Towards an Understanding of Board IT Governance: Antecedents and Consequences

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Board involvement in Information Technology (IT) governance and the antecedents and consequences of such involvement are examined from both a theoretical and practical perspective.

Practitioner and academic IT governance literature highlight the need for increased board involvement in IT governance; however, it seems that many corporate boards do not practice a formalized style of IT governance, while those that do, face significant challenges. A gap clearly is seen as in spite of the potential benefits of board IT governance and the costs of ineffective oversight, there has been little field-based research in this area, nor adequate application of theory. This research addresses this gap by developing and testing an exploratory multi-theoretic framework of board IT governance.

Drawing upon strategic choice and institutional theories, and Ashby's Law of Requisite Variety, a model of the antecedents (organization factors and board attributes) of board IT governance and its consequences (financial performance and operational performance) is both developed and tested. Unlike previous studies, board IT governance is designated as a central construct in this model rather than a secondary factor.

Constructs of board IT governance and IT competency are explored and multi-item measures for both constructs are developed. Board IT governance is conceptualized as the extent of offensive and defensive board oversight activities, while IT competency is conceptualized as the extent of IT expertise (IT knowledge, experience and training) and IT governance mechanisms (structures, processes and relational mechanisms). Detailed interviews with board members enabled a preliminary examination of the theoretical framework. To further test the propositions in the theoretical framework and to validate the measures for the board IT governance and IT competency constructs, an online survey was administered to corporate directors across Canada.

Exploratory Factor Analysis and Ordinary Least Squares multiple regression were used to analyze responses from 188 directors. The board IT governance and IT competency constructs were well supported by the data. In addition, the results show that the organizational factors explain 28% of the variance in board IT governance, and that board attributes explain 39% more of the variance, for a total explained variance in board IT governance of approximately 68%. The results also show that board IT governance has a positive impact on operational performance, explaining 19% of the variance in operational performance. However, the proposed impact of board IT governance on

financial performance, and the impacts of 'fit' between role of IT and board IT governance approach on financial and operational performance were not supported by the survey results.

Overall, this research makes a theoretical contribution by: focusing on the board's role in IT governance; developing a multi-theoretical model of the antecedents and consequences of board IT governance; developing measures of board IT governance and board IT competency, and; empirically assessing the antecedents and consequences of board IT governance.

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> Then said a teacher, "Speak to us of Teaching." And he said:
>
> No man can reveal to you aught but that which already lies half asleep in the dawning of our knowledge.
>
> The teacher who walks in the shadow of the temple, among his followers, gives not of his wisdom but rather of his faith and his lovingness.
>
> If he is indeed wise he does not bid you enter the house of wisdom, but rather leads you to the threshold of your own mind.
>
> The astronomer may speak to you of his understanding of space, but he cannot give you his understanding.
>
> The musician may sing to you of the rhythm which is in all space, but he cannot give you the ear which arrests the rhythm nor the voice that echoes it.
>
> And he who is versed in the science of numbers can tell of the regions of weight and measure, but he cannot conduct you thither.
>
> For the vision of one man lends not its wings to another man.

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Chapter 1
Introduction

There has been increased attention to Information Technology (IT) governance by boards of directors in the practitioner and academic literature. Board IT governance is the provision of oversight of: business/IT strategic alignment; IT value delivery; IT resource management; IT risk management, and; IT performance management (ITGI, 2003). As with corporate governance, boards have a fiduciary duty and a duty of care in IT governance, they are responsible for acting honestly and in good faith and for spending time to make informed business judgments. However, it seems that many corporate boards do not explicitly practice a formalized style of IT governance while those that do, encounter significant challenges. Furthermore, in spite of the increased attention to potential benefits of board IT governance in the literature and the potential costs of ineffective oversight, there has been little field-based research in this area and little application of theory to examine board IT governance.

This research attempts to partially fill the gap in the literature by developing and testing a multi-theoretic framework of board IT governance. Drawing upon strategic choice and institutional theories from organizational research and Ashby's Law of Requisite Variety from the field of cybernetics, this research develops and tests a model of the antecedents of board IT governance and its consequences.

This research is informed by findings from IT governance and corporate governance literature. The intention is to supplement the limited amount of research on board IT governance with the extensive research on corporate governance in order to create a theoretical framework of board IT governance. This is done by building on the findings from the corporate governance literature while taking into consideration characteristics of IT that distinguish it from boards' other governance responsibilities.

Overall, this research identifies actual behaviors and actions that boards engage in to perform their key IT governance roles and functions, and tests the relationships between board attributes (proportion of insiders to outsiders, board size, IT competency), organizational factors (organization size, organization age, role of IT in the organization) and board IT governance. It also tests the relationship between board IT governance and firm performance (financial performance and operational performance), and tests whether the role of IT in the organization moderates this relationship.

The objectives of this research are to investigate the following four questions:

1. How do boards govern IT?

2. What are the expertise areas, and governance mechanisms that represent board IT competencies?

3. Are there systematic relationships between board attributes (proportion of insiders, size and IT competency), organizational factors (size, age and role of IT) and board IT governance?

4. Is there a relationship between IT governance and firm performance? Is the relationship between board IT governance and firm performance moderated by the role of IT in the organization, such that the relationship is significant when there is a fit between the type of board IT governance practiced and the role of IT in the organization, and not significant when there is not a fit?

The theoretical framework discussed in this dissertation is exploratory in nature. It builds on findings reported in the literature to enable a richer understanding of the antecedents and consequences of board IT governance. The Critical Decision Method (CDM) and a semi-structured questionnaire were used to conduct interviews with corporate directors. These interviews allowed the conceptualization and measurement of two new constructs – board IT governance and board IT competency – that were developed further and then used in the subsequent survey. The interviews also enabled a preliminary examination of the theoretical framework. Next, an online survey was conducted to uncover relationships and effects across a larger number of boards.

In summary, the research agenda was to advance and test relationships predicated by: (i) strategic choice theory; (ii) institutional theory, and; (iii) Ashby's Law of Requisite Variety, in order to better explain why and how boards become involved in IT governance and the consequences of this involvement. This research extends prior work in four ways:

1. focuses on the board of directors' role in IT governance;

2. examines antecedents and consequences of board IT governance not previously studied in the literature by relying on guidance from corporate and IT governance literature, and with a multi-theoretic viewpoint;.

3. develops measures of board IT governance and board IT competency that have not previously been studied, and;

4. empirically assesses the antecedents and consequences of board IT governance.

1.1 Board IT Governance Defined

There remains limited understanding of the role of the board in IT governance (DeHaes and VanGrembergen, 2005; Huff et. al., 2006; Jordan and Musson, 2004; Trites, 2004). This limited understanding is exhibited by the lack of one, generally accepted, definition for IT governance (DeHaes and VanGrembergen, 2005; Simonsson and Johnson, 2005). This research adopts one of the most widely cited definitions:

"IT governance is the responsibility of the board of directors and executive management. It is an integral part of enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategies and objectives" (ITGI, 2003, p.10).

This definition suggests that the board, in addition to executive management, must play an active role in IT governance; however, most IT governance research has not focused on board involvement and has instead focused on executive management's use of organizational structures and the contingences that influence the choice of structure (Brown and Grant, 2005). Researchers of board IT governance cannot rely on the findings at the management-level because there are distinctions between board-level and management-level decision-making (Forbes and Milliken, 1999). For example, the boards' role, unlike that of management, is to provide oversight of strategic decisions, not to implement the decisions, also board composition is different than managerial groups - boards consist of outsiders and insiders, and boards meet infrequently (Forbes and Milliken, 1999).

The IT Governance Institute (ITGI) views stakeholder value as the driving force for all IT governance responsibilities and suggests that IT governance is a continuous process occurring uniquely in each organization and driven by the IT strategy of the organization. Thus, the board is responsible for understanding the importance of IT to the organization and adjusting its IT governance activities accordingly. The ITGI (2003) posits that the board can uncover and address problems in IT governance in the following areas.

- **Oversight of business/IT strategic alignment** – ensure strategic integration between the current and future IT organization and the current and future organization;

- **IT value delivery** – ensure on-time and within-budget delivery of appropriate quality;

- **IT resource management** – ensure optimal investment, use and allocation of IT resources, including: people, applications, technology, facilities, and data;

- **IT risk management** – ensure the safeguarding of IT assets and disaster recovery;

- **IT performance management** – ensure project delivery and the monitoring of IT services.

1.2 Corporate Governance vs. IT Governance

Most of the corporate governance literature regards the key role of the board as one that allows the separation of oversight from management decision making, thus assuring stakeholders that the organization is using its resources as they intended (Johnson et al, 1996). However, the board's role has extended beyond oversight and is now often looked upon to provide a central and strategic role in governance for stakeholders

by acting as a source of expertise to improve decision-making (e.g. Agrawal and Knoeber, 2001; Booth and Deli, 1999). Although IT is not explicitly cited as an area of responsibility for corporate boards, all areas involve IT in some respect as IT plays an important role in virtually all businesses and thus oversight of IT decisions is necessary. For example, boards cannot effectively monitor a firm's financial performance without also considering the IT systems upon which these financials rely. Also, business strategic planning cannot effectively occur without consideration of the technology (financial, personnel, etc.) to support those strategic plans.

As the strategic importance of IT and the associated risks have grown so too has the need for governance of IT decisions. Weill and Ross (2004, pp. 14-18) suggested the following reasons why IT decision making requires good governance:

- organizations with above-average IT governance performance have superior profits;

- IT is expensive - on average greater than 4.2 percent of annual revenues;

- governance of IT creates mechanisms to determine the value of IT;

- success of IT depends on joint business-IT decision-making;

- IT governance mechanisms provide a transparent IT decision-making process that is aligned with business strategy;

- IT is pervasive and requires IT decision-making throughout the organization;

- rapid introduction of new IT creates strategic threats and opportunities;

- there is no one-size-fits-all approach to IT governance - governance decisions concerning IT depend on characteristics of the organization.

