TABLE OF CONTENTS

Chapter 1: Introduction to Research Problem	1
1.1 Introduction.....	1
1.1.1 What is the Role of a CTO?	3
1.1.2 What is the Role of a CIO?	4
1.2 Research Purpose.....	4
1.2.1 Internal and External Strategy.....	6
1.3 Research Problem.....	6
1.3.1 Current CTO Models and Frameworks	7
1.4 Scope of Research	7
Chapter 2: Theory and Literature Review	9
2.1 Introduction.....	9
2.2 Strategic Responsibilities of the CTO	10
2.3 Competitiveness	12
2.4 Information as an Asset.....	14
2.5 Line Manager.....	16
2.5.1 CIO Integration into Executive Team	17
2.6 Conclusion of Literature Review	18
Chapter 3: Research Questions	19
3.1 Research Question 1:.....	19
3.2 Research Question 2:.....	19
3.3 Research Question 3:.....	19
3.4 Research Question 4:.....	19
3.5 Research Question 5:	19
Chapter 4: Research Methodology.....	20
4.1 Research Design	20
4.2 Secondary Data.....	20
4.3 Proposed Unit of Analysis.....	20
4.4 Population Relevance.....	21
4.5 Sampling Method and Size.....	21
4.6 Data Collection and Data Analysis	21
4.6.1 Data Collection.....	21
4.6.2 Data Analysis	22
4.7 Research Limitations	22

Chapter 5: Research Results	24
5.1 Description of Sample.....	24
5.2 Difficulty in finding CTOs	24
5.3 Confidentiality of companies details	25
5.4 Patterns observed in the research sample	27
5.5 Research Results	28
5.5.1 Research Question 1: How are CTOs positioned in organisations, especially with respect to roles?	28
5.5.2 Research Question 2: What is the typical level of a CTO?.....	31
5.5.3 Research Question 3: How do CEOs Influence the role of CTOs within organisations?	32
5.5.4 Research Question 4: How should the role of a CTO be positioned in an organisation that does not consider technology to be a competitive factor?.....	33
5.5.5 Research Question 5: What are the prospects for CTOs to be appointed without having a previous line manager role?	36
5.6 Conclulsion to Research Results.....	38
 Chapter 6: Data Analysis	 39
6.1 Introduction.....	39
6.2 Key variables for CTO positioning	39
6.3 Discussion of Research Questions.....	40
6.3.1 Research Question 1: How are CTOs positioned in organisations, especially with respect to roles?	40
6.3.2 Research Question 2: What is the typical level of a CTO?.....	42
6.3.3 Research Question 3: How do CEOs influence the role of CTOs within organisations?	44
6.3.4 Research Question 4: How should the role of a CTO be positioned in an organisation that does not consider technology to be a competitive factor?.....	45
6.3.5 Research Question 5: What are the prospects for CTOs to be appointed without having a previous line manager role?	47
6.4 Technical talk to simple language.....	47
6.5 What does technology mean?	48
6.6 Establishing an understanding of the role.....	48
6.7 Roadmap to becoming a CTO	49
6.8 CTO TIE model.....	49
6.8.1 De-constructing the variables on the axis	52
6.8.2 De-constructing the quadrants of the CTO TIE model	53
6.8.3 Summary of CTO TIE model.....	55
6.9 Listing of CTO Job Descriptions in 2010.....	55

Chapter 7: Conclusion.....	57
7.1 Findings.....	57
7.2 CTO TIE model.....	58
7.3 CTO implies Leadership in Technology	58
7.4 Technology s-curve.	60
7.5 Future Research Ideas	60
7.6 Summary	61
Appendices	63
Appendix 1: Consistency Matrix	63
Appendix 2: CTO Role for Organisational Needs	64
Appendix 3: The New Voice of the CIO	65
Appendix 4: CTO CIO Job Advert.....	66
Appendix 5: Interview Consent Form.....	67
Appendix 6: Interview Questionnaire	68
References.....	72

LIST OF TABLES

Table	Page
Table 1: Key / Legend to colour coding used across all tables	26
Table 2: Research sample	26
Table 3: Research Question 1: Comments on roles before the CTO position	28
Table 4: Research Question 1: Recency of CTO positions	29
Table 5: Research Question 1: Comments on why the need for CTO?	29
Table 6: Research Question 1: Roles and responsibilities of the CTO	30
Table 7: CTO relationship to CIO and CEO	31
Table 8: CTO executive functions	32
Table 9: Research Question 4: Comments on what does technology mean to you and your company?	33
Table 10: Research Question 4: Comment on ways you assist your company to improve its competitiveness?	34
Table 11: Research Question 4: CTOs involvement in the data centre	35
Table 12: Research Question 4: Comments on CTO data centre responsibility and usage of information	35
Table 13: Research Question 5: Type of skills required for CTO ...	36
Table 14: Research Question 5: Comments on skills required for a CTO	37

Chapter 1: Introduction to Research Problem

1.1 Introduction

The technology landscape has changed significantly over the past three decades, companies are more reliant on technology than ever before for their strategic business decisions. Medcof and Atkison (2009) assert that the CTO has a strategic role to play in business, which includes;

- ensuring that technology is operational and optimal for business needs,
- ensuring the effective integration of technology into the organisation's business strategy,
- mediating across the various business divisions for technology decisions,
- engaging as a member of the top management team and executive team, to play an advisory role which will go beyond the technology arena and scope.

There is limited research on the important leadership role that the CTO serves in an organisation (Medcof, 2008; Smith, 2007). There is also differing points of views. A review of academic literature relating to and positioning the role of the CTO as line manager by Gwynne (1996), Medcof and Youofpourfard (2006) and Roberto (2003) present a different picture to academics such as Smith (2003).

Medcof and Yousofpourfard (2006, p. 10) suggest that "CTOs are unlikely to enter the stable core of executive decision makers (Roberto, 2003). If they do

not have experience as line managers in areas other than research and development (R&D). Smith (2003, p. 3) goes on to state that “managers are so focused on day-to-day operations that they do not have time to study broadly and deeply enough to locate the technologies that will be essential in the company’s future. These people frequently identify important changes once a competitor has already implemented a similar idea”.

The above debate, on whether it is necessary to have prior line-manager skills, can seriously disadvantage a potential CTO incumbent who may not have line manager experience. The prospective employer therefore needs to be knowledgeable of when line-manager skills are mandatory and when they are not. This is only one example of the many functional roles of the CTO that needs to be explored. Failure to fully understand the role of the CTO can result in mis-alignment of duties and functional roles of the CTO.

Smith (2007, p. 19) states that “the position is vague and one would expect that many people in the position to be ‘winging-it’ and the superiors to be evaluating them on trial and error”. This research will provide valuable insights and learnings on how the changing business dynamics have influenced the CTO roles accordingly. The research aims to highlight the importance of the c-level suite executive team (CEO, CFO, COO and CIO) to have a clear understanding of the strategic intent when assigning the CTO position in an organisation. This is crucial to prevent organisational distortion between executives, especially at the c-level suite.

The CTO is at the core of technology leadership within the organisation. The organisational structure that the CTO reports to or operates in, plays a key role in the positioning of the CTO. Companies are becoming totally dependant on technology and use technology to either; 'keep their lights-on' or to take their organisation to the next s-curve. Technology within an organisation can range from a simple machine or client/server within a local office to a highly complex and integrated robotic manufacturing plant or client/server architecture over a global footprint. In light of the varying degrees of complexity of an organisation's technological environment, which evolves with company growth, the role of the CTO needs to be constantly reviewed.

Smith (2003, p. 9) has the firm belief that "the CTOs relationship with the CIO should be based on a more clearly defined division of responsibility". To effectively continue this research topic it will be most appropriate to define the roles of the CTO and CIO. It is crucial to do this, since as the research progresses, it will become apparent that certain functions between these two c-level suite executives do indeed overlap.

1.1.1 What is the Role of a CTO?

This person is a high-level corporate officer who is in charge of all technology needs, including information technology of the organisation. Smith (2003, p. 9) states that "the CTO's primary responsibility is contributing to the strategic direction of the company by identifying the role that specific technologies will play in its future growth. The CTO looks for contributions that technology can

make to the competitive advantage of the company”. The focus is on technology of which IT is one part of the spectrum.

1.1.2 What is the Role of a CIO?

This person is seen as the highest-ranking Information System (IS) officer in the organisation, usually a vice president, who oversees the planning, development and implementation of information services. CIOs serve as leaders to all IS professionals in the organisation. Smith (2003, p. 9) states that “the CIO leads the application of information technology to internal processes and services. This person is responsible for improving the efficiency of internal systems”.

1.2 Research Purpose

The researcher’s recent quest to understand the role of the CTO resulted in more confusion instead of a clear guideline or explanation to this strategic and critical role. Nathan Myhrvold, CTO at Microsoft, was interviewed in the early 2000’s by John Brockman the editor of **Edge**. John Brockman asked Nathan Myhrvold “what’s a CTO?” (Edge, 2010, para. 1). Nathan Myhrvold comments that “...many of the people who actually were great CTOs didn't have that title, and at least some of the people who have that title arguably aren't great at it” (Edge, 2010, para. 2).

This research will make CTOs and c-level executives knowledgeable to position the CTO role correctly within their organisation. In certain instances, organisations will come to a consensus and understanding that there is no need to have a CTO (Medcof and Yousofpourfard, 2006; Smith, 2007).

When a CTO is appointed to an organisation, this research will guide the CTO to;

- create a framework for their roles and responsibilities,
- position themselves correctly and strategically in the organisational structure and hierarchy. This will prevent distortion amongst the c-level suite members especially the CIO (Smith, 2003),
- be ambassadors of the CTO role, by branding themselves correctly within their organisation. This will also benefit future incumbents that take over the reigns of existing CTOs,
- build the organisation's competitive edge by utilising their role effectively and strategically,
- ensure that key performance indicators are set correctly so that the CTO can be measured fairly at annual performance appraisals.

Smith (2007) identifies patterns of the CTO position. These patterns are attributes and characteristics of CTOs, which Smith groups together. This research will adopt some of the attributes identified by Smith and attempt to create a working model that a CTO could use or a c-level team member could use, to position the CTO appropriately within the organisation.

The CTO position is not restricted to IT companies. Smith (2003, p. 2) states that "each company has unique requirements for its CTO and provides a unique organisational structure into which the person will fit". Smith highlights that,

although the CTO position is new, it is being widely used in many different industries and each of these industries have a very different business model, customer base, internal structure and culture.

1.2.1 Internal and External Strategy

Companies are becoming highly reliant on technology which in turn is placing increasing responsibilities on the CIO. The CIO is said to focus on internal strategy while the CTO focuses on external strategy (Smith, 2003; Minevich, 2005; Pala, 2008).

1.3 Research Problem

Uttal, Kantrow, Linden and Stock (1992) found that many CTOs believe that they, and technology, are undervalued by their organisations and that they have not been accorded sufficient degrees of influence in their organisations. Further studies, into the roles of the CTO, Smith (2007, p. 19) found that “the position is vague and one would expect that many people in the position to be ‘winging-it’ and the superiors to be evaluating them on trial and error”. These significant findings by Uttal et al. (1992) and Smith (2007) is the basis of the research problem. The CTO position is; vague, incorrectly positioned within the organisation, the strategic and competitive advantage is not fully exploited and CTOs are not being evaluated fairly.

The CTO position is generally viewed as an executive position and as such it is part of the c-level suite of executives. Since the CTO is in the ‘mid-field of the game, and in-order for them to remain in the game’ a vague role cannot be

accepted. There is a need for clear guidelines and directions for the positioning and functions of the CTO.

1.3.1 Current CTO Models and Frameworks

The researcher will review the current frameworks and models by Uttal et al. (1992), Berray and Sampath (2002) (appendix 2) and Smith (2007) which positions the role of a CTO. This review would be done in conjunction with the IBM CIO study (IBM, 2009) (appendix 3). The researcher will attempt to develop an updated model to position the CTO.

C-level executives are constantly in a 'fish-bowl' and serve as ambassadors for these roles, which fellow senior managers aspire to. Within this research, a model will be constructed to assist c-level suite executives to establish a clearer set of rules-of-engagement for the CTO.

1.4 Scope of Research

The scope of this research focuses on the IT industry. Using the current model by Berray and Sampath (2002) (appendix 2) the researcher will attempt to construct an updated and relevant model for the role of the CTO. The researcher will also attempt to explore that if the CTO position is that of an IS Manager operational role then does the potential exists for the CTO position to be under-valued by their colleagues and the industry at large? Smith (2003, p. 8) also highlighted "many organisations have a difficult time separating the responsibilities of the CTO from those of the CIO, which can make the working relationship between the two very difficult".

An internet search for the captains-in-the-industry shows that CTOs like that of Amazon.com often refer to the model created by Berray and Sampath (2002) as a guideline to position the CTO role in organisations (All Things Distributed, 2007). The researcher interviewed the CTO of IBM, Mr. C. Foster an IBM Distinguished Engineer, who also referred to this model to explain the role of the CTO.

An updated model will be developed to assist the CTO to be appropriately positioned within an organisation. In the words of Smith (2003, p. 9) “the goal is to create a complementary and supportive relationship that maximises contributions to corporate strategy and profitability” of the organisation.

Chapter 2: Theory and Literature Review

2.1 Introduction

In-order to remain in business, an organisation must constantly review its strategy to ensure it is aligned to overcome the competition in the market place. The strategy of the organisation is clearly supported by its capabilities which includes its competencies, its guiding vision, values and goals it sets for itself. The CTO is a core thread in the competencies of the organisation. Pala (2008) and Medcof and Atkison (2009) states that the CTO has a strategic role to play in the organisation. Generally, the CTO position is viewed as an executive position and as such it is part of the c-level suite of executives. In light of this, it is important to review the role of the CTO when considering a competitive strategy.

Berray and Sampath (2002, p. 2) state that “the ambiguity of the (CTO) role speaks to the concern that the single most important question of future competitive strategy: how does technology (in the widest sense possible) relate to optimal decision-making at the top, which in turn enhances competitive performance, higher margins, greater market share, and long-lasting dominance of a certain industry?” With this said the literature review will focus on four major themes; strategic responsibilities of a CTO, competitiveness, information as an asset and line manager responsibilities.

2.2 Strategic Responsibilities of the CTO

In technology-driven industries, a CTO plays a crucial role in effective integration of technology into the firm's strategy (Roberts, 2001; Smith, 2003; Medcof and Yousofpourfard, 2006). This can only occur if the CTO has sufficient influence. Medcof (2008, p. 407) posit that "a firm with an unpowered CTO will not be successful".

Strategic Contingencies Theory (SCT) of organisational power can be applied to the strategic responsibilities of the CTO (Hickson, Lee, Schneck and Pennings, 1971). SCT states that "the more critical the strategic contingencies of an organisation unit, the more power the unit has". Finkelstein (1992) and Harpaz and Meshoulman (1997) extended this logic to individuals in the firm, such as the CTO. It follows that, if the CTO is the key individual handling technology contingencies for the firm, the more strategically important technology is for the firm and the greater will be the power of the CTO (Medcof and Yousofpourfard, 2006).

Uttal et. al (1992) classified three roles a CTO should serve which are determined by the firm strategy. The three roles being; functional leadership, strategic leadership or supra-functional leadership. These involve increasing levels of strategic responsibility and in many firms the CTO sits at c-level suite of executives. Medcof (2008) states that the CTO in the supra-functional leadership is responsible for developing strategy for the entire firm and this strategy is not limited to the technology function. The CTO oversees the

execution of this strategy across the entire firm and not just in the technology space.

Roberts (2001) found that in technology driven firms, the degree to which technology strategy is integrated into overall strategy is correlated to organisational effectiveness. This is measured as overall corporate sales growth and percentage of sales from new products and services. Medcof and Yousofpourfard (2006, p. 2) suggest that “in some firms the potential of technology has not been realised because CTO’s are not given roles of sufficient stature to lead the integration of technology into the firm’s strategy”.

A CTO must have a level of identity within the organisation in its current technological dependence and its proposed future dependence based on the firm’s strategy. This information will afford the CTO to position themselves appropriately within the organisation and not just ‘winging-it’ as identified by Smith (2003). Medcof and Yousofpourfard (2006, p. 2) note that “tones of some discussions seems to suggest that CTOs, universally, should be elevated to the top tiers of their organisations”.

Strategy is owned by the CEO, however, it is developed and supported by the c-level suite of executives of the organisation. Roberts (2001, p. 25) notes that “technically trained CEOs show no special bias in appointing CTOs either to the company board of directors or even to the firm’s senior management committee. However, CEOs in general might influence the relationship and thereby the role

of the CTO”. Medcof and Yousofpourfard (2006, p. 1) point out that “the leadership style of the CEO can also significantly enhance or detract from the ability of the CTO to influence firm strategy”. CTOs improve the competitive position of an organisation through leading innovation (Medcof, 2008). The CTO needs to have access to the executive level decision makers of the organisation for their input to be recognised and “the CTO must earn the trust and confidence of the CEO” (Smith, 2003, p. 7).

It is important to note that the current literature reviewed for strategic responsibilities, 1992 to 2008, highlight the CTO positioning which speaks to the fact that their power of influence is highly dependant on the technological dependence of the organisation. One can then argue that perhaps a CTO should not be appointed at all in certain organisations that have a very low dependency on technology as identified by Medcof and Yousofpourfard (2006) and Smith (2007).

2.3 Competitiveness

To attain competitiveness, Porter states in Gibson (1998, p. 49) “companies have to find ways of growing and building advantages rather than just eliminating disadvantages”. Established organisations need a CTO to “assure development of fundamental technologies offering clear competitive advantage for current and future businesses” (O’Neill and Bridenbaugh, 1992). The relationship between technology and competitiveness is a subject of much discussion. There exists a wide range of indicators such as; market shares,

profit and growth, dividends and investments which are used to assess the competitiveness of firms.

The findings by Porter (1990), Romer (1990), IDRC (1993), UNDP (2001) and Lingela and Buys (2007) confirm that the rate of technological progress determines the ability of industries to open new markets, develop new products and services that command high prices in domestic and international markets. Competitive advantage is increasingly derived from knowledge and technological skills and experience in the creation of new products (Teece, Pisano and Shuen, 1997; Tidd, Bessant and Pavitt, 1997).

Uttal et al (1992) points out that when technology and the CTO roles are undervalued when setting a firm's strategy, this will undoubtedly undermine the firm's competitiveness. As highlighted in the previous section, 'strategic responsibilities of the CTO', the priorities given to technology by the organisation, can improve the competitiveness of the organisation and as such the CTO must be given the appropriate level of strategic involvement. Organisations need to design an effective organisational structure as this is essential to attain competitive advantage (Medcof, 2001).

Medcof (2008) states for competitiveness, technology needs to be part of the firm's strategy instead of just ensuring that the technology function is operational. IBM (IBM, 2009) asserts that the degree of application of business intelligence and analytics is directly correlated to a company's competitiveness.

CTOs must therefore ensure that the appropriate investments are made in business intelligence technologies to achieve competitiveness.

The investments made in technological projects must be aligned to the corporate strategy, and hence must be realistic in its contribution to the company's competitive advantage. This requires the CTO to have a clear understanding of the role technology can play in the competitive position of the company (Smith, 2003). The more technologically dependant the company is, the more the CTO will lean towards the role of a supra-functional CTO as termed by Uttal et. al (1992).

2.4 Information as an Asset

Information as an asset is a vital consideration in creating value for an organisation and can have a dramatic impact on the effectiveness of an organisation (Oppenheim, Stenson and Wilson, 2001). Oppenheim, Stenson and Wilson (2001, p. 460) state that by "locating information assets and their attributes within an organisational framework and identifying members using these assets, makes it possible to identify which information assets and their attributes are significant for enhancing the organisation's effectiveness". The attributes include; quality, currency, accuracy and comprehensiveness (Burk and Horton, 1988) and verifiability (Sterling, 1970).

Boisot (1998, p. 76) states that "the value of an information asset is derived partly from the utility of the service and partly from its positional status; it

confers a competitive advantage on those who possess it". Information helps organisations achieve competitive advantage by enabling delivery of cost effective or more highly-differentiated products and services (Porter, 1980). Garelli (2003) states that nations manage their competitiveness by competing heavily with either their assets or processes.

Information Asset is (IAD, 2010);

- organised information that is valuable and easily accessible to those who need it,
- it comprises a wide range of corporate product, service and process information,
- it empowers an organisation to reach its goals,
- it increases in value according to the number of people able to make effective use of this information,
- increases in value according to the amount of analysis it performs converting low level information into more refined information.

The literature highlights that technology and information as assets are correlated. If an organisation relies on information as an asset, then it implies that their technological dependency will increase. The increased dependence on technology will have profound impacts for a CTO. The CTO's effectiveness will be evaluated by technological efficiencies in delivering information that is qualitative, current, accurate, comprehensive and verifiable.

2.5 Line Manager

Medcof (2008) found a common theme in the CTO literature (Smith, 2003) that is, CTO's technological expertise is the key reason they are included in executive decision making. Medcof and Atkinson (2009) found that leadership is essential to developing, communicating and engaging an organisation's vision, where the organisation is going and how innovations contribute to their mission.

Those CTOs that recognise the promoting of technical expertise as a basis for influence, where technology is a critical contingency at both the macro-environment and firm level, might take every opportunity to demonstrate the value of that expertise when supra-functional issues are discussed (Medcof and Atkinson, 2009). Smith (2003) points out that these companies 'attract and retain the highest quality' technology leaders available. However, these capabilities should align to the corporate business strategy for them to effectively contribute to the business objectives.