Most researchers suggest that IT governance is a subset of organizational governance; however there is some confusion regarding where IT governance fits within the organizational governance framework. As Figure 1 shows, this research, following the definition of Korac-Kakabadse and Kakabadse (2001), treats IT governance as a subset of corporate governance, and treats the IT governance responsibilities as additions to the board's traditional responsibilities in corporate governance.

Figure 1 - Integration of IT Governance with Corporate Governance
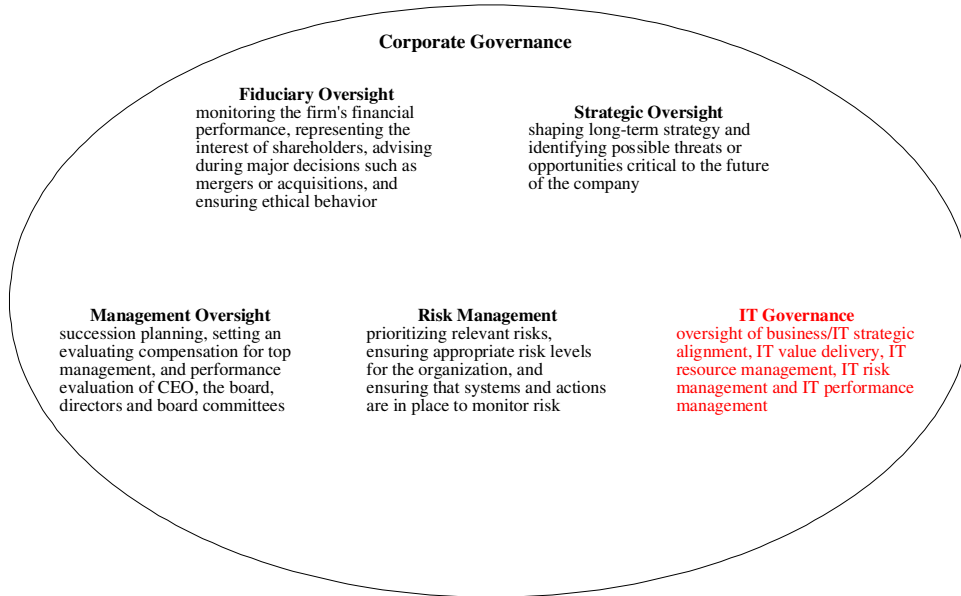
There are an extensive number of empirical studies on the antecedents and consequences of board involvement in corporate governance (LeBlanc, 2003); however, it is not sufficient to assume that these are the same for IT governance because of the differences between IT and other areas of an organization traditionally governed by the board (e.g. financial performance, human resources).

In particular, the pervasiveness, complexity and rapidly changing nature of IT have changed the knowledge and experience required to govern an organization (Weill and Ross, 2004). The pervasive nature of IT systems (i.e. systems are not separate entities and span organizational functions) necessitates that they must be managed together with other systems and management practices. This pervasiveness may extend the scope of expertise needed to include multiple functions or individuals inside or outside of the organization. Furthermore, the complexity and rapidly changing nature of IT may also impact the knowledge and experience required for its governance. Complexity and rapid changes imply that directors must be able to quickly understand the changes in complex IT systems and how they may impact the organization's operational and strategic goals. These inherent differences between IT and traditional areas of corporate governance necessitate the study of board IT governance.

1.3 Outline of Dissertation

The dissertation is divided into 9 Chapters.

Chapter 1 provides an overview of the research questions and theories that guide this dissertation, briefly defining board IT governance, and discussing the characteristics of IT that distinguish it from boards' other

governance responsibilities. Chapter 2 presents an overview of the applicable IT governance literature with a focus on the role of the board in IT governance and highlighting the gap between practice and theory. Chapters 3 and 4 continue by discussing the theoretical development more thoroughly and then presenting this dissertation's theoretical framework and propositions. Chapter 5 discusses an overview of the research methodology and analysis. This is followed by Chapter 6 which presents the methodology and findings for phase one - interviews with directors, and Chapter 7 which describes the data collection, measures, analysis and findings for phase two - survey of directors. Chapter 8 presents the overall findings of this research. Chapter 9 concludes the dissertation by discussing the contributions of the research findings, presenting the limitations of this exploratory study, and discussing how future research can expand upon these findings and address the limitations.

Chapter 2

Literature Review - IT Governance

As shown in Figure 2, the IT governance literature can be classified into two separate streams. The first focuses on the design of decision-making structures at the managerial level, while the second focuses on the role of the board.

Figure 2 - Review of IT Governance Literature
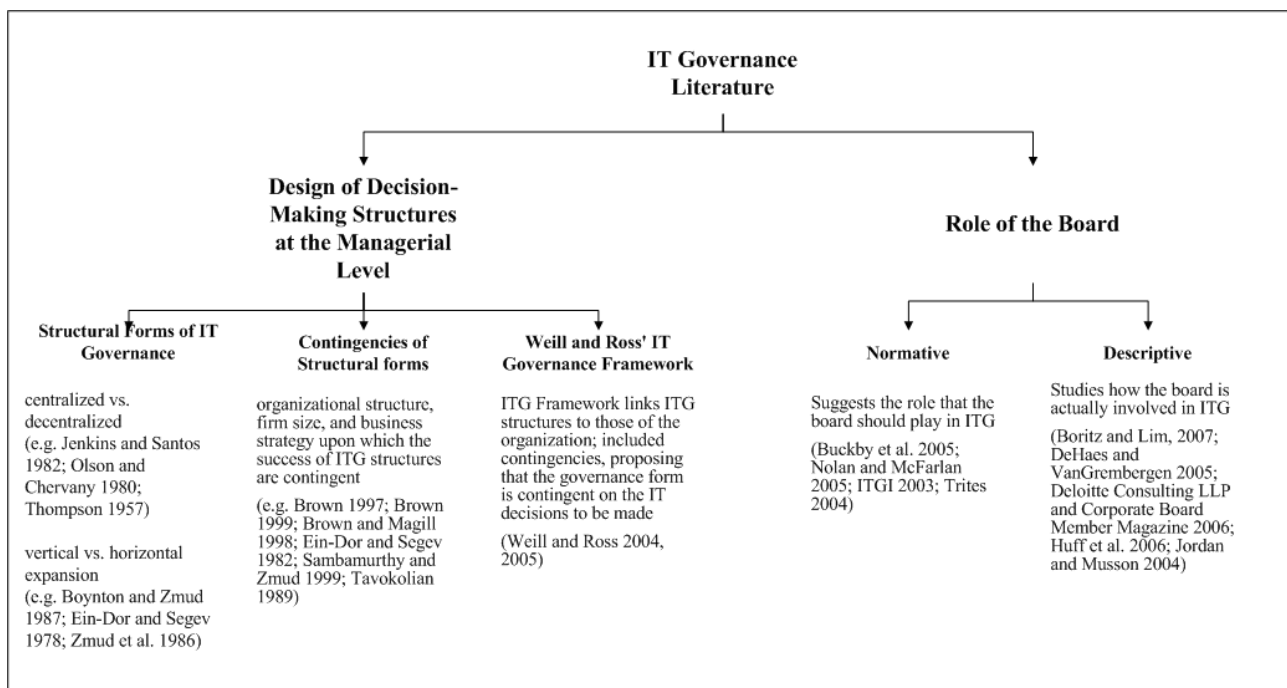
The first stream - focusing on the design of decision-making structures at the managerial level - is the predominant line of research in the literature. In a recent review (Brown and Grant, 2005) three categories focusing on the design of decision-making structures of IT governance were identified, they are:

1. <u>Structural forms of IT governance - centralized vs. decentralized and vertical vs. horizontal -</u> This category of research focuses on the decision-making structures adopted by IT organizations, including traditional centralized and decentralized IT organizational structures (e.g. Jenkins and Santos, 1982; Olson and Chervany, 1980; Thompson, 1957), and what Brown and Grant (2005) coined vertical and horizontal expansion which dealt with bi-polar governance systems within the same organization (e.g. Boynton and Zmud, 1987; Ein-Dor and Segev, 1978; Zmud et al., 1986).

2. <u>Contingencies of IT governance structural forms</u> - This category focuses on understanding the factors such as organizational structure, firm size, and business strategy upon which the success of IT governance structures are contingent (e.g. Brown, 1997; Brown, 1999; Brown and Magill, 1998; Ein-Dor and Segev, 1982; Sambamurthy and Zmud, 1999; Tavokolian, 1989). This category of research identifies contingencies that influence the adoption of particular structural forms.

3. <u>Weill and Ross' IT governance Framework (2004)</u> – Brown and Grant (2005) described this category of research as an extension of the two previous categories of IT governance. The framework links IT governance decision-making structures to those of the organization, proposes different governance forms for different IT decisions, and includes contingencies - proposing that the governance form is contingent on factors such as strategic and performance goals, organizational structure, governance experience, size and diversity, and industry and regional differences.

The second stream of research – focusing on the role of the board in IT governance - can be classified as either normative or descriptive. The normative literature (Buckby et al., 2005; ITGI, 2003; Nolan and McFarlan, 2005; Trites, 2004) advocates the importance of the board's role in IT governance. A level of board involvement in IT governance contingent on the characteristics of the organization and its use of, and dependence on, IT is recommended. Nolan and McFarlan (2005) suggest that the board's IT governance responsibilities depend upon the role of IT in the organization. Their IT Strategic Impact Grid (the most widely cited contingency view of IT governance in the literature reviewed) proposes a model of board involvement contingent upon the organization's reliance on IT for operations versus competitive advantage.

As shown in Table 1, my review of the descriptive literature revealed very few studies concentrating on how the board is actually involved in IT governance. Although the number of studies is relatively small, the consensus is that boards are not fulfilling their IT governance duties effectively. The studies imply that a gap exists between the normative and descriptive research, with the board's involvement in IT governance in practice falling well short of the level of involvement proposed in the literature.

Table 1 - Summary of Descriptive Studies of the Board's Role in IT Governance

	Research Question	Data Collection	Sample	Findings
Jordan and Musson, 2004	How are boards dealing with IT governance?	Interview	13 board members (with positions on 60 boards)	Knowledge of IT poor Limited experience in e-commerce e-commerce ventures primarily reviewed and implemented by consultants, not the board
DeHaes and VanGrembergen, 2005	Can IT governance be deployed using a mixture of structures, processes and relational mechanisms?	Interview, review of reports	1 organization (Belgian Financial Group) Interviewed IT and business managers, CIO, IT governance project manager, member of the board, executive committee	Executive Committee reports to the board monthly on major events and projects IT Strategy Committee consists of 3 board members; however, it "did not enable a more thorough and ongoing involvement of boards in IT governance" (p.5) The "Board works at a very high, strategic level and they are consequently not the 'steering power' for IT or IT governance" (p.5)
Huff et al., 2006	How are boards dealing with IT governance?	Interview	17 board chairs, board members and 17 CIOs in the same medium to large companies (half financial services and half primary resources)	IT attention deficit in boards CIOs think that boards should pay more attention Boards pay attention to IT Risk Half of financial service firms and no primary resources companies pay attention to other IT governance topics None of the companies have board-level committees CIOs do not support board-level committees
Deloitte Consulting LLP and Corporate Board Member Magazine, 2006	Is the board involved in IT Strategies?	Survey	455 directors at $1B public companies worldwide (out of 10,000 surveys)	Overall think IT strategy and implementation is important to the success of the company 13.8% board completely and actively involved in IT 66.5% think IT should be discussed at the board level 56.4% of boards have 3 or more members knowledgeable in IT (only 8% of boards have no members with IT knowledge)
Boritz and Lim, 2007	Do top management's IT knowledge and IT governance mechanisms contribute to financial performance?	Compustat database	84 public US companies with an IT Strategy Committee and a matched sample of 84 companies without such a committee	IT knowledge at top executive levels and the board is associated with a company's use of IT governance mechanisms such as CIOs and IT Strategy committees that lead to improved financial performance

2.1 Key Findings in the Literature

The review of the IT governance literature revealed three key findings: (1) the predominance of a contingency view of board IT governance; (2) the potential influence of IT expertise on board IT governance, and; (3) a paucity of research on board IT governance with limited theoretical basis.

The first key finding is that the literature seems to suggest an approach to board IT governance contingent on the role of IT in the organization. Nolan and McFarlan (2005) suggest there is no "one-size-fits-all" model for board supervision of a company's IT operations and they propose a contingency model based upon an organization's operational reliance and strategic reliance on IT – the IT Strategic Impact Grid (refer to Figure 3). Operational reliance on IT refers to an organization's reliance on IT for operations and thus the

need for reliable IT, whereas strategic reliance refers to an organization's reliance on new IT for a competitive edge.

Figure 3 – Nolan and McFarlan's IT Strategic Impact Grid (2005)

If your company is in Support Mode, ask the question in set A.
If your company is in Factory Mode, ask the question in sets A and B.
If your company is in Turnaround Mode, ask the question in sets A and C.
If your company is in Strategic Mode, ask the question in sets A, B, and C.

A
Has the strategic importance of our IT changed?
What are our current and potential competitors doing in the area of IT?
Are we following best practices in asset management?
Is the company getting adequate ROI from information resources?
Do we have the appropriate IT infrastructure and applications to exploit the development of our intellectual assets?

B
Has anything changed in disaster recovery and security that will affect our business's continuity planning?
Do we have in place management practices that will prevent our hardware, software, and legacy applications from becoming obsolete?
Do we have adequate protection against denial of service attacks and hackers?
Are there fast-response processes in place in the event of an attack?
Do we have management processes in place to ensure 24/7 service levels, including tested backup?
Are we protected against possible intellectual-property infringement lawsuits?
Are there any possible IT-based surprises lurking out there?

C
Are our strategic IT development plans proceeding as required?
Is our applications portfolio sufficient to deal with a competitive threat or to meet a potential opportunity?
Do we have processes in place that will enable us to discover and execute any strategic IT opportunities?
Do we have processes in place to guard against IT risk?
Do we regularly benchmark to maintain our competitive cost structure?

Defensive | Offensive

Factory Mode | Strategic Mode
Support Mode | Turnaround Mode

Low to High Need for Reliable Information Technology

Low to High Need for New Information Technology

The Strategic Impact Grid is intended to aid board decision making by suggesting a list of questions that a board should ask about IT governance depending on where their organization falls in the grid. The questions include topics such as the strategic importance of IT, competitors' use of IT, business continuity, and IT risks. Nolan and McFarlan (2005) also suggest that the board form committees depending on where the organization falls in the grid. They suggest that the committees aid decision making by supplementing board-level IT expertise with individuals with the requisite IT knowledge and experience. Such committees, referred to as IT Governance Committees (known commonly as IT Strategy Committees), are suggested to be composed of board members and executives with the objective of assisting management and the board in IT governance decisions. Nolan advocated the use of such committees because of the lack of IT knowledge at the board-level and the inability of CIOs to bring technology issues to the attention of the board (2004).

While there has been no direct empirical testing of the IT Strategic Impact Grid, studies have found that boards do not appear to be following the recommended role in IT governance (e.g. DeHaes and VanGrembergen, 2005; Deloitte Consulting LLP and Corporate Board Member Magazine, 2006; Huff et al., 2006; Jordan and Musson, 2004). For example, in a study of eight financial services firms a lack of involvement of the boards was found (Huff et al., 2006); however, according to the IT Strategic Impact Grid, it is firms that rely on IT for their competitive edge such as these financial services firms who should be paying the most attention to IT governance at the board level. Similarly, a Deloitte Consulting and Corporate Board Member Magazine survey (2006) found that board involvement in IT governance is not commensurate with the importance directors' place on IT. Furthermore, according to a research survey conducted for the ITGI's IT Governance Domain Practices and Competencies Series (2005), the responsibility for IT strategy is often delegated to management levels below the board. In particular, the survey found that fewer than 25 percent of entities engage board members directly in the IT strategy-setting process. In addition, the use of board-level committees to aid decision-making in IT governance has also been found to fall short of Nolan and McFarlan's (2005) recommendations. An analysis of a database of public companies in the US[1] found that only 4%, or 86 companies, had IT strategy committees (Ernst & Young, 2006). Similarly, in a study of 17 boards, Huff et al. (2006) found that no companies in their study had such board-level committees, and that the CIOs of those companies did not support such committees.

The second key finding is the potential influence of IT expertise on board IT governance. The descriptive literature shows that there are conflicting results regarding boards' knowledge of IT governance and subsequently their ability to effectively participate in IT governance. Most studies imply there is an IT governance knowledge deficit at the board level. For example, Jordan and Musson (2004) found that the 13 board members they studied had very poor levels of IT knowledge "with most directors expressing at best only survival skills in IT" (p. 6). A study of more than 3,000 businesses, including the Fortune Global 500 (Burson-Marsteller, 2005), also found this low level of IT knowledge at the board level. It revealed that few global companies are reserving board seats for technology experts, with only 5% having CIOs on their boards of directors. This same study found that Fortune Global 500 companies that have CIO board members tend to outperform their competitors, delivering annual returns of 9.2% above relevant indices. However, in contrast to the knowledge deficit noted by these studies, a Deloitte Consulting Survey (2006) found that 56.4% of boards have three or more members knowledgeable in IT with only 8% of boards having no members with IT knowledge. These inconsistent findings on boards' IT knowledge suggest that further research is necessary to gain a deeper understanding of the role that directors' IT expertise plays in board IT

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[1] The Corporate Library conducted its analysis for Tapestry Networks on June 9, 2006, on a database of 2,143 public companies that it follows.

governance. The literature does not look at what IT expertise is required at the board level or how it influences board involvement in IT governance or the decisions that are made. The theoretical framework proposed in this dissertation addresses this finding by operationalizing board IT expertise and operationalizing it in a way that measures distinct dimensions of IT expertise.

Finally, the literature review revealed that there is a small amount of research on board IT governance and there is a limited theoretical basis.

These findings provided much of the impetus for this research. Firstly, the theoretical framework developed in this research addresses the contingency view of board IT governance, but goes beyond the contingent role of IT in the organization and investigates the contingent role of board attributes and other organizational factors. Secondly, this research examines the potential influence of IT expertise on board IT governance by identifying IT expertise and IT governance mechanisms that form IT competencies, and examining how they influence board IT governance. Finally, the theoretical framework applies a multi-theoretic approach to the study of board IT governance.

Chapter 3
Towards a Theoretical Framework

As mentioned in the introduction, this research uses three theoretical perspectives to develop a theoretical framework of the antecedents and consequences of board IT governance: (1) strategic choice theory, (2) institutional theory, and (3) Ashby's Law of Requisite variety.

This chapter presents an overview of each of these theoretical viewpoints while Chapter 4 introduces the theoretical framework developed in this research.

3.1 Strategic Choice Theory

Strategic choice theorists focus on organizational actors and the role that they play in organizational change instead of focusing solely on change as a passive environmental selection process (Child, 1997). Strategic choice theory was first proposed by John Child in a 1972 article. Child argued that "purposeful actions abound in organizations and that organizational members have substantial leeway in shaping their own fates" (Judge and Zeithaml, 1992, p. 770). Strategic choice theory is nondeterministic in that it argues that individuals and groups within organizations can make proactive choices to influence organizational outcomes.

When strategic choice theory was first introduced by Child in 1972 structural determinism was the prominent view in organizational research. Structural determinism views organizations' design and structure as determined by their operational contingencies (Child, 1972). However, strategic choice theorists propose that this view is inadequate because it ignores the influence that leaders of organizations may have on the design and structure of organizations.

In structural determinism, behavior is seen as determined by and reacting to structural constraints (Astley and Van de Ven, 1983). Early studies in the structural determinism perspective examined the impact of contextual factors such as technology (Thompson, 1967; Woodward, 1965) and organizational environments (Burns and Stalker, 1961; Lawrence and Lorsch, 1967) on organizational structure. Contingency theory, another form of structural determinism, has more recently received considerable attention in the literature (e.g. Donaldson, 1995; Luthans, 1992; Robbins, 1993; Vecchio, 1991). Contingency theorists view organization operations as bound by contextual constraints (Astley and Van de Ven, 1983).