CTOs are generally promoted from senior technical positions directly into leadership. There are many challenges that a CTO can potentially face in this new leadership role, because of the "nature of technical work, the nature of technical training, and the type of people who are attracted to these technical fields" have no prior management exposure (Medcof and Atkinson, 2009, p. 17). Medcof and Atkinson (2009, p. 17) state that "individuals within this field have usually been trained in a technical discipline such as engineering or science

and have spent most, if not all, of their professional lives in predominantly technical roles”.

Medcof and Yousofpourfard (2006, p. 10) suggest that “CTOs are unlikely to enter the “stable core” of executive decision makers (Roberto, 2003) if they do not have experience as line managers in areas other than R&D”. Consistent with this point, Gwynne (1996) makes the case that “firms should adopt the policy of requiring CTOs to concurrently hold a line management position to foster their sense of the business and to gain credibility”.

Smith (2003) provides us with a business scenario of a company, Alcoa, which could have missed a serious threat with the emergence of mini-mills since the executives were no longer familiar with the latest scientific developments in metal production. The CTO, Bridenbaugh, was in a position to advise Alcoa of this threat by the mini-mills. Smith (2003, p. 3) state that “managers are so focused on day-to-day operations that they do not have time to study broadly and deeply enough to locate the technologies that will be essential in the future. These people frequently identify important changes once a competitor has already implemented a similar idea”.

2.5.1 CIO Integration into Executive Team

Smith (2003, p. 8) recalls that “when the CIO position emerged, they too were branded as technologists who could not function as business strategists. This image has diminished as CIOs have shown themselves to be just as effective in

making business decisions as their management-schooled peers”. Therefore, the CTO should leverage from the integration experience of the CIO. Executive Committee members should also recognise “that the technological stereotype that was not accurate for the CIO might also prove to be inaccurate for the CTO” (Smith, 2003, p. 8).

2.6 Conclusion of Literature Review

The researcher would like to highlight that based on the differing opinions in the literature review presented, it depends on the technology focus the organisation has for its competitiveness. In today’s current, business and client engagement roles, leaders are requested to be skilled in risk taking, working on large customer accounts and defining strategy for complex bids. These positions are not line management functions but contain attributes of those functions.

Strategic leadership positions such as; client executive, account executive, project executive, service delivery manager, technical solutions manager and project manager are some of the technology roles that leads to a skills matrix for a CTO role. There is a need for empirical studies to confirm this, especially with the maturity of technology and its associated client relationship delivery roles. Technology is consistently evolving and becoming more innovative hence the need for continuous academic research, to make the understanding of the CTO position more suitable to current technology leadership requirements.

Chapter 3: Research Questions

The purpose of this research is to gain insights into the current positioning of the CTOs in an organisation. The exploratory questions posed will provide valuable knowledge on how the CTO positions are managed.

The questions which will be answered in this research are:

3.1 Research Question 1:

How are CTOs positioned in organisations, especially with respect to roles?

3.2 Research Question 2:

What is the typical level of a CTO?

3.3 Research Question 3:

How do CEOs influence the role of CTOs within organisations?

3.4 Research Question 4:

How should the role of a CTO be positioned in an organisation that does not consider technology to be a competitive factor?

3.5 Research Question 5:

What are the prospects for CTOs to be appointed without having a previous line manager role?

Chapter 4: Research Methodology

4.1 Research Design

Zikmund (2003) states that when a researcher has limited experience or knowledge about a research issue, exploratory research is a useful preliminary step. A qualitative research method was selected to explore the positioning of the CTO in an organisation. The researcher conducted in-depth experience surveys. Zikmund (2003) states that an experience survey consists of interviews with a small number of people who have been carefully selected.

The research study obtained data through semi-structured interviews. The questionnaire would be a typical design that would meet the needs of a qualitative study. This was administered mainly by face-to-face interviews. There were certain interviews that had to be conducted over a telephone call since the interviewees were out-of-country for an extended period. This is concerning since vital observations which are mandatory for qualitative research was potentially lost.

4.2 Secondary Data

The researcher reviewed past interview questionnaires and collected data from previous academics research in a field similar to this research topic.

4.3 Proposed Unit of Analysis

The unit of analysis will be the IT individual, the CTO.

4.4 Population Relevance

Zikmund (2003) states that it is important to identify the target population at the outset of the research project. The researcher has identified the population to be, a CTO who serves in the IT industry.

4.5 Sampling Method and Size

The researcher secured an interview with a CTO from a leading multinational technology company. The interviewee offered to provide access to additional suitable interviewees. This is referred to as snowball sampling. Zikmund (2003) states that “this technique is used to locate members of rare populations by referrals”. He goes on to state that, “reduced sample sizes and costs are clear advantages of the snowball sampling”. The researcher interviewed seven(7) CTOs.

4.6 Data Collection and Data Analysis

4.6.1 Data Collection

The collection and analysis after each interview was taken iteratively in order to gain in-depth levels of knowledge as the process progresses. The proposed method was as follows;

- A formal letter of consent (appendix 5) which required a confidentiality clause be signed by each interviewee before the start of the interview.
- Conduct the personal interview, using a semi-structured interview schedule (appendix 6).

- Notes were made of the interview session.
- Make key observations of respondents' words, emotions, expression descriptions, stories and visual portrayals.
- Capture researchers notes. Look at developing themes using words that the respondent used.
- Cross-reference current and new themes that emerge from the interview sessions.
- Analyse the data to determine trends and links to create meaningful information.
- Review the information in line with the literature and perform in-depth analysis.
- Populate the information into tables and record them accordingly.

4.6.2 Data Analysis

Narrative, comparative and content analysis is used to analyse the data. The transcript of the interview was categorised into relevant categories and sub-categories. These categories is then related back to the academic literature and examples of 'actual speech' is appropriately referenced in the research.

4.7 Research Limitations

The following research limitations have been identified using the selected methodology:

4.7.1 Certain organisations within specific industries will not have assigned CTO's however, the CIO performs the CTO function. The initial limitation identified is that CIO will be subjective in providing information regarding the CTO's role. This could be crucial in understanding the obstacles faced by a CTO in his position.

4.7.2. Roberts (2001) found that depending on geography, the CTO will have different levels of responsibility or positioning on the board. Most, if not all CTOs, will be from a South African IT company. Based on the research by Robert's there will be limitations in mapping the model on a global scale.

Chapter 5: Research Results

5.1 Description of Sample

The research sample was from the IT industry as outlined earlier in the research methodology. All CTOs in the sample interviewed, were from companies that are listed on either the Johannesburg Securities Exchange or on the New York Stock Exchange.

It was intended at the outset to interview a total of fifteen CTOs, however, only a total of seven interviews were conducted. Five of the interviews were conducted in-person, while two interviews were conducted telephonically, since these two interviewees were out-of-country for an extended period. The semi-structured interviews lasted for approximately an hour.

Due to the functional role and strategic importance of the CTO in the organisation, the timing of the interviews was crucial. A further challenge was posed by the fact that there are very few CTOs in the country, and these CTOs are not readily available. This meant that there is little fallback or accessibility to other CTOs. The interviews were scheduled one month in-advance. At this stage, three of the interviews had to be rescheduled a week before the appointments at the request of the CTO in question, due to executive meetings that arose.

5.2 Difficulty in finding CTOs

It is pertinent to note that the researcher obtained a database comprising of contact details for approximately 140 CIOs of South African companies. A well

articulated email was forwarded to the CIOs of major South African companies from the spreadsheet in question, for the researcher to be afforded the opportunity to interview their CTOs. The researcher did actually receive responses from the respective CIOs. Most of them replied with a similar statement, “Unfortunately I am not the CTO and our company does not have one, I am afraid”. This was more often the response that was received from many companies in South Africa who just had CIOs and IT Directors. Interestingly, only two of the big four banks in South Africa have a CTO.

5.3 Confidentiality of companies details

For the purposes of confidentiality, the identity of the organisations interviewed was intentionally not disclosed in the research findings. This is in line with the research methodology outlined in Chapter 4.

Each interviewee was required to sign the consent form (appendix 5) before proceeding with the interview. This was to ensure the respondents confidentiality was maintained. This proved to be ethically responsible and also assisted in obtaining candid and informative responses from the interviewees.

Confidentiality has been assured in the research findings by using fictional company names as indicated in table 2. This also assures that companies could not be identified. This allowed the quality and content of the research findings not to be altered in any way.

Table 1: Key / Legend to colour coding used across all tables

	<ul style="list-style-type: none"> • CTO reports to CIO. In the case of Company C, CTO and CIO is the same person. • Company as an internal business technology focus.
	<ul style="list-style-type: none"> • CTO reports to CEO or country GM. • Company as an external business technology focus.

Table 2: Research sample

Company CTO Relating Attributes	A	B	C	D	E	F	G
Official Designation	CTO	CTO	CIO and CTO	CTO	CTO	CTO	CTO
CTO reports to	CIO	CIO	Country GM	CEO	CEO	Country GM	Country GM
CTO relationship to CIO	Manager	Manager	Performed by Same Person	Peer	Peer	Peer	Peer
CEO technical	No	No	Yes	No	No	Yes	Yes
1 st time CTO position	No, 2006	Yes	Yes	No	Yes	Yes	No
Direct Board Activities	No	No	Yes	No	Yes	Yes	Yes
Management of Data Centre	Yes	Yes	Yes	No	No	No	No
Line manager skill is key for CTO position	Yes	Yes	Yes	No	No	No	No

In table 1, on page 26, a colour was assigned to group companies together to highlight common findings based on the patterns that were consistent for the companies.

5.4 Patterns observed in the research sample

It was not the objective of the researcher to split the sample interviewed into two distinct group; CTOs that reported to the CIO and CTOs that reported to the CEO or GM. However, the research results highlighted the following:

Companies A, B and C:

- are highly dependent and make extensive use of technology internally,
- the CTOs of Companies A and B report to the CIO,
- the CTO of Company C reports to the country General Manager (GM) and the CTO here assumes the role of CIO and CTO as per the directive of their international organisation.

Companies D, E, F and G:

- the CTOs reports directly to the CEO or GM
- these companies supply or provide technology services to their external clients.

Table 2, on page 26, represents all the CTOs interviewed from the research sample against attributes that were consistent with the themes in the literature review (chapter 2) and associated research questions (chapter 3).

The responses received from the sample interviewed, enabled the research questions to be answered and thus satisfied the research objectives.

There were five research questions to be answered (Chapter 3). In order to get a complete response to any single question, probing questions were often asked. This provided a more complete response to the question. The outcome will be noticed in the discussion of the research results below. Although the researcher had the interview sheet during the interview (appendix 6) the questions posed to the interviewee were not word-for-word or paraphrased from the interview sheet. The objective was to identify if there was a theme being developed by the respondents.

5.5 Research Results

5.5.1 Research Question 1: How are CTOs positioned in organisations, especially with respect to roles?

The results for research question 1 are presented in tables 3, 4, 5 and 6.

Table 3: Research Question 1: Comments on roles before the CTO position

Company	Comments
A	I was selected for this position because of my experience on data centre migrations.
B	I was the IS Manager, hence it was the natural progression.
C	Responsible for networks and IT Director.
D	I was in a delivery role, involved in Innovation.
E	Technical Director in previous role.
F	Distinguished Engineer in the company.
G	Chief Technical Architect for a customer.