Structural determinism perspectives view the environment as ultimately determining organizational characteristics - "they stress environmental selection rather than selection of the environment" (Child, 1997,

p. 45). In contrast, strategic choice theorists focus on the role of organizational leaders who have the power to influence the structures of their organization - "the strategic choice view draws attention to individuals, their interactions, social constructions, autonomy, and choices, as opposed to the constraints of their role incumbency and functional interrelationships in the system" (Astley and Van de Ven, 1983, p. 249).

Strategic choice theory has undergone many changes since it was first introduced. In a 1997 article reviewing the literature on strategic choice theory since his 1972 article, Child identified three key issues with respect to strategic choice theory that mark the evolution of the theory through the years: (1) the nature of agency and choice; (2) the nature of environment, and; (3) the nature of the relationship between organizational agents and the environment.

The first issue identified by Child (1997), the nature of agency and choice, refers to the ability of decision-makers (agents) to make a choice regarding organizational characteristics. Whittington (1988) suggested that there may be two constraints on decision-makers ability to choose. He coined these constraints environmental determinism and action determinism. Environmental determinism refers to the idea that "although the actor may well select any from a range of available courses of action, in fact the environment ensures that only one is compatible with survival - all others lead to extinction. Choice is not meaningful because, in order to survive, the decision-maker can pursue only one course of action" (Whittington, 1988, p. 523). Whittington (1998) proposed that contrary to what much of the literature had suggested to that point in time, external constraints (environmental determinism) were insufficient for explaining decision-makers capacities for exercising choice, and that one must also consider the characteristics of the decision-maker, or action determinism. Action determinism asserts that, "given certain drivers, the actor will select only one sort of action. The simple single-mindedness of the actor's internal mechanisms denies any genuine choice between alternatives" (Whittington, 1988, p. 523). Therefore, contrary to environmental determinism, "for the action determinists it is the environment that is of secondary importance" (Whittington, 1988, p. 523).

Child (1997) suggested that "the introduction of action determinism enriches the analysis of strategic choice because it focuses attention onto the characteristics of key organizational actors themselves, which may foreclose the degree of choice that they exercise, even in the absence of external constraints" (p. 51). Therefore, action determinism refocuses the attention on the characteristics of the decision-makers.

The second issue identified by Child (1997), the nature of environment, refers to the fact that one must also consider the environment when considering the ability of decision-makers to make a choice, in that the environment limits the choices available to decision-makers. It is argued that organizational actors 'enact' their environments and according to Child (1997), "enactment in strategic choice analysis thus refers mainly to actions which bring certain environments into relevance" (p. 53).

Finally, the third issue identified by Child (1997), the nature of the relationship between organizational agents and the environment, refers to the fact that one must consider the relationships between environment and the decision-makers when considering the ability of decision-makers to make a choice. The relationships are a product of the environments and the decision-makers' interpretations of the environment, that is, the relationships that decision-makers choose to enact depend on their interpretation of the environment. This view considers Simon's bounded rationality (1976) and perceptual limits in that decision-makers' perceptions of their environment may not reflect objective reality and thus they do not seek one optimal alternative. Instead, they may select alternatives that are satisfactory and sufficient, or "good enough".

The original variant of strategic choice theory proposed that the environment may constrain choice; however, these three issues focus attention on factors other than the environment that may constrain choice. They suggest that strategic choice theory has evolved to also consider the characteristics of the decision-maker, and the relationship between the environment and the decision-maker as possible constraining factors. This has been an important evolution of strategic choice theory, as it no longer considers environmental factors as the only constraining forces on choice, but also considers characteristics of the decision-makers and their perceptual interpretations of the environment when explaining decision-makers capacities for exercising choice.

3.2 Institutional Theory

Institutional theorists emphasize "environmental norms and the weight of firm history as explanations of organizational actions" (Judge and Zeithaml, 1992, p. 769). Institutional theorists view organizational behavior as "the product of ideas, values and beliefs" – institutional pressures – and propose that "organizational behaviors are responses to not only market pressures but to institutional pressures" (Greenwood and Hinnings, 1996, p. 1025). Furthermore, institutional theory, unlike strategic choice theory, is a deterministic theory that argues that organizational practices can be predicted and explained by factors such as cultural values, industry traditions and firm history, rather than relying on individuals and groups as explanations for organizational actions (Eisenhardt, 1988). Therefore, organizational convergence to an institutionally derived structure, rather than organizational uniqueness is stressed as the basis for organization structure (Greenwood and Hinnings, 1996). The four foundational works of institutional theory are discussed below to provide an introduction to this theory.

In the first foundational work, Meyer and Rowan (1977), argued that "the formal structures of many organizations in postindustrial society dramatically reflect the myths of their institutional environments instead of the demands of their work activities" (p. 341) They suggested that many of the organizational theories were inaccurately based on the view that organizations function according to their "formal blueprints" (e.g. Thompson 1967; Weber, 1930, 1946, 1947; Woodward, 1965). Meyer and Rowan (1977)

argued that much of the empirical literature cast doubt on these theories because of the gap found between the formal and informal organization (e.g. Dalton, 1959; Downs, 1967; Homans, 1950), and because formal organizations are often loosely coupled (e.g. March and Olsen, 1976; Weick, 1976). Instead, Meyer and Rowan (1977) proposed that organizations should be found to adapt to environmental changes, even if no evidence of their effectiveness exists, and "organizations which incorporate institutionalized myths are more legitimate, successful, and likely to survive" (p. 361).

The second work by Zucker (1977) proposed that there are degrees of institutionalization and investigated the effect of different degrees of institutionalization on cultural persistence in three distinct experiments. She found that the greater the degree of institutionalization, the greater the maintenance of the culture without direct social control, and the greater the resistance to change through personal influence.

In the next work, DiMaggio and Powell (1983) contended that bureaucratization and other forms of organizational change occur as the result of processes that make organizations more similar without necessarily making them more efficient. They identified three mechanisms through which institutional isomorphic change occur – coercive, mimetic and normative and propose predictors of isomorphic changes.

In the fourth foundational work, Scott and Meyer (1983) proposed the concept of social sector, which includes "all organizations within a society supplying a given type of product or service together with their associated organizational sets: suppliers, financiers, regulator, and so forth" (p. 129). They argued that social sectors differ in a number of ways and that those differences influence the structure and performance within each sector. For example, they proposed that regulatory process would have different effects in different sectors and that these differences may be due to differences not only in political processes and economic mechanisms, but in organizational arrangements.

These four foundational works of institutional theory have been succeeded by a large and varied amount of literature which has built on and advanced this area of research. It is important to recognize the different variants of institutional theory in order to understand the different institutional arguments. In a review of the predominant variants in the literature Scott (1987) identified four such variants: (1) process of instilling value, (2) process of creating reality, (3) as a class of elements, and (4) as distinct societal spheres. Table 2 presents a comparison of the key ideas/themes of these variants of institutional theory.

Table 2 - Variants of Institutional Theory[2]

Variant	Primary Research	Emphasis
1. Process of Instilling Value	Selznick, 1957	Institutionalization as a means of instilling value. Supplying intrinsic worth to a structure or process that before institutionalization had only instrumental utility. Promotes stability – persistence of structure over time. Focuses on <u>what</u> occurs not <u>how</u>.
2. Process of Creating Reality	Berger and Luckman, 1967	Institutionalization as a social process by which individuals come to accept a shared definition of social reality. Independent of the actor's own views or actions, but is taken for granted as defining the "way things are".
3. As a Class of Elements	Meyer and Rowan, 1977	Emphasis shifts from the properties of general belief systems to the existence of a variety of sources of beliefs (cultural approach). Less emphasis on institutionalization as distinctive process – organizations conform to a set of institutionalized beliefs because they are rewarded for doing so.
4. As distinct societal spheres	Hughes, 1939 Hertzler, 1961	Focuses attention on the existence of a set of differentiated and specialized cognitive and normative systems – institutionalized logic and patterned human activities that arise and tend to persist in all societies. Studies why institutionalized forms develop.

These variants are all similar in that they propose that institutional elements affect the structural characteristics of organizations; however, they differ as to in what parts of the structure such effects occur (Scott, 1987). The first two variants are similar in that they propose a process of generating general belief systems; however, they differ in *why* the process of generating this belief system occurs. The <u>process of instilling value</u> views institutionalization as a means of instilling value in a process in order to promote stability in the structure over time. Whereas the <u>process of creating reality</u> views institutionalization as a social process by which the structure becomes accepted as defining the "way things are". The last two variants shift from the existence of a general belief system to the existence of *diversity* among belief systems. <u>As a class of elements</u> views these diverse belief systems as determining the organization structure and views the sources of belief systems as institutionalized. In this variant of institutional theory it is proposed that this process of institutionalization occurs because organizational members are "rewarded for doing so through increased legitimacy, resources, and survival capabilities" (Scott, 1987, p. 498). The fourth variant of institutional theory, <u>institutions as distinct societal spheres</u>, shifts towards studying the different belief systems and why they are associated with different structures. In summary, the existence of these variants of institutional theory illustrates the variety of institutional processes, how and why these processes occur, and the range of influences of these processes on organizations.

3.3 Ashby's Law of Requisite Variety

Cybernetics, the field from which Ashby's Law of Requisite Variety was derived, regards systems as dynamic with the ability to regulate/control their output by responding to disturbances. Control is the central concept of cybernetics and Ashby's Law. Control is a regulatory process with set goals, a way of measuring those goals, the ability to act when goals are not achieved, and feedback to detect unwanted variances in the system. Control is initiated when there are unwanted deviations in the system or when performance needs to be corrected (Beer, 1982).