Table 3 highlights the previous job roles that the CTOs had before assuming their current role as the CTO. The theme evident from this table is:

- CTOs from Companies A, B and C highlighted job roles that were internally focused and at an IT operational level,
- CTOs from Companies D, E, F and G highlighted job roles that were more externally and technology solution focused.

Table 4: Research Question 1: Recency of CTO positions

Company	A	B	C	D	E	F	G
1 st time CTO position	No, 2006	Yes	Yes	No	Yes	Yes	No

Table 4 shows that 42% of the companies had a previous CTO while 58% had the position for the first time. However, all CTOs indicated that the CTO role was fairly recent. Company A, advised the position was first created in 2006.

Table 5: Research Question 1: Comments on why the need for CTO?

Company	Comments
A	The need arose since two federated businesses divorced. It was required for the building of an IT infrastructure and technology team from scratch.
B	Need arose to standardise IT across all divisions, since more of the divisions were going online.
C	The need for the position arose last year when there was integration between international head quarters and our local head office.
D	Someone to focus on emerging technologies.
E	A person to understand the trends and impact of business patterns.
F	A person being a single point of contact for customer facing technology
G	A technology leader for the geography

In table 5 it is relevant to note that the CTOs interviewed were not posed the question ‘why was the need for a CTO role in this organisation?’ The question posed was ‘what made you choose the CTO role?’ All interviewees responded with, ‘the need arose because...’. This is consistent with table 4 where the CTOs stated the positions were fairly recent.

Table 6: Research Question 1: Roles and responsibilities of the CTO

Roles and Responsibilities \ Company	A	B	C	D	E	F	G
CTO reports to	CIO	CIO	GM	CEO	CEO	GM	GM
Data Centre Management	✓	✓	✓				
Responsible for IT / Ops Managers	✓	✓	✓				
Technical Support Help Desk duties	✓	✓					
Daily IT Operations	✓	✓	✓				
Managing Cost Per user/licence/bit	✓	✓	✓	✓			
Managing CAPEX	✓	✓	✓				
Interacting with communities (int/ext)	✓	✓	✓	✓	✓	✓	✓
Responsible for Project Implementation	✓	✓	✓	✓			
Implementing Strategy	✓	✓	✓				
Developing Strategy			✓	✓	✓	✓	✓
Focus on Competitive Advantage			✓	✓	✓	✓	✓
ROI				✓	✓	✓	✓
Focus on Select Client Base/Group				✓	✓	✓	✓
Direct Board Activates			✓		✓	✓	✓
Educational Activities:							
Skilling Staff	✓	✓	✓	✓	✓	✓	✓
Involved in Lab work				✓	✓	✓	✓
Promoting Innovation			✓	✓	✓	✓	✓
Thought Leadership				✓	✓	✓	✓
Promote technology at universities				✓	✓	✓	✓

Table 6 was compiled from keywords the respondents used during the interviews. The researcher did not provide table 6 for the respondents to check or tick. These are the core roles or functions that the respective CTOs

informed the researcher that they are currently responsible for. It is important to note that the CTO from Company C assumes both the CTO and CIO role as represented in table 2.

Table 6 shows a distinct polarisation of the results from the feedback received from the CTOs. The polarisation is; when the CTO reported to the CIO the job roles and responsibilities will be similar, and this was evident again when the CTO reported to the CEO or GM.

The common function indicated by all CTOs was they;

- interact with internal and external committees and associations,
- are passionate about skilling their teams.

5.5.2 Research Question 2: What is the typical level of a CTO?

Table 7: CTO relationship to CIO and CEO.

Attributes Relating to CTO \ Company	A	B	C	D	E	F	G
Official Designation:-	CTO	CTO	CIO & CTO	CTO	CTO	CTO	CTO
CTO Reports to :-	CIO	CIO	GM	CEO	CEO	GM	GM
CTO Relationship to CIO :-	Manager	Manager	Performed by same person	Peer	Peer	Peer	Peer
CEO Technical :-	No	No	Yes	No	No	Yes	Yes

Table 7 shows that in Company A and B the CTO reports to the CIO. The CTO in Company C assumes both the CIO and CTO role and reports to the GM. Companies A, B, and C also have a high technology dependence.

CTOs from Companies D, E, F and G report to the highest level of office within the country, being the CEO or country GM. These companies supply or provide technology services to companies like A, B and C.

5.5.3 Research Question 3: How do CEOs Influence the role of CTOs within organisations?

Table 8: CTO executive functions

Company	A	B	C	D	E	F	G
CTO Reports to :-	CIO	CIO	GM	CEO	CEO	GM	GM
CEO Technical :-	No	No	Yes	No	No	Yes	Yes
Implementing Strategy :-	✓	✓	✓				
Developing Strategy :-			✓	✓	✓	✓	✓
Direct Board Activities :-			✓		✓	✓	✓

Table 8 shows CTOs that report to the CIO are involved in implementing the strategy of the company and they do not have any direct board activities. On the other hand, the CTOs that report directly to the CEO or country GM are responsible for developing the technology strategy of a company and have direct board activities. The exception being the CTO from Company D.

The reporting structure for Company D can be attributed to the fact that the CTO is not directly involved in board activities. Since the board for Company D is located at their global headquarters. This is consistent with Roberts (2001) findings that depending on the geography, the CTO will have different levels of responsibility or positioning on the board.

5.5.4 Research Question 4: How should the role of a CTO be positioned in an organisation that does not consider technology to be a competitive factor?

The feedback for research question 4 is presented in tables 9, 10, 11 and 12.

Table 9: Research Question 4: Comments on what does technology mean to you and your company?

Company	Comments
A	Development and procurement of equipment.
B	The respondent emphasised their focus was on 'internal technology' for the organisation. "Experiment to understand business need.... very seldom are we early adopters... understanding of technology... bad technology can be used more effectively ... it makes a difference".
C	The CTO asked, "what is the definition of Technology". Technology strategy is big... not an enabler... heart of our business.
D	It provides flexibility to our organisation, where our consultants have flexibility due to key mobile applications... It allows us to show to our clients that we are adopters of our own technologies. We have an extensive and focused team in India that does our development.
E	We are involved in research and development and support of OEM products... being involved at the embryonic level of a technology.
F	All layers or spheres of technology. R&D to deployment into the market.
G	Multifaceted technology involvement. We involved in designing to deploying into the market.

It is strikingly evident from table 9 that Companies A, B and C have an internal technology focus. Whereas Companies D, E, F and G have an external technology focus and their business is centered on technology R&D.

Table 10: Research Question 4: Comment on ways you assist your company to improve its competitiveness?

Company	Comments
A	Flexible to give business processing power when IT needs it... best-of-breed of technology.
B	Ability to standardise and run the technology... always benchmark ourselves to the outside.
C	Focus on good decision making... good strategy and plan.... ensure delivery... quick execution.
D	Ensuring new cutting edge technology is deployed quick and fast. You have a small window of opportunity. CTO is about how quick you can deploy and having it quicker than everyone else. Understand, deploy and make it quicker... drops to the bottom line quicker. Looking out for the creation of disruptive technologies.
E	Initially this question was avoided, "this is what differentiates us from our competitors." The CTO is very focused on "patterns" in the industry. He, "spots those trends, focus on items at embryonic level... people don't understand the embryonic level."
F	Making sure that technical teams deliver the proposition to the market. Defining a strategy... position the products to market to stakeholders. research the market.
G	Combination of research and how they can use it. Focus on engineering excellence... creates a strategy going forward.

The theme that developed from table 9 is continued in table 10. CTOs from Company A, B and C positioned technology as to providing competitive advantages in their internal IT domain. CTOs from Company D, E, F and G focused on the development of technologies and executing speed of delivery for those technologies to the market place as their competitive advantage.

Table 11: Research Question 4: CTOs involvement in the data centre

Company	A	B	C	D	E	F	G
CTO Reports to:-	CIO	CIO	GM	CEO	CEO	GM	GM
Data Centre Management:-	✓	✓	✓				
Responsible for IT / Ops Managers:-	✓	✓	✓				
Technical Support Help Desk Duties:-	✓	✓					
Daily IT Operations :-	✓	✓	✓				
Managing cost per user / licence / bit :-	✓	✓	✓	✓			

It is evident from table 11 that CTOs that report to the CIO have direct involvement in data centre tasks. This holds true for Company C as well, where the CTO of Company C is both the CTO and CIO of the organisation as indicated in table 2.

Table 12: Research Question 4: Comments on CTO data centre responsibility and usage of information.

Company	Comments
A	Business intelligence space is key.
B	I manage and look after the three data centres... focus on cost per user / licence.
C	I oversee the data centre... focus mainly on the construction of data centres and ensuring they are built according to objectives and standards. Additionally, focuses on good decisions which come from good information. I require relevant valuable information. Not directly involved with mergers and acquisitions... only assisted with due diligence.
D	CTO provides advice to the operations management team... dotted line responsibility for data centre. Key is go-to-market, more external focused.
E	No data centre management. However, I get involved in the limitations and problems that arise in that space. CIO is responsible for data centre. Concerned with what is being done with just metadata and functions of it.
F	How can we use this information for strategic advantage?
G	Understand what clients are doing with the information.

Table 12 shows CTOs from Companies A, B and C;

- have direct data centre responsibilities,
- information is used mainly for business intelligence,
- are more internally focused.

CTOs from Companies D, E, F and G;

- have no direct data centre responsibilities,
- information is used to develop strategy,
- are more externally focused.

5.5.5 Research Question 5: What are the prospects for CTOs to be appointed without having a previous line manager role?

The feedback for research question 5 is presented in tables 13 and 14.

Table 13: Research Question 5: Type of skills required for CTO

Company	A	B	C	D	E	F	G
Official Designation :-	CTO	CTO	CIO & CTO	CTO	CTO	CTO	CTO
CTO Reports to :-	CIO	CIO	GM	CEO	CEO	GM	GM
People Manager skills :-	✓	✓	✓				
Finance skills (Profit and Loss) :-	✓	✓		✓	✓		✓
Leadership skills :-			✓	✓	✓	✓	✓

In table 13 it is evident that CTOs from Companies A, B and C stated that people manager skills and management of profit and loss competencies were essential. However, CTOs from Companies D, E, F and G stated that leadership skills and profit and loss competencies were essential for an individual to become a CTO.

Table 14: Research Question 5: Comments on skills required for a CTO

Company	Comments
A	Yes. Performance evaluation and create performance improvement plans... annual salary reviews and discussions.
B	You need to have and understand people manager and finances skills.
C	Yes. If people report to you, you need to know how to manage staff... having people and leadership skills. Your leadership style affects organisations performance... The higher you go up, you need to focus on this. I am very passionate about human resources aspects, million times more.
D	Line manager skill is not essential but important. Important, since business is about adding tangible value. CTOs are at strategic level, you need to understand the impact on the detail to the bottom line which is the responsibility of the line manager. You need the industry process knowledge.
E	No. A CTO requires leadership qualities. There are three important factors to consider: a: They need to bridge the gap between Business and ICT (Information Communications and Technology). Take complex decisions and bring it to simplistic level. The key objective is that they are looking for capital growth. I need to convince stakeholders why we need to look at this solution. b. Be humble. There are constant technical changes. Keep on learning. Keep on questioning. c. Culture of growing people. Sharing with who you can share with
F	Most important, how you sell an idea... collaborative skills. Not so much managing a group of influences. More leadership skills are required.
G	They need to manage profit and loss. Taking pragmatic decisions, I did this through the consulting role

Table 14 shows that CTOs from technology dependent Companies (A, B and C) focused on key management competencies as being essential for a CTO. The CTOs in technology providing companies (Companies D, E, F and G) stated that leadership competencies are essential and management skills are not necessary for a CTO.

5.6 Conclusion to Research Results

The purpose of this chapter is to present the research results from the research sample, based on the research questions in Chapter 3. It was not the objective of the researcher to split the sample interviewed into two distinct group; CTOs that reported to the CIO and CTOs that reported to the CEO or GM. However, as the analysis was being tabulated and presented in this chapter it was noted that there was a definite pattern emerging.

These findings and other pertinent qualitative comments collected from the research sample will be discussed in the next chapter in conjunction with the literature review presented in Chapter 2.

Chapter 6: Data Analysis

6.1 Introduction

The research sample was from the IT industry, as outlined in the research methodology. All CTOs, in the sample interviewed, were from companies that are listed on either the Johannesburg Securities Exchange or on the New York Stock Exchange.

Current CTO and CIO studies are grouped into high growth and low growth companies, IBM (2009) and eJobDescription.com (2010), which is derived from profit before tax. With the economic downturn since October 2008, this was not an option to pursue in categorising the results.

6.2 Key variables for CTO positioning

It is evident from Table 2, 6 and section 5.4 that the CTO role will be positioned differently based on two key variables;

- a. either the company is internally or externally focused. The researcher defines internally focused when the CTO is servicing clients internally, within the organisation. The researcher defines externally focused to be when the CTO is servicing clients external to the organisation,
- b. whether the CTO reports to the CIO or CEO. Berray and Sampath (2002) alluded to this in their CTO model, however, they did not include this in their model.

As the results are discussed this classification will become more evident.

6.3 Discussion of Research Questions

6.3.1 Research Question 1: How are CTOs positioned in organisations, especially with respect to roles?

Smith (2007) and Medcof (2008) state that there is very limited research on the important leadership role that the CTO serves in an organisation. This is consistent with the CTOs interviewed that state the CTO role is not clearly understood. The exception was for Company C, where the individual assumes the roles of both the CTO and CIO of the company.

The questions posed to the CTOs were, “What do you think about the maturity of the CTO role in South Africa. Do you think this is a new role and easily understood in South African business?” The CTO from Company C was the only individual that responded ‘Yes’ to this question. All other respondents agreed that the CTO role is not clearly understood. Company C’s response can be attributed to a particular bias, since the respondent performs both the CIO and CTO role.

Table 6 highlights the following themes from the CTOs responses,

CTOs that report to the CIO are;

- focused on daily IT operational duties,
- internally focused,
- responsible for managing operational costs,
- implementing strategy.

CTOs that report to the CEO or GM are;

- externally focused,
- responsible and takes ownership for ROI on projects created for achieving the strategy,
- focused on developing strategy for the organisation,
- promoting external information sharing, which includes universities and media,
- have a responsibility for thought leadership.

Minevich (2005, CTO and Evangelist, para. 2) states “the CTO is heavily involved in evangelising at a strategic level, a market position for the company”. The CTOs of Company F and G summarised their roles to be the “evangelist for technology” in their organisations. This feedback is consistent with the responses received from the CTOs that report to the CEO or GM.

6.3.1.1 CTO, internally or externally focused

A dominant theme emerges from the analysis of the CTO roles and responsibilities. It is observed that when the CTO reports to the CIO, then the CTO will be internally focused, however, if the CTO reports to the CEO or GM, then the CTO will be externally focused. This is consistent with the views of Smith (2003), Minevich (2005) and Pala (2008) who state that the CIO focuses on internal strategy.

When the CTO reports to the CIO, the CTO’s roles and responsibilities will be guided by the SCT power of influence of the CIO (Hickson, Lee, Schneck and

Pennings, 1971; Finkelstein,1992; Harpaz and Meshoulman,1997). This means that the CTOs power of influence will, almost always, be in-line with their superior to ensure alignment of business goals and, more importantly prevent distortion amongst senior level executives (Smith, 2003). The CTO of Company E stated, “I made my position be understood from the beginning - there is CIO distortion if you (CTO) report to the CIO”.

6.3.2 Research Question 2: What is the typical level of a CTO?

Medcof and Yousofpourfard (2006, p. 1) pointed out that “the leadership style of the CEO can also significantly enhance or detract from the ability of the CTO to influence firm strategy”.

In Table 7 and 8, the research sample highlights CTOs who reported to the CIO;

- the CEO was not technical,
- the CTO had no direct board activities,
- the CTO was responsible for implementing strategy.

CTOs who reported to the CEO or GM;

- the CEO or GM was more often technical,
- the CTO had direct board activities,
- the CTO was responsible for developing strategy.

In the research sample, when CEOs were not technical and the CTOs still reported to the CEO, it is noted that;

- The CTO of Company E stated, “I made my position be understood from the beginning with the executive team”.
- Company D, the global organisation structure and the board of directors is based at their international head quarters. The CTO provided indirect input onto their board. This is consistent with Roberts’ view (2001) who state that “depending on geography the CTO will have different levels of responsibility or positioning on the board”.

6.3.2.1 Technical trained CEOs do show bias when appointing the CTO

The findings from this research negates Roberts (2001) who noted that “technically trained CEOs show no special bias in regard to appointing CTOs either to the company board of directors or even to the firm’s senior management committee. Roberts (2001) additionally noted that, “CEOs in general might influence the relationship and thereby the role of the CTO”.

The findings presented in table 8 shows that as technology is becoming more strategic for companies, together with its associated complexity, technically trained CEOs do show a bias for the appointment of the CTO. This implies that the CTO, being a new role and not easily understood, has a responsibility to create the necessary framework and rules-of-engagement for their role. As in the case of the CTO from Company E, it is imperative that CTOs take the lead in branding themselves and ensuring that their position and role is clearly understood in the organisation, and especially amongst c-level suite of executives.

6.3.3 Research Question 3: How do CEOs influence the role of CTOs within organisations?

The CTO improves the competitive position of an organisation through leading innovation (Medcof, 2008). The CTO needs to have access to the executive level decision makers of the organisation for their input to be recognised. If the CTO is the key individual handling technology contingencies for the firm, the more strategically important technology is for the firm, the greater will be the power of the CTO (Medcof and Yousofpourfard, 2006).

6.3.3.1 CTOs that report to CIO

Medcof (2008) is of the belief that the CTO's can influence power and gain credibility if they are included in executive meetings. From the sample, table 8 indicates that when CTOs that report to the CIO, these CTOs;

- are not included in direct board activities, which imply that they are excluded from executive meetings.
- have no role in developing strategy, they only implement strategy.

In summary, CTOs here can only be recognised for promoting innovation if they are given the opportunity to influence executive decisions at the board level. There is a high probability that CTOs that report to the CIO will have limited influence at the board level for promoting innovation. In organisations where companies are more reliant on technology, CTOs should win a place at the board. The CTO of Company E took it upon himself to ensure that the CIO and CEO of the company understood his value-add to the company, and to be recognised in the board.

6.3.3.2 CTOs that report to CEO

When the CTO reports to the CEO or GM, the CTO;

- has direct board activities most of the time, which then affords the CTO greater opportunities of influence in executive decisions.
- is directly responsible for developing firm strategy, which will give the CTO more leverage to promote innovation in the organisation. This is consistent with the feedback noted on table 6 which highlights that these CTOs have a desire to promote innovation.
- will earn credibility because they are represented on the board, Medcof (2008). It is important to establish credibility from the start (Minevich, 2005).

6.3.4 Research Question 4: How should the role of a CTO be positioned in an organisation that does not consider technology to be a competitive factor?

The extent and frequency to which data is used as information determines the level of competitiveness of the organisation. This will give firms an opportunity to create innovation and ultimately value for the firm (Oppenheim, Stenson and Wilson, 2001; IBM, 2009).

CTOs from Companies A, B, C are taking immediate direction from the CIO.

The responses to the two questions;

1. What does technology mean to you and your company?
2. What are some of the ways in which you assist your company to improve its competitiveness?

The responses from these CTOs were internally focused, “flexible to give business processing power when it needs it”. They were also directly responsible for the data centre management. This meant that the focus for these CTOs is on day-to-day IT operations when compared to CTOs from Companies D, E, F and G, as indicated in table 6 and 11.

CTOs from Company D, E, F and G;

- were externally focused , which is consistent with the CTO roles identified on table 6,
- had no direct data centre responsibility, refer to table 12,
- were seen as advisors to the data centre management teams, refer to table 12,
- used information for strategy planning, “How can we use this information for strategic advantage”, “Understand what clients are doing with the information”.

In summary, CTOs who extracted greater value of information from data were seen to be more strategic in their position within the organisation. However, their influence will be contained within SCT power of influence (Hickson, Lee, Schneck and Pennings, 1971; Finkelstein, 1992; Harpaz and Meshoulman, 1997).

6.3.5 Research Question 5: What are the prospects for CTOs to be appointed without having a previous line manager role?

Smith (2003) points out that to become a CTO, it is not a pre-requisite to have a prior line manager's position. Medcof and Youofpourfard (2006), Roberto (2003) and Gwynne (1996) differ with this viewpoint. From the research results (table 13 and 14), CTOs who reported to the CEO or GM stated that;

- line manager skills was not a must-have, however, it was seen as an advantage, as noted in tables 13 and 14. The CTO of Company E stated that he got his management skills by performing various senior consultancy roles.
- leadership skills and good decision making skills were seen to be more important.

CTOs who reported to the CIO, stated that line manager skills were a must-have in order to progress to the CTO role.

6.4 Technical talk to simple language

The world of technology, because of evolving legacy systems, is becoming more complex (Hopkins and Jenkins, 2008). The CTO's responsibility is to take complex technology 'talk' and convert this to simple language for the benefit of the organisation at large and more importantly for the c-level suite executives to understand. This was clearly indicated by the CTO from Company E. Minevich (2005, chap. 6, para. 4) underscores the point of my finding that "the CTO adds critical expertise because the CTO is capable of accurately translating some product and technology details into terms that can be used in marketing and business development".

6.5 What does technology mean?

It was interesting to note that technology meant different things to different CTOs and organisations. Some CTOs expressed a deep passion to correct the researcher in the questioning of the usage of the word 'technology' being; IT, ICT or Technology, Media and Telecommunications (TMT). The CTOs comments presented on table 5 shows a key theme that the group of CTOs that reported to the CIO referred more often to 'IT' as their focus. Interestingly the CTO of Company C asked the researcher, "what is the definition of technology". However, the group of CTOs that reported to the CEO referred to technology as their focus. It is evident that the CTOs that equated technology to IT were mainly the internally focused CTOs and they reported to the CIOs. There is a distinct correlation noted here.