Ashby describes the control process whereby for every disturbance the system must generate a response to maintain a stable output. This is known as *requisite variety* and is often stated as 'only variety can destroy variety' (1956). Variety is the number of possible states of a system (Ashby, 1956), and the variety of disturbances may originate outside or inside the system - referred to as External (V_E) and Internal Variety (V_I) respectively. Achieving requisite variety necessitates that the regulator must sense the incoming variety and have a large enough variety of responses (V_R) to deal with the disturbances. Mathematically, this is expressed as: $V_E + V_I \leq V_R$. Beer (1959) was the first to extend cybernetics to management and others have followed (e.g. Beer, 1985; Green and Welsh, 1988; Turnbull, 2002).

3.4 Integration of these Theories

This research applies strategic choice and institutional theories, and Ashby's Law of Requisite Variety in order to help understand the antecedents and consequences of board IT governance. The three theories operate under different, partially-overlapping theoretical assumptions, and thus each theory gives only a limited explanation of the whole phenomena regarding the antecedents to board IT governance and its consequences.

Strategic choice and institutional theories offer complementary views of why boards decide to become involved in the governance of IT. Proponents of these theories have noted the need to apply both these theories together to understand organizational behavior and that one of these theories – either a purely deterministic or non-deterministic perspective – would be insufficient for explaining organizational behavior (e.g. Hitt and Tyler, 1991; Oliver, 1991). According to Oliver (1991) "The major criticisms of institutional theory have been its assumptions of organizational passivity and its failure to address strategic behavior and the exercise of influence in its conceptions of institutionalization" (p. 173). Also, as discussed in the overview of strategic choice, the theory has evolved from its original conception of decision-makers' choice

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[2] Adapted from Scott (1987).

to extend to the environment within which the organization is operating. Thus, organizational structure and design would be a factor of both characteristics of decision-makers' and environmental conditions.

Institutional and strategic choice theories have primarily been applied in the context of organizational structures; however, these theories have also been applied together in the context of corporate governance (Judge and Zeithaml, 1992). According to Judge and Zeithaml (1992), a board's response to an environment depends on the institutional pressures an organization faces and the strategic judgment of top management.

Strategic choice theory also offers a view of the consequences of board IT governance. This theory has been applied in the context of the performance outcomes associated with corporate governance (Judge and Zeithaml, 1992); however, a review of the literature did not find any studies that applied this theory to examine the performance outcomes of board IT governance. Additionally, this research proposes that strategic choice theory does not adequately consider all of the consequences of board IT governance because it does not incorporate the concept of 'fit' between role of IT and board IT governance approach into the extent of consequences. Therefore, this research integrates strategic choice theory with Ashby's Law of Requisite Variety to study this relationship. Ashby's Law provides a useful framework to analyze the impact of 'fit' on performance. IT governance is an evolving process and requires responses from the board (regulator) for the incoming disturbances from the organization, management, industry, or other parties such as competitors, in order to effectively govern IT and improve firm performance (requisite variety). The regulator is essential for the system to be able to control for a stable outcome. However, according to Ashby, the capacity of the regulator cannot exceed its capacity as a channel of communication (1956). This means that the capacity of the board to receive, interpret and communicate information determines the capacity of the board as a regulator. Therefore, the type and number of disturbances with respect to IT, for example in the case of organizations that rely strategically versus operationally on IT, determine the capacity of the regulator needed to achieve a stable output (i.e. enhanced firm performance).

In summary, in this research, strategic choice theory is used to examine the relationship between board attributes and board IT governance, and institutional theory is used to examine the relationship between organization factors and board IT governance. Furthermore, strategic choice theory supports the relationship between board IT governance and firm performance. Finally, Ashby's Law of Requisite Variety offers support for why not just *greater* board IT governance, but *more appropriate* board IT governance ('fit'), positively influences firm performance. These theories and how they led to the development of the theoretical framework and propositions are discussed in more detail in the following chapter.

Chapter 4

Theoretical Framework and Propositions

The theoretical framework developed and tested in this research is shown in Figure 4.

Figure 4 - Theoretical Framework: Antecedents and Consequences of Board IT Governance
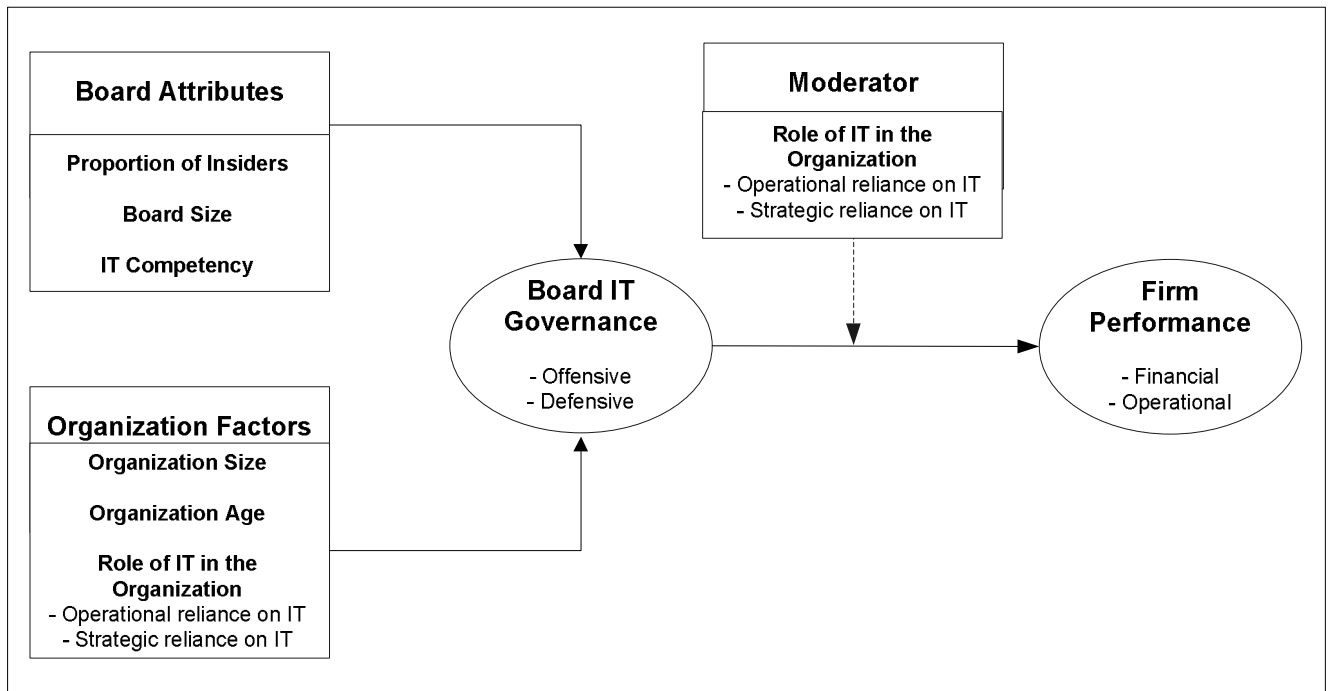
This chapter discusses the four major constructs of this framework: board attributes, organization factors, board IT governance, and firm performance, and describes the proposed relationship among them. The propositions are organized into two categories: (1) the antecedents to board IT governance, and; (2) the consequences of board IT governance. This chapter starts by defining the board IT governance construct and then moves on to discuss the propositions.

4.1 Board IT Governance

Review of the governance literature did not find any studies that examined board IT governance directly in an empirical study; therefore, the more general corporate governance literature was reviewed to determine how boards conduct corporate governance. It was found that the majority of prior research in corporate

governance has focused on board and organizational attributes as proxies for board processes, and the relationship between these proxies and overall financial performance. Interestingly, prior research has seldom directly examined how boards conduct corporate governance. It has been suggested that this lack of attention to the processes of corporate governance may be why contradictions and unanswered questions appear in board research (Johnson et al, 1996; Zahra and Pearce, 1989).

A review of the corporate governance literature revealed four studies which have explored the construct of board involvement directly in empirical studies. In the first study Judge and Zeithaml (1992) used a multi-item scale to measure the level of board involvement on two dimensions: the formation of new strategic decisions, and the evaluation of prior strategic decisions. However, this scale only operationalized board involvement in strategic decision making, and did not measure the oversight function of the board. In the second study Johnson et al. (1993) examined board involvement in corporate restructuring. A 7-point Likert scale was used to measure board involvement; however, their measure was limited to board involvement in restructuring and acquisitions. In the third study Westphal (1999) measured board involvement as the extent to which the board is involved in monitoring and provides advice and counsel. This appears to have been the first study that directly examined the boards' oversight and strategic roles; however, this measure of board involvement was limited because it simply asks whether the two roles are performed by the board and what is meant by these functions is left up to the interpretation of the respondent. The fourth study attempted to alleviate these limitations by operationalizing board involvement as a multi-dimensional construct with three underlying dimensions: time, information and expertise (Baack, 2000).

Building upon these studies, this research develops a board IT governance construct and generates its measures using actual directors' behaviors and actions in IT strategic decision making and oversight of IT. By creating objective criteria for measuring board involvement, this model examines what is happening at the board level, rather than relying exclusively on proxy variables (e.g. board size or proportion of insiders) as indicators of what might or could be happening.

Board IT governance is defined as the level of involvement in offensive and defensive governance of IT activities. The distinction of "offensive" versus "defensive" IT governance was introduced by Nolan and McFarlan's contingency model of board IT governance (2005). Offensive IT governance is needed when the organization relies on IT for its competitive edge, and defensive IT governance is needed when the organization relies on IT for operations. For example, offensive IT governance involves ensuring that there are processes in place to enable the discovery and execution of any strategic IT opportunities. Whereas defensive IT governance targets uninterrupted operations through privacy, security and disaster recovery plans.

The research propositions in this dissertation are organized into two categories: (1) Antecedents to Board IT governance - Propositions 1-8, and; (2) Consequences of IT Governance - Propositions 9-14.

4.2 Antecedents to Board IT Governance

No empirical studies examining the antecedents of board IT governance were found in the literature. Therefore, based on findings in the normative and descriptive board IT governance and the corporate governance literature, and using strategic choice and institutional theories, this research examines the relationship between board attributes, organizational factors and board IT governance (Figure 5).