6.6 Establishing an understanding of the role

Smith (2007, p. 19) goes on to say that "the position is vague and one would expect that many people in the position to be 'winging-it' and the superiors to be evaluating them on trial and error". This will continue to be the situation as long as CTOs do not take the responsibility to gain a clear understanding and to establish the rules-of-engagement with their reporting line. It has been established that the CTO role is relatively new. It is now up to the CTO, who has been entrusted with this new role, to create a framework for the organisation to fully understand this role within their specific industry and organisational maturity and or operations. The CTO of Company E made it clear what his deliverables would be.

Having a clear understanding of the deliverables, roles and responsibilities affords individuals to be evaluated fairly;

- it will avoid distortion of duties and responsibilities which will enable a more effective and constructive working relationship,
- the CIO will not be seen to be derailing the CTOs deliverables and objectives, but rather collaborating effectively.

6.7 Roadmap to becoming a CTO

Interestingly there was a request from a CTO, from the sample, who requested from the researcher for a roadmap to become a CTO. This is indeed very important to develop. However, the different industries will have different roadmaps and no two roadmaps will be the same. Skills sets such as leadership and evangelist are some of the common attributes among CTOs.

6.8 CTO TIE model

The researcher revised the previous CTO models to create the 'CTO TIE model'. The researcher adapted key constructs from current models and frameworks which were created by Uttal et al. (1992), Berray and Sampath (2002) (appendix 2), Smith (2007) and IBM (2009) (appendix 3) to develop an updated model for positioning the role of a CTO.

Pala (2006) proposed a model of how CTO's effectiveness on the overall company performance can be assessed. Pala argues that, in particular, three factors are of vital influence; (1) the technological intensity of the company, (2) the importance of technology for the company, and (3) the chairman's

perception of the environment. This however, varies by company size and industry growth rate (as control variables). These factors were used in the development of the CTO TIE model.

Technology is changing rapidly, hence the CTO positioning will also change with the current demands within the technology industry. The CTO position has matured further, since the model developed by Berray and Sampath (2002). To position the role of the CTO, it is important to take note of the industry the organisation operates in.

The positioning of the CTO role will be based on two key variables as stated;

- a. is the company internally or externally technology focused, with regards to the clients they service?
- b. whether the CTO reports to the CIO or CEO?

Based on these variables the name of 'CTO TIE model' was developed.

The 'TIE' acronym is represented in two ways as follows;

firstly, technology-focus being internal or external;

T = **T**echnology

I = **I**nternal

E = **E**xternal

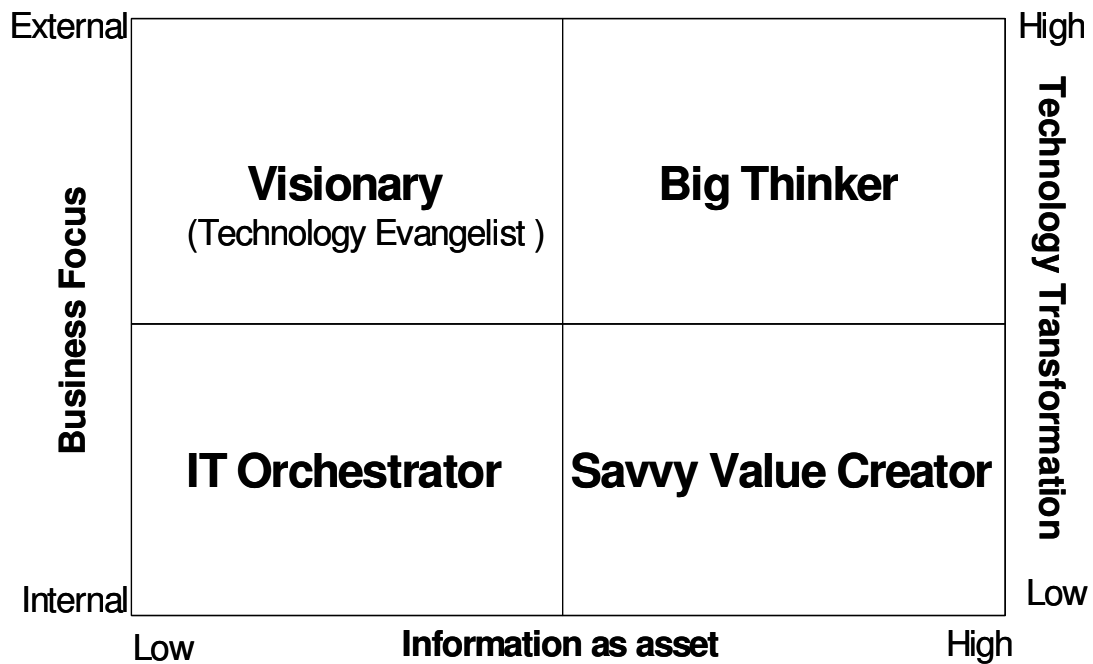
secondly, the CTO reports to the CIO or CEO;

T = chief **T**echnology officer, so it is the 'T' in **CTO**

I = chief **I**nformation officer, so it is the 'I' in **CIO**

E = chief **E**xecutive officer, so it is the 'E' in **CEO**

Figure 1: CTO TIE model



The 'CTO TIE model', figure 1, can be used by;

- the c-level suite of executives when assigning the CTO role into their organisation,
- the prospective CTO, to position themselves within the organisation,
- individuals to avoid pre-conceived notions relating to the CTO role and this can be contained and managed immediately. This will help prevent what Smith (2007) states, CTOs are expected to be 'winging-it' and 'evaluated on trail-and-error',
- aspiring CTOs to create a roadmap to understand and acknowledge their skills gaps to work towards attaining a CTO position.

This will afford all stakeholders to have a common building block (or a foundation) to work from and hence will enable the CTO to be evaluated more fairly.

6.8.1 De-constructing the variables on the axis

The variables; business focus and technology transformation are on the same axis. These are however, used independently.

6.8.1.1 Information as an Asset

Information goes through a cycle, from low to high and then from high back to low. When information as an asset is regarded as low, information is seen as data and it is about quantity. Information as an asset is high when it adds critical value to the business. At this point, data becomes information that is usable. It is qualitative information used for strategic decision making. When information as an asset is high, it eventually returns to low since the value from it has been extracted and already used exhaustively. At this stage, it is used in thought leadership, for example, to understand and confirm trends and patterns in the industry.

6.8.1.2 Technology Transformation

Technology transformation varies from low to high. The attribute was taken from Pala (2006) where he looks at; (1) the technological intensity of the company, (2) the importance of technology for the company, and (3) the chairman's perception of the environment. The positioning here is dependant on the level and frequency at which technology is changing in the organisation.

6.8.1.3 Business Focus

Varies from internal focus to external focus. Internal is when the CTO services clients, internally, within the organisation. Externally focused is when the CTO

and the organisation generally provides and delivers technology for clients external to the organisation. In the external stage, the CTO assists with mergers and acquisitions and focuses outside the core business deliverables.

6.8.2 De-constructing the quadrants of the CTO TIE model

6.8.2.1 IT Orchestrator

The attributes referred to by Berray and Sampath (2002), in their model, within the IS Manager quadrant are relevant here. The natural career progression of the CTO in this quadrant is from an IS Manager. This is within stable industries. Mergers and acquisitions don't consume the current business deliverable. There is either very limited or no due diligence involvement required. They should be able to pre-empt potential disruption to IT services. Information is regarded as data. Responsibility for data is about security and reliability of data. Data is also quantitative. They are responsible for the infrastructure and operations of IT to ensure the IT environment is operating efficiently. The focus is on cost reduction and leveraging of IT infrastructure across divisions. CTOs are told what projects to focus on, which is the implementation of strategy. In this quadrant the CTO role is potentially under-valued and it is not strategically positioned to earn an executive position.

6.8.2.2 Savvy Value Creator

CTOs in this quadrant create superior value for clients by proactively crafting data into actionable information. Data is now qualitative information, and will be used for decision making. IBM (IBM, 2009, p. 23) states that "change from

push to pull model, this is where the customer expresses requirements and IT answers it immediately”. The CTO works closely with the customer to add value to the business to generate greater returns. They will be responsible for cost-cutting, doing more with less. CTOs are responsible for “centralised infrastructure and process enable shared services optimisation that, in turn, provides economies of scale” IBM (2009, p. 25). CTOs add concrete input and value to mergers and acquisitions.

6.8.2.3 Big Thinker, Collaborative Business Leader

CTOs in this quadrant have a fundamental or critical responsibility in mergers and acquisitions. They are involved with the experimenting or testing and the timely launching of new products. CTOs promote collaboration by facilitating communication between divisions and establishing synergies between them. In this quadrant information is crucial, CTOs use information for value decision making. Information is seen as a strategic advantage. CTOs differentiate between IT and technology, but their focus is on technology. IT is seen as a component of technology. CTOs have a constant drive for new technology, which is used to drive fundamental changes in how business gets done. CTOs are seen to guide the development of effective business strategy.

6.8.2.4 Visionary / Technology Evangelist

In this quadrant, the CTOs focus is more on business strategy and how technology can assist to reach visions and goals of the organisation. They experiment with disruptive technologies. Innovation and leading edge technology is embraced by the CTO and they see it as injecting future growth

into the organisation. CTOs focus on technology at the embryonic level. Information has gone through a full-cycle, and CTO use this for thought leadership. CTOs monitor clients on how they are using Information, however, it is not qualitatively used. CTOs play a fundamental role in developing strategy.

6.8.3 Summary of CTO TIE model

It is noted that when the CTO reports to the CIO, the CTO will be mapped to the bottom half of the model. There will be little overlap onto the top half. When the CTO reports to the CEO, they will be mapped to the top half of the model, again with a little overlap to the bottom half of the model.

6.9 Listing of CTO Job Descriptions in 2010

Minevich (2005) and Smith (2007) state that the CTO position is often confused, interchangeable and integrated into a modified CIO position. It is worthy to note that current CTO positions, advertised by leading recruitment agencies, advertise the CTO position as, 'CTO CIO recruitment for', (PNET, 2010). This is one of many recent vacancies posted on the internet, (appendix 4) which implies that the CTO position is regarded as being the same as CIO.

The purpose of this research was to ensure that the critical position of the CTO in an organisation is understood. The research aims to eliminate concerns raised by prospective CTOs. Branding of the CTO role starts at the employment or engagement process. It is often that the recruitment agencies

are provided with a mandate from the hiring company, and hence it needs to be traced back to the source of the document owner who actually created the template or job description for the CTO.

Chapter 7: Conclusion

7.1 Findings

The intent of the research was to correctly position the role of the CTO into the organisation and to harness this position for the company to gain strategic advantage. The findings from the research, both the literature review and the interviews conducted, did conclude that there is definitely changing dynamics in the position of the CTO role from the earlier studies. This positioning needs to be continuously evaluated based on the level of dependence and maturity of technology within the organisation.

The findings of academics (Smith, 2007), as is evident in the literature review, underscores the point of my finding that the position of the CTO in an organisation is not fully understood. It is imperative that the CTOs and other c-level executives understand the role of the CTO and aligns the role within the organisation to maximise their strategic and competitive advantage.

It is worthy to note that the research conducted by Synman (2007, p. 92) confirms that “the competitive advantages of an organisation must be very clear to executive leaders before they can create a conceptual strategic position to share with their organisations”. This said, it is then of utmost importance for the CTO to brand and position themselves correctly amongst the senior executive team of the organisation. This will also alleviate CIO and CTO distortion (Smith, 2003).

7.2 CTO TIE model

The updated CTO model, the CTO TIE model, developed by the researcher was done in conjunction with the findings by Uttal et al. (1992), Berray and Sampath (2002), Smith (2007), IBM (2009) and confirmed against the research interviewee responses.

The CTO TIE model will assist current CTOs, future CTOs and c-level suite executives to effectively position the CTO within the organisation. This research arrived at the resounding conclusion that the positioning of the CTO is influenced by two key variables;

1. Does the CTO report to the CIO or CEO?
2. Is technology internally or externally focused?

7.3 CTO implies Leadership in Technology

Two key attributes, leadership and technology are being merged into the CTO role. The CTO is responsible to provide leadership in technology, and not just be a keeper or manager of technology. These are indeed vast disciplines, both of which are relatively new to most organisations.

Organisations are still trying to understand management, when they have to now move to leadership and now the new buzz word of 'thought leadership'. On the other-hand, companies are just trying to understand their IT functioning, by having IT to 'keep their lights-on' and now they need to define or position what technology means to them. In the words of Berray and Sampath (2002, p. 2) "the Holy Grail of all competitive strategy will concern

the elusive nexus of ‘technology’ and ‘leadership.’ These parallel issues converge in a unique way in the CTO role.”

7.3.1 Leader in technical communities

There is one common thread among all CTOs; they belong to internal and external committees and technology boards. This alone shows that the CTO has a strong extended reach into internal and external business networks. The CTO of Company E stated the he belongs to 17 global research boards.

The CTOs should therefore take advantage of this platform to promote their brand. It is not up to business to make this decision. The CTO of Company E stated “I realised the distortion between the CIO and myself (CTO) and I took it upon myself to make my role noted”.

By engaging and contributing constructively on these boards and committees, the CTOs brand themselves and can secure a place around the executive table. This will then enable the CTO to be strategically positioned within the organisation, to provide the required leadership in technology.

Together with the CTO role goes risk management. By being closely involved in project implementations, it is important for the CTO to provide direction to the relevant committees and boards to mitigate risk. This would build on the CTO’s credibility by them providing input and feedback to the technical councils they serve on.

7.4 Technology s-curve.

Technology affords companies the competitive advantage to move onto the new s-curve (Bowden, 2004). The CTO is appropriately positioned to carry the company to this key stage. The objective should always be for the CTO to take the organisation to the new s-curve with technology being the enabler to achieve this goal. This is where the CTOs can distinguish themselves by being strategic, collaborative team players. By promoting, functioning, operating and collaborating with business and formulating the firm strategy, the CTO can innovate using technology to afford business an opportunity to achieve its vision of moving the organisation to the new s-curve.

7.5 Future Research Ideas

1. There is a need for empirical studies to understand the relationship between the CEO being technical and his influence thereof on the CTO. This is to understand at which point the CTO can win a seat at the executive board, and if this is championed by the CEO.
2. An in-depth understanding of the advanced skills sets gained by senior leaders like that of; client executive, account executive, project executive, service delivery manager, technical solutions manager and project manager are strategic roles that leads to a skills matrix for a CTO role. This implies that line manager skills, that of individual performance improvement plans, and similar are not required to become a CTO.

3. It will be most appropriate to take the CTO TIE model developed in this research study and see how it best applies to the industry at large and note the shortcomings, if any.

7.6 Summary

The strategic positioning of the CTO in an organisation is key to obtaining a competitive advantage in the market place for technology dependant companies, therefore it is important for the the c-level executives to take cognisance of this role to ensure competitiveness in their respective industries.

This research arrived at the sharp conclusion that the role of the CTO is not fully understood in the South African business climate. This is consistent with Smith's (2007) point of view that people in the position will be 'winging-it' and evaluated on 'trial and error. As the technology maturity of an organisation evolves so to would the CTO position, hence the CTO role needs to be constantly evaluated to ensure it is strategically positioned in the organisation.

At times there is no need for a CTO, therefore the position should not be awarded or created unnecessarily, since this role belongs to the executive leadership team of the organisation (Smith, 2007). The South African banking sector is rated as one of the strongest in the world, currently 13th (Business Monitor International, 2010). The fact that only two of the big four banks in South Africa, who are highly dependant on technology, have a CTO speaks for itself. However, it is equally important to note that global companies like IBM have many CTOs, with a CTO assigned to individual geographies.

The 'CTO TIE model' developed from this research will empower CTOs and the c-level executives to ensure that business understands the importance of the CTO role to harness their value by correctly positioning the role. The c-level executives need to recognise the value of the CTO role and give them the platform to soar like an eagle by allowing the CTO to spread their wings to positively enhance the organisation. This would allow the CTO to appropriately shift the organisation to the new s-curve.

APPENDICES

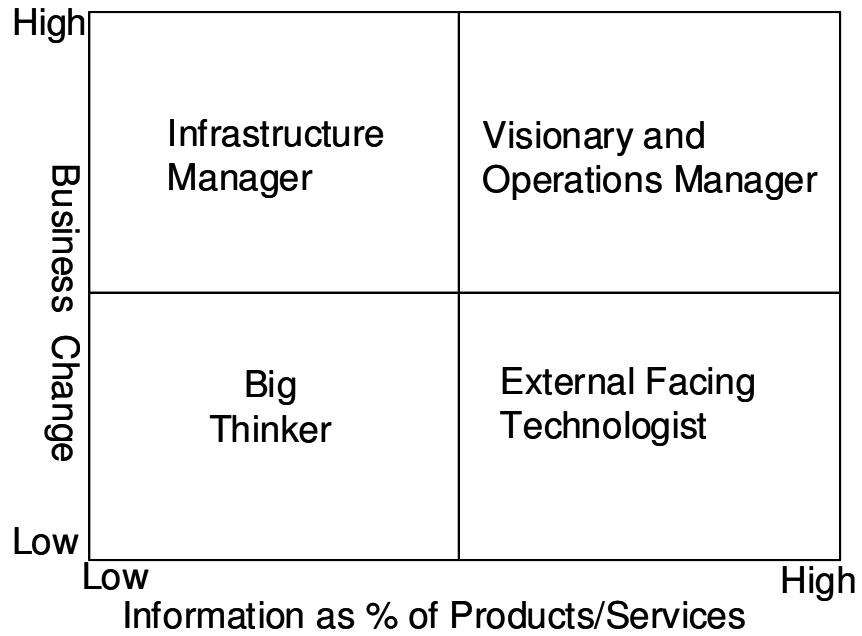
Appendix 1: Consistency Matrix

Title: Consistency Matrix for Positioning the Role of a CTO.

Research Questions	Literature Review	Data Collection Tool	Analysis
1. How are CTOs positioned in organisations, especially with respect to roles?	Berray and Sampath(2002) Finkelstein(1992) Harpaz and Meshoulman(1997) Hickson, Lee, Schneck and Pennings (1971) IBM (2009) Medcof (2008) Smith (2003; 2007) Uttal, Kantrow, Linden and Stock (1992)	Question from interview questionnaire	Narrative Analysis Comparative Analysis
2. What is the typical level of a CTO?	Medcof and Yousofpourfard (2006) Medcof (2008)	Question from interview questionnaire	Frequency analysis Content analysis
3. How do CEOs influence the role of CTOs within organisations?	Medcof & Yousofpourfard (2006) Medcof (2008) Roberts (2001) Smith (2003)	Question from interview questionnaire	Narrative Analysis
4. How should the role of a CTO be positioned in an organisation that does not consider technology to be a competitive factor?	IBM (2009) Medcof (2008) Oppenheim, Stenson and Wilson (2001) Uttal et al (1992)	Question from interview questionnaire	Content Analysis Frequency Analysis
5. What are the prospects for CTOs to be appointed without having a previous line manager role?	Gwynne (1996) Medcof and Yousofpourfard (2006) Roberto (2003) Smith (2003)	Question from interview questionnaire	Content Analysis Frequency Analysis

Appendix 2: CTO Role for Organisational Needs

Title: CTO Role for Organisational Needs

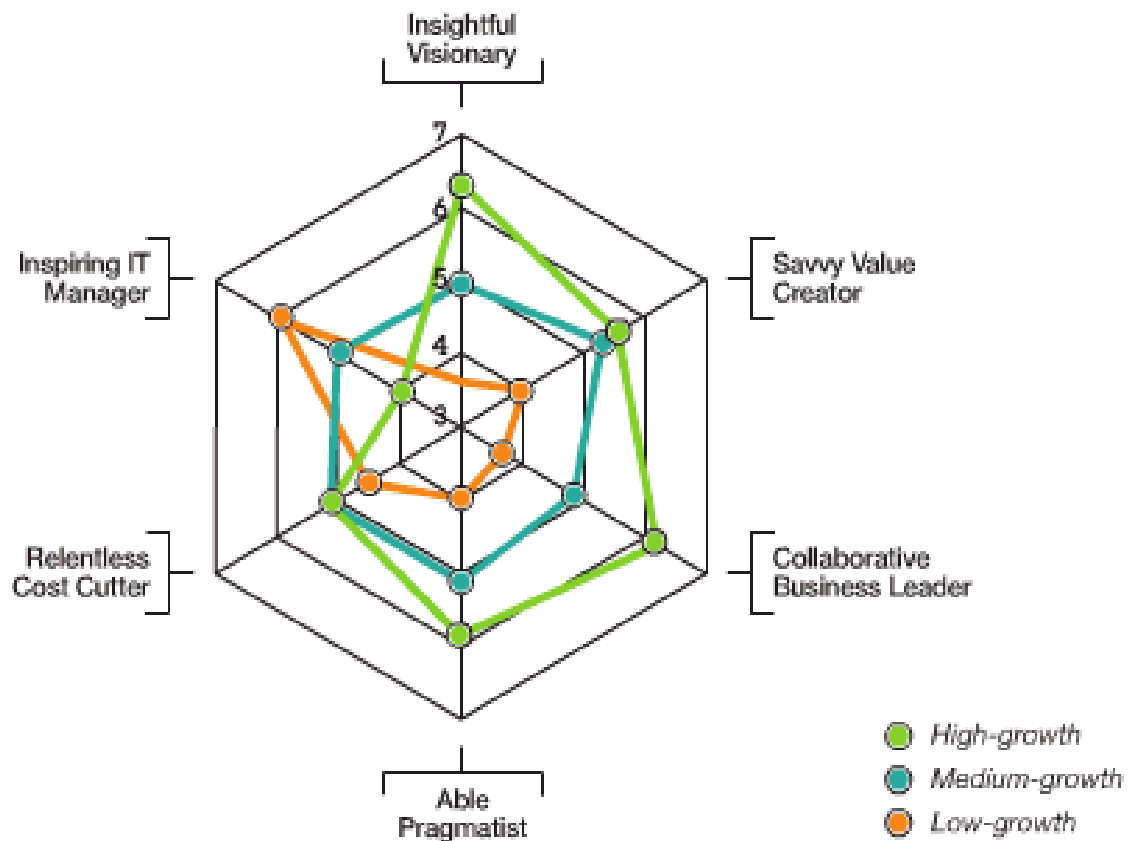


Source: CTO Role for Organisational Needs by Berray and Sampath, 2002.