Figure 5 - Theoretical Framework with Theories and Propositions Identified
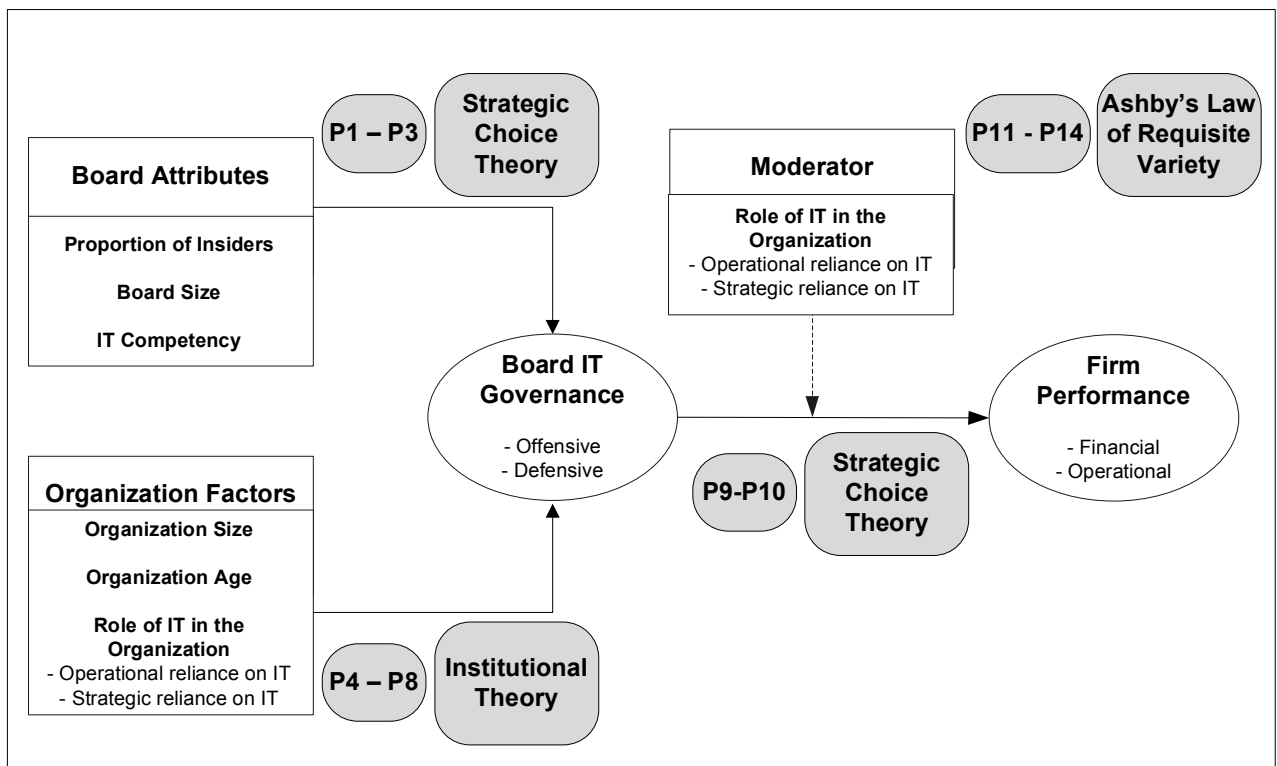
4.2.1 Board Attributes and Board IT Governance

This research uses strategic choice theory to propose relationships between board attributes and board IT governance (Figure 5). The focus in strategic choice theory is on those in an organization who possess decision-making power and it is implicit that not all organizational actors have the power to affect change. Therefore, it is appropriate to study the board of directors as this powerful group because they have the authority to decide what their role will be in IT governance, and this role may ultimately impact how IT is governed in the organization. Although prior research has not applied this theory to IT governance, strategic

choice theory would suggest that board composition may influence the boards' fulfillment of different roles and that boards can enhance the quality of IT governance by participating in the process and contributing their experience and expertise in particular areas (e.g. industry knowledge, risks, strategy and best practices in business and IT).

Board attributes refer to characteristics of the board: the proportion of insiders to outsiders, board size and the IT competency of directors. Each of these characteristics is discussed in turn.

4.2.1.1 Proportion of Insiders

Inside directors are those members of the board who are employed as part of the organization's management team, their subordinates, relatives, or managers of the organization's subsidiaries. Also, these directors could be members of the organization's immediate past management team (Cochrane et al, 1985).

The proportion of inside directors appears to have been one of the most commonly studied variables in the corporate governance literature. Central to much of the research examining the relationship between insiders and board involvement and firm performance is the idea that the interests of insiders and outsiders may diverge. The interests of insiders are proposed to be aligned with those of management, while those of outsiders are aligned with stockholders. So whereas insiders may be more likely to pursue strategies consistent with maximizing the size and diversity of the firm, outsiders may be more likely to pursue strategies consistent with maximizing the long-run profitability of the firm (Hill and Snell, 1988).

In the literature reviewed, the study of the relationship between insiders and board governance has yielded mixed results. Judge and Zeithaml (1992) and Baack (2000) found a negative relationship between insider representation and board involvement; however, Westphal (1999) found that insiders can increase board involvement by raising the frequency of advice and counsel interactions between CEOs and outside directors.

Conflicting results have also been found in reviews of the predominant research area which has studied the relationship between insiders, as proxies for board involvement, and financial performance (e.g. Molz, 1988; Zahra and Pearce, 1989). For example, in studies of 200 manufacturing firms (Vance, 1955) and 406 Fortune 500 firms (Cochran et al, 1985) positive relationships were found between the proportion of insiders on a board and financial performance. However, in studies of 80 chemical companies (Schmidt, 1975), 21 pairs (successful/failing) of retail firms (Chaganti et al, 1985), and 100 Fortune 500 companies (Zahra and Stanton, 1988) no relationships were found between insiders and financial performance. In addition, contradictory findings have been found. In studies of 266 major corporations (Baysinger and Butler, 1985) and 536 firms (Schellenger et al., 1989) it was found that the proportion of outsiders on boards was positively related to financial performance.

As this review shows, it remains unclear what impact the proportion of insiders has on board involvement in governance. However, the use of strategic choice theory as the lens through which to study this relationship has made this relationship clearer.

The literature draws attention to the relevance of information for the exercise of strategic choice and points to the necessity of securing relevant information that is not ambiguous. Child (1997) argued that the degree of strategic choice may be constrained by limited or ambiguous information. Furthermore, Judge and Zeithaml (1992) argued that according to strategic choice theory a large proportion of insiders may raise the level of information flows within the boardroom and thus enable directors to be more involved in governance. This research proposes that this argument holds for board IT governance, and that insiders have relevant knowledge of IT and business activities that allows them to notify the board about organizational issues that necessitate board IT governance. For example, insiders may be able to alert the board to IT risks that pose a threat to the organization and thus require board oversight and input. Therefore, it is proposed that:

Proposition 1: Insider representation is positively related to board IT governance.

4.2.1.2 Board Size

Board size is another of the most commonly studied variables in the corporate governance literature. While board size has been the subject of extensive research, only one study could be found in the literature which directly studied the relationship between board size and board involvement in corporate governance. In that study, Judge and Zeithaml (1992) found a negative relationship between these variables. In the predominant research area studying the relationship between board size and firm performance, inconsistent relationships have been found. For example, in a study of 46 non-profit agencies Provan (1980) found that board size and performance were positively related; however, in a study of 100 Fortune 500 firms Zahra and Stanton (1988) found that board size was not associated with performance, and in a study of 452 large industrial companies Yermack (1996) found a negative association between board size and firm performance.

Strategic choice theory focuses on management's perceptions of environmental conditions and its ability to make decisions that cope with those conditions (Miles and Snow, 1978). With respect to IT governance, strategic choice theory would suggest that the degree and type of board involvement will depend on the ability of the board to work together to effectively debate and discuss the organization's IT. However, group dynamics literature suggests larger board size impedes debate and discussion on the board (Harrison, 1987). Lipton and Lorsch (1992) suggested that board size should be limited to ten directors with eight or nine being preferable. They argued that when a board has more than ten members it becomes more difficult for them to express their ideas and opinions because like any group of individuals working together they must be cohesive in order to be able to communicate with each other and reach consensus among the group. They

suggested that since boards spend a limited amount of time together, a smaller board would enable directors to get to know each other and encourage their contribution to deliberations. Therefore, it is proposed that:

Proposition 2: Board size is negatively related to board IT governance.

4.2.1.3 IT Competency

This research defines IT competency as the extent to which a board has IT expertise and uses IT governance mechanisms to govern IT. It is proposed that while these concepts are separate, both are required for IT competency.

IT competency at the board level is examined and multi-level measures for this construct are introduced. The inclusion of the IT expertise construct in the theoretical framework as a dimension of IT competency is motivated by the IT governance literature which has suggested that many boards seem to be falling short in their IT governance responsibilities because of a knowledge deficit (e.g. Burson-Marsteller, 2005; Huff et al., 2006; Jordan and Musson, 2004; Nolan and McFarlan, 2005). The inclusion of the IT governance mechanisms construct as a dimension of IT competency is motivated by the IT governance literature which has recommended the use of such mechanisms at the board level (e.g. ITGI, 2003; Nolan and McFarlan, 2005), and at the organizational level (e.g. DeHaes and VanGrembergen, 2005, 2008; Peterson, 2003; Weil and Ross, 2004).

This section starts with a discussion of IT expertise, this is followed by a discussion of IT governance mechanisms, and the section concludes with a proposition on IT competency driven by the strategic choice perspective.

IT Expertise – An expert is defined as "one with the special skill or knowledge representing mastery of a particular subject" (Merriam-Webster). Expertise refers to "the characteristics, skills, and knowledge that distinguish experts from novices and less experienced people" (Ericsson, 2006). The differences between experts' and novices' decision-making abilities may be most evident in the solving of ill-structured problems. In a review of the literature on ill-structured problems, Voss and Post (1988) suggested that "…many problems of the world are presented as ill-structured problems, but become well-structured in the hands of the problem solver" (p. 262). Thus, they emphasized the role of the solver as a provider of the organization and suggested that:

> "experts should excel with respect to two particular aspects of such solving – namely, that they should be better able than novices to decompose an ill-structured problem into appropriate sub problems; and similarly, that they should be better able to select parameter values for open constraints in a manner that leads to a meaningful solution, given the goals at hand" (p. 265).