Appendix 3: The New Voice of the CIO

Title: IBM CIO Study

Profile shows striking differences among the three CIO groups.



Source: The New Voice of the CIO by IBM, 2009.

Appendix 4: CTO CIO Job Advert

Job Title

CTO CIO RECRUITMENT FOR TELCO SECTOR GAUTENG

Reference

LEC1985

Advert Details

Recruiter: Leading Edge Consulting

Updated on: 2010-09-30 11:06:42

AA/EE: Not Applicable

Contract Permanent

Location: Midrand

Available: ASAP

Category: Telecommunications

Offer: R1.1M

Introduction

CIO Systems Manager with BSS GSM Mediation Telco Billing Telco Banking Phone Banking experience for Gauteng Telco Operator

Minimum Requirements

Graduate

Telecommunications Background

BSS

OSS

GSM

Job Specification

CTO CIO RECRUITMENT FOR TELCO SECTOR GAUTENG

Location - Midrand - Industry - Telco - Perm - Salary - R1.1M

Called in Thursday 30th September 2010. A Cell Phone Operator running the usual mix of Telco Systems ... BSS, OSS, GSM, Billing and Client Analytics are looking for an IT Manager to run the day to day operations of their Systems Department and drive new projects.

For a CIO of a Telco, R1.1M is loose change ... Hence my educated guess is that should you be a Programme Manager else a Divisional Manager with a Telco Operations Mobile Banking background looking for that next rung for your career plan. This opportunity could be the tactical opportunity that you have been waiting for.

Appendix 5: Interview Consent Form

I am an MBA student (researcher) at the Gordon Institute of Business Science (University of Pretoria). I am conducting research on Positioning the role of a Chief Technology Officer in an organisation.

This interview is expected to take about 60 (sixty) minutes. On completion it will assist both the Chief Technology Officer and organisation to effectively position the role. This is purely an independent research for academic purposes.

Please remember that your participation is voluntary and you have the right to decline your participation and/or withdraw at any time without any penalty. All comments noted and data gathered from this interview will be kept confidential to ensure your privacy. No information will be forwarded for any other marketing purposes.

Please contact me or my supervisor if you have any concerns. Our details are listed below:

University: Gordon Institute of Business Science
Telephone: 011 771 4000

Researcher's name: Mr. Vejay (Vejaykumaran) Reddy
Email: vejayr@za.ibm.com
Phone: 082 570 4690 or 011 302 5220

Supervisor Name: Mr. Roy Page-Shipp

Email roy@pageshipp.co.za

Phone 082 447 6289 or 011 771 4000

Signature of Participant: _____ Date: _____

Signature of Researcher: _____ Date: _____

Appendix 6: Interview Questionnaire

The following questions will simply require your contribution based on your experience of the topic. There is no right or wrong answers to these questions. The findings of this research will be made available to you if you indicate so on completion. Let us begin.

1. What was your roles before this? How long have you been in IT, if any?
What made you choose the CTO role?

2. Describe the organisational structure from the CTO to CEO?
Does you CEO have a technology background?
Where is the IT operations manager located in the organisational structure?

3. To what extent is your organisation dependant on technology?

4. Who in your organisation at the c-level suite is responsible for formulating and then driving the need for new Technology in your organisation?

5. Who in your organisation at the c-level suite is responsible for formulating and then driving the need for strategy in your organisation?

6. What are your core functions and roles as the CTO in your organisation? Do you also serve on the various executive committees?

7. As the CTO what are your day-to-day task role deliverables in your organisation?

8. Relating to information as an asset, what role do you play in managing your data centre?

9. What are some of the ways you assist your company to improve its competitiveness?

10. Do you think it is important to have line manager skills before you take on the task of a CTO role. What are the key skills/knowledge that is carried forward from the line manager position to the CTO position?

11. What do you think about the maturity of the CTO role in South Africa? Do you think this is a new role and not easily understood in South African business?

12. How do you keep yourself updated with the latest technology information?

I thank you kindly for the time you took out of your schedule and for the contribution you have made in assisting me to complete this very important part of the research project. Your information is vital in making decisive conclusions about the topic under study.

Please indicate if you would like to receive the findings of this project:

Yes

No

REFERENCES

All Things Distributed (2007). The Different CTO Roles. Retrieved from http://www.allthingsdistributed.com/2007/07/the_different_cto_roles.html

Berray, T. & Sampath, R. (2002). *The Role of the CTO: Four Models for Success*. Cabot Consultants, Inc.

Bowden, M.J. (2004). Moore's Law and the Technology S-Curve. *Stevens Alliance for Technology Management*, 8(1).

Boisot, M.H. (1998). *Knowledge Assets: Securing Competitive Advantage in information Economy*. USA: Oxford University Press.

Burk, C. and Horton, F. (1998). *Infomap: A Complete Guide to Discovering Information Resources*. USA: Prentice Hall, Englewood Cliffs, New Jersey.

Business Monitor International (2010). *South Africa Commercial Banking Report Q2 2010*. Business Monitor International.

Edge (2010). *The Chef*. Retrieved from http://www.edge.org/digerati/myhrvold/myhrvold_p1.html

eJobDescription.com (2010). *Chief Information Officer*. Retrieved from http://www.ejobdescription.com/CIO_Job_Description.html

Finkelstein, S. (1992). Power in Top Management Teams: Dimensions, Measurement, and Validation. *Academy of Management Journal*, 35(3), 505-538.

Garelli, S. (2003). Competitiveness of Nations: The Fundamentals. *IMD World Competitiveness Yearbook. Competitiveness Project*, 702-713.

Gibson, R (1998). *Rethinking the Future*. London: Nicholas Brealey Publishing.

Gwynne, P. (1996). The CTO as a Line Manager. *Research Technology Management*, 39(2).

Harpaz, I. and Meshoulman, I. (1997). Intraorganisational Power in High Technology Organizations. *The Journal of High Technology Management Research*, 8(1), 107-128.

Hickson, D.J., Lee, C.A., Schneck, R.E., and Pennings, J.M., 1971. A Strategic contingencies theory of Intraorganizational power. *Administrative Science Quarterly*, 16, 216-229.

Hopkins, R. and Jenkins, K. (2008). *Eating the IT Elephant: Moving from Greenfield Development to Brownfield*. IBM Press.

IAD (2010). *What is an Information Asset?* Information Asset Development, INC. Retrieved from <http://informationassetdevelopment.com/what.html?page=1>

IBM (2009). *The New Voice of the CIO*. IBM Global Business Services.

IDRC (1993). *Towards a Science and Technology Policy for a Democratic South Africa*. IDRC Canada.

Lingela, V and Buys, A. (2007). An Innovation management framework to improve competitiveness in developing countries. In: 16th International conference on Management of Technology. Miami, Florida, USA. *International Association for Management of Technology 2007 Proceedings, May 13-17, 2007*.

Medcof, J.W. (2001). Resource-based strategy and managerial power in networks of internationally dispersed technology units. *Strategic Management Journal*, 22, 999-1012.

Medcof, J.W. (2008). The organisational Influence. *R & D Management*, 406-420.

Medcof, J.W. and Atkinson, K. (2009). Introduction into Technology Leadership. *DeGroot School of Business, McMaster University*.

Medcof, J. W. & Yousofpourfard, H. (2006). The Chief Technology Officer and Organizational Power and Influence. *The Michael G. DeGroot School of Business, McMaster University*.

Minevich, M. (2005). *The CTO Handbook: Chief Technology Officer/Chief Information Officer Manual*. New York: Thomson West.

O'Neill, P.H., & Bridenbaugh, P.R. (November-December, 1992). Credibility between CEO and CTO – A CEO's perspective; Credibility between CEO and CTO – A CTO perspective. *Research Technology Management*, 35(6), 25-34.

Oppenheim, C. , Stenson, F. and Wilson, R. M. S. (2001). The attributes of information as an asset. *New Library World. MCB University Press*. 102 (1170/1171), 458-463.

Pala, O. (2006). Do CTOs affect performance? A Proposed Model for Assessing the CTO Performance Relationship. *Working Paper (Sabanci University, Turkey)*.

Pala, O. (2008). Do CTOs affect Performance A Proposed Model for Assessing the CTO Performance Relationship. *Sabanci University, Turkey*.

PNET (2010). *CTO CIO Recruitment for Telco sector Gauteng*. The PNET The Job Portal. Retrieved from http://www.pnet.co.za/index.php?s=advert_view&q=4803&x=1848433&i=112&pop=1

Porter, M.E. (1990). *The Competitive Advantage of Nations*. Free Press, New York.

Porter, M.E. (1980). *Competitive Strategy: Techniques for Analysing Industries and Competitors*. New York: Free Press, New York, NY.

Roberto, M. (2003). The stable core and dynamic periphery in top management teams. *Management Decision*, 41(2), 120-131.

Roberts, F. (2001). Benchmarking Global Strategic Management of Technology. *Research Technology Management*, 25-36.

Romer, P.M. (1990). Endogenous Technological Change. *Journal of Technological Economy*. 98(S71-S10).

Smith, R. (2003) The Chief Technology Officer: Strategic Responsibilities and Relationship. *Research Technology Management*. July-August 2003, 1 -14.

Smith, R. (2007). What CTO's Do? *Industrial Research Institute*, 18-22.

Sterling, R.R. (1970). *Theory of Measurement of Enterprise Income*. University Press of Kansas, Lawrence, Manhattan, KS.

Synman, L. (2007). South African Executive Leadership an Art form: skills requirements. Gordon Institute of Business Science.

Teece, D. , Pisano, G. and Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18, 509-553.

Tidd, J. , Bessant, J. and Pavitt, K. (1997). *Managing Innovation*. New York, NY: John Wiley & Sons.

UNDP (2001). *Human Development Report 2001: Making new technologies work for human development*. Human Development Reports.

Uttal, B. , Kantrow, A. , Linden, L.H. and Stock, S. (1992). Building R&D leadership and credibility. *Research Technology Management*, 35 (3), 15-24.

Zikmund, W.G. (2003). *Business Research Methods*. 7th ed. United States of America: South Western.