Many of the problems faced in IT governance would be considered to be ill-structured and are characterized by ambiguous problem situations and where the possible responses are not known to the decision-maker. This research's analysis of board-level making of ill-structured IT governance decisions will possibly be the first attempt at studying how directors represent such problems and search for solutions.

The positive relationship between expertise and level of decision-making ability has been well established in the management literature (e.g. Liao, 2003; Wagner and Sternberg, 1985, 1991; Cianciolo et al, 2006). However, the research suggests that an expert who is skilled in one domain cannot transfer the skill to another (Glasser and Chi, 1988). This emphasizes the need for the study of experts in a particular context. Unfortunately, there has been limited study of expertise at the board level. In the corporate governance literature it seems that the study of expertise has been limited primarily to expertise of audit committee members (e.g. DeZoort, 1997; DeZoort and Salterio, 2001) or to high-level measures acting as a proxy for types of expertise, such as the ratio of insiders to outsiders on the board or the background of directors (Leblanc, 2003). In the IT governance literature, one study has empirically examined the relationship between board IT expertise and firm performance (Boritz and Lim, 2007). A positive relationship was found; however, that study did not use direct measures of expertise, instead using high-level measures of expertise obtained from proxy statements (e.g. IT-related college degrees or previous work in a public IT firm), and the study did not examine the relationship between expertise and board IT governance.

IT Governance Mechanisms - The second component of board IT competency is IT governance mechanisms. It is proposed that IT governance mechanisms increase the capacity of the board to acquire, interpret and disseminate information, thus increasing the ability of the board to govern IT. While IT governance mechanisms have been studied at the organization level, this is the first study to comprehensively explore the use of IT governance mechanism at the board level.

At the managerial level, it has been proposed that IT governance can be enacted using a variety of IT governance mechanisms - structures, processes and relational mechanisms (e.g. DeHaes and VanGrembergen, 2005, 2008; Peterson, 2003; Weil and Ross, 2004). Structures include "structural (formal) devices and mechanisms for connecting and enabling horizontal, or liaison, contacts between business and IT management (decision-making) functions" (Peterson, 2003). IT governance processes refer to "formalization and institutionalization of strategic IT decision making or IT monitoring procedures" (Peterson, 2003). Relational mechanisms refer to "the active participation of, and collaborative relationship among, corporate executives, IT management, and business management" (Peterson, 2003). Examples of IT governance mechanisms are outlined in Table 3.

Table 3 – IT governance mechanisms[3]

Structures	Roles and responsibilities, IT organization structure, CIO on Board, IT strategy committee, IT steering committee
Processes	Strategic Information Systems Planning, Balanced (IT) Scorecards, Information Economics, Service Level Agreements, COBIT and ITIL, IT alignment / governance maturity models
Relational Mechanisms	Active participation and collaboration between principle stakeholders, Partnership rewards and incentives, Business/IT co-location, Cross-functional business/IT training and rotation

Literature which has focused on board-level governance has recommended a number of IT governance mechanisms for the board, including: forming an IT Strategy Committee; engaging outside experts; reviewing and critiquing IT strategy projects and IT security practices; holding sessions with the CFO, and; holding executive sessions with committee members (ITGI, 2003; Nolan and McFarlan, 2005). However, only one study was found which empirically examined two of these board-level IT governance mechanisms. Boritz and Lim (2007) examined the impact of the presence of a CIO and IT Strategy Committee on financial performance. They found that boards that had these mechanisms had superior financial performance. However, there is limited understanding of how or when these mechanisms are effectively incorporated in board decision-making. Furthermore, research has revealed that it might be necessary to directly measure IT governance mechanisms and to examine their influence on actual board IT governance – not just on financial performance – because it is unclear how these mechanisms impact board IT governance. For example, a field study of a Belgian financial group found that even though the company had an IT Strategy Committee it "did not enable a more thorough and ongoing involvement of boards in IT governance" (DeHaes and VanGrembergen, 2005, p. 5).

IT Competency and Strategic Choice Theory – As discussed in the previous chapter, external constraints (environmental determinism) are insufficient for explaining decision-makers capacities for exercising choice, and that one must also consider the characteristics of the decision-maker (action determinism) (Whittington, 1998). Action determinism suggests that predetermined mind-sets could limit the range of strategic choices recognized and considered by decision-makers. For example, Johnson (1987) found that the managers of a clothing firm had problems adjusting to a new competitive situation because their mind-set tended toward stability, and thus this inhibited their ability to make strategic choices that were necessary for a new situation. Dutton (1993) coined this "automatic strategic issue diagnosis" and suggested that decision-makers activate ready-made categories for issues and they respond with ready-made responses based upon issues they have encountered in the past. This places emphasis on the importance of the cognition of decision-makers when considering the extent of strategic choice. For example, Wiersema and Bantel (1992) found that top management teams with higher educational levels and training, among other characteristics were

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[3] Adapted from Peterson (2003).

more likely to exercise strategic choice by undergoing changes in corporate strategy. Therefore according to action determinism, IT expertise may push back limits on the exercise of choice by decision-makers.

In addition to IT expertise, IT governance mechanisms may also impact strategic choice because "strategic choice is recognized and realized through a process whereby those with the power to make decisions for the organization interact among themselves … with other organizational members and with external parties" (Child, 1997, p. 60). Child (1997) argued that the possibilities for interactions are framed by existing structures, both within and without the organization and thus have "structured limits". Furthermore, strategic choice theorists suggest that social networks enable the acquisition of knowledge by organizations and the exchange of information. Therefore, structures, processes and relational mechanism may enable decision-makers to access relevant information in a timely fashion, and expertise may enable the decision-makers to deal with the information when making strategic choices.

In summary, board decisions are strategic in nature and when faced with such decisions, decision makers typically perceive only selected alternatives and adopt a simplified model of the situation which is largely shaped by their prior knowledge and experience (Geletkanycz and Hambrick, 1997). Accordingly, from a strategic choice perspective, broad-based and firm-specific IT expertise provides directors with the knowledge and experience needed to determine what IT activities should be governed and how they should be governed. It is proposed that as directors develop IT expertise they are likely to also enhance their ability to challenge, question, or probe management regarding IT activities, and that IT expertise enables directors to know what questions to ask and to understand the response. However, it is proposed that IT expertise is not sufficient for IT governance because it is likely that a particular board decision has never previously been addressed and in the face of uncertainty directors may need to seek the advice of other directors, management or other advisors through established IT governance mechanisms or may need to use established processes to provide oversight of IT activities and input into strategic decision making. This research proposes that IT governance mechanism increase the information sources thereby enabling directors to obtain more IT information both inside and outside of the organization, and thus increase the board's capacity to govern IT. Therefore, it is proposed that:

Proposition 3: IT competency is positively related to board IT governance.

4.2.2 Organization Factors and Board IT Governance

This research uses institutional theory to propose relationships between organizational factors and board IT governance (Figure 5). It is proposed that, in addition to rational pressures, institutional factors have an influence on board involvement in IT governance.

Organizational factors refer to the size of the organization, the age of the organization and the role of IT in the organization. Each of these factors is discussed in turn.

4.2.2.1 Organization Size

The relationship between organization size and board involvement does not appear to have been studied in IT governance; however, it has been studied in the corporate governance literature. Baack (2000) found a positive relationship between organization size and board involvement in corporate governance. In another study, Judge and Zeithaml (1992) examined the relationship between the structural differentiation of organizations and board involvement in corporate governance. This is relevant because larger organization size has been suggested to be associated with increased structural differentiation (Blau, 1970). Judge and Zeithaml (1992) found that increased differentiation was negatively associated with board involvement. They used institutional theory to explain the relationship between differentiation and board involvement and suggested that "an organization's level of diversification will be negatively associated with board involvement because isomorphic pressures should be more diffuse for diversified firms than for non-diversified ones" (Judge and Zeithaml, 1992, p. 773).

A similar argument has been made in the organizational literature with respect to differentiated organizations' resistance to institutional pressures. Oliver (1991) argued that differentiated organizations do not have environments that are interconnected, and this impedes the "spread of institutional consensus and conformity" (p. 171). Interconnectedness refers to "the density of inter-organizational relations" (Oliver, 1991, p. 170), and institutional and resource dependence theorists suggest that interconnectedness facilitates the voluntary diffusion of norms, values, and shared information (e.g. DiMaggio and Powell, 1983; Meyer and Rowan, 1977; Pfeffer and Salancik, 1978). Oliver (1991) argued that "organizations are more likely to accede to the values or requirements of the institutional environment when this environment is highly interconnected….because highly interconnected environments provide relational channels through which institutional norms can be diffused" (p. 171).

This research uses organization size as a proxy for level of differentiation, and thus views larger organizations as more differentiated. In terms of board involvement in IT governance, the larger the organization, and thus the more differentiated, the less the pressures to adopt any one particular IT governance activity. This may occur because an organization operates in more than one industry, regulatory or legal environment, or geographic area and it is not likely to be interconnected and have channels that share institutional pressures. Therefore, it is proposed that:

Proposition 4: Organization size is negatively related to board IT governance.

4.2.2.2 Organization Age

It has been suggested that organizational processes reflect the practices at the time of founding because the organization adopts the predominant practices in that time, furthermore, since organizational processes change slowly many of the practices remain unchanged from the time of organization founding.

This concept was first discussed by Stinchcombe (1965). He suggested that "the organizational inventions that can be made at a particular time in history depend on the social technology available at the time" (p. 153). He commented how certain types of institutions were founded at the same time (i.e. savings bank - 1830s, universities - 1870-1900, and unions - civil war, 20th century), and that certain structural characteristics of a type of organization were stable over time. He found that organizations that were formed at one time typically had a different social structure from those formed at another time. In examination of industries in the United States by age of industry classification – from pre-factory to modern – he found a strong correlation between the age at which industries were developed and their structure at the present time.

More recent studies have also found a relationship between time of founding and organization structure. For example, organization age has been shown to effect organization processes such as compensation practices (Eisenhardt, 1988), and amount of autonomy in choosing organizational structures (Tolbert and Zucker, 1983).

According to this view, board activities, and thus board IT governance, reflect a pattern of doing things that evolve over time and become legitimated within the board and the organization. Board activities are then resistant to change even in the face of major changes in the organization, such as the emergence of the strategic importance of IT. Although institutional theory has not been applied to board IT governance in prior research, from this perspective, organization history will impact board activities, so if boards have not governed IT in the past then this becomes legitimated and it is less likely that they will govern IT in the immediate future.

The only study found to examine the effect of organization age on board processes reported that age was positively related to board involvement (Judge and Zeithaml, 1992). This finding is interesting because it was opposite to the relationship which was proposed by the authors. They proposed that because older organizations were formed at a time when pressures for board involvement in strategic decision making were weaker, institutional theory would suggest that boards of older organizations would not be as involved in strategic decision as boards of newer organizations. Since that study only examined 42 boards and only looked at one board process - involvement in strategic decision making (and not involvement in oversight) – further research is needed to investigate the relationship between organization age and governance. This research proposes that the institutional perspective holds and a board's current practices would reflect those at the time of founding . Therefore, it is proposed that:

Proposition 5: Organization age is negatively related to board IT governance.

4.2.2.3 Role of IT

The normative IT governance literature recommends a view of board involvement contingent on the organization's use of, and dependence on IT (ITGI, 2003; Nolan and McFarlan, 2005). Nolan and McFarlan's IT Strategic Impact Grid (2005) proposes a model of board IT governance contingent upon the organization's operational versus strategic reliance on IT. For example, organizations in the Strategic Mode (upper right-hand corner of the IT Strategic Impact Grid – Figure 3) would require more board oversight of IT and input into strategic decision-making than an organization in Support Mode (lower left-hand corner of the IT Strategic Impact Grid) because the organization in Strategic Mode would rely on IT to maintain its current operations and to achieve a competitive edge, whereas the organization in Support Mode would not significantly rely on IT for current or future operations and thus board involvement required would be minimal.

It has been proposed in the literature that the level and type of reliance on IT would be relatively consistent across an industry. For example, financial services firms would likely have high operational and strategic reliance on IT (i.e. classified in the Strategic Mode); whereas, primary resources firms would likely have a relatively low operational and strategic reliance on IT (i.e. classified in the Support Mode). This industry-wide similarity in terms of degree of reliance on IT was reaffirmed in a study of eight financial services firms and nine primary resources companies where it was found that overall financial services firms had high operational and strategic reliance on IT, but primary resources firms had relatively no reliance on IT (Huff et al., 2006).

Institutional theorists have suggested that organizations may seek external legitimacy by adopting the structural features of the industry. For example, DiMaggio and Powell (1983) found that even though voluntary hospitals in the US are not required to receive accreditation from the Joint Commission on Accreditation of Hospitals, most seek out such legitimization. Also, Singh et al. (1986) found that voluntary social service agencies who adopted external authorization mechanisms had significantly higher survival rates than those that did not adopt such mechanisms.

Since institutional theory would suggest that industry norms influence organizational processes through isomorphism (DiMaggio and Powell, 1983), and organizations with a high reliance on IT would likely be operating in an industry which also relies highly on IT, the industry norm would likely be higher board involvement in IT governance. Furthermore, industry norms in board IT governance, predicated by the role of IT (operational versus strategic reliance), would influence the board IT governance approach (defensive versus offensive). Therefore, it is proposed that:

Proposition 6: The <u>operational reliance</u> on IT in the organization is positively related to board <u>defensive</u> IT governance.

Proposition 7: The <u>strategic reliance</u> on IT in the organization is positively related to board <u>offensive</u> IT governance.

Proposition 8: The <u>overall</u> role of IT in the organization is positively related to <u>board IT governance</u>.

4.3 Consequences of Board IT Governance

The second category of propositions examines the performance consequences of board IT governance. Organizations are spending an increasing amount on IT, with the median level of spending on IT reaching 1.8% of revenues for organizations in the US (Computer Economics, 2007); however, a large percentage of these IT investments fail to deliver their intended return. In recent years, studies have suggested the need for effective board-level IT governance in order to realize value from IT (e.g. Buckby et al., 2005; ITGI, 2003; Nolan and McFarlan, 2005; Trites, 2004), but the relationship between board IT governance and IT value has not been empirically tested until this research.

The propositions regarding the consequences of board IT governance address two main arguments. The first addresses the performance consequences associated with the *amount* of board IT governance, and the second addresses the *appropriateness* of board IT governance.

As shown in Figure 5, strategic choice theory is used to develop Propositions 9 and 10 regarding the relationship between *amount* of board IT governance and firm performance, and Ashby's Law of Requisite Variety is used to develop Propositions 11 to 14 regarding the relationship between the *appropriateness* of board IT governance and firm performance.

Two measures of firm performance are used: financial performance and operational performance. The rationale for the selection of these two measures is discussed in Chapter 7, section 7.2.3.

4.3.1 Amount of Board IT Governance and Firm Performance

An empirical study directly examining the consequences of board IT governance was not found during the literature review; however, evidence from a recent study on the relationship between proxies for board IT governance and performance suggests that a positive relationship does exist (Boritz and Lim, 2007). In fact, there is empirical support for a positive relationship between board involvement in corporate governance and financial performance (Judge and Zeithaml, 1992) and between proxies for board involvement in governance and firm performance (refer to Zahra and Pearce (1989) for a review).

According to strategic choice theory, organizational strategy and its processes affect firm performance (Miles and Snow, 1978). It has been argued that increased board involvement improves organizational

strategy and its processes by "forcing managers to check their assumptions and do their homework before advancing strategic proposals", and by "helping to challenge narrow thinking, escalating commitment, and weak analysis" (Judge and Zeithaml, 1992, p. 775). Furthermore, there is some research that indicates when boards provide richer information; management is more likely to engage in behaviors that are consistent with stockholders interests (Richardson, 2000). Therefore, it is proposed that:

Proposition 9: Board IT governance is positively related to <u>financial performance</u>.

Proposition 10: Board IT governance is positively related to <u>operational performance</u>.

4.3.2 Appropriateness of Board IT Governance and Firm Performance

The relationship between overall board IT governance and firm performance may hold; however, it is proposed that this relationship may only hold under certain conditions. This research proposes that role of IT in the organization moderates the relationship between board IT governance and firm performance (Figure 5).

This part of the theoretical framework relates board IT governance to Ashby's cybernetic concept of control and proposes that board IT governance impacts firm performance by increasing the board's ability to respond to disturbances in the environment and therefore increases the board's ability to control the organization's outcomes. It is not sufficient to have *more* IT governance, but rather to have more *appropriate* IT governance, and it is proposed that the type of board IT governance needed, and thus the impact on firm performance, is contingent on the role of IT in the organization.

Following Nolan and McFarlan's IT Strategic Impact Grid (2005), this research proposes that an organization which relies strategically on IT should practice offensive board IT governance; whereas an organization which relies operationally on IT for operations should practice defensive board IT governance. Using Ashby's Law of Requisite Variety it is proposed that a fit between the type of board IT governance needed, as dictated by the role of IT in the organization, and the type of board IT governance practiced will positively influence performance. Expressed in terms of Ashby's Law it is contended that the variety of IT governance activities available to directors, either offensive or defensive, enables them to sense a potential deviation from the goal (i.e. effective IT governance and improved firm performance) and to make more accurate and complex analyses of problems to respond to the deviation, and thus leads to an increase in achievement of goals. For example, the board of an insurance company that has a high reliance on IT for operations would need defensive board IT governance. Defensive IT governance activities could include oversight of the reliability, privacy and security of the systems and making sure that management has processes in place to ensure that IT resources are available to support IT in the organization. However, an organization with a similar reliance on IT, but who's board does not practice defensive IT governance, would

be more likely to be in a situation where the risks associated with IT are not addressed and a problem could occur (e.g. proprietary information compromised).

Since organizations vary in their IT governance needs, it follows that the impact of the type of board IT governance on firm performance will depend on the importance of IT to the organization. Consequently, the performance impacts of offensive board IT governance are amplified for organizations in which there is a strategic reliance on IT, and the impacts of defensive board IT governance are amplified for organization in which there is an operational reliance on IT. Therefore, it is proposed that:

Proposition 11: The positive relationship between *offensive* board IT governance and <u>financial performance</u> will be significant in organizations characterized with *high strategic reliance* on IT, but not in organizations characterized with low strategic reliance on IT.

Proposition 12: The positive relationship between *offensive* board IT governance and <u>operational performance</u> will be significant in organizations characterized with *high strategic reliance* on IT, but not in organizations characterized with low strategic reliance on IT.

Proposition 13: The positive relationship between *defensive* board IT governance and <u>financial performance</u> will be significant in organizations characterized with *high operational reliance* on IT, but not in organizations characterized with low operational reliance on IT.

Proposition 14: The positive relationship between *defensive* board IT governance and <u>operational performance</u> will be significant in organizations characterized with *high operational reliance* on IT, but not in organizations characterized with low operational reliance on IT.

Chapter 5
Research Methodology and Analysis

5.1 Phase One – Interviews with Directors

The first phase of the field research was qualitative, and consisted of both semi-structured questions on boards' general approaches to IT governance, and a discussion of IT governance decisions with which the board was involved.

The discussion of the IT governance decision was guided by the Critical Decision Method (CDM). CDM builds upon Flanagan's Critical Incident Technique (1954), by not only having experts recall and retrospect about previously encountered critical incidents, but by also using "a set of probe questions to elicit specific information about the important cues, choice points, options, action plans and the role of experience in judgment and decision making" (Hoffman et al, 1998, p. 257). The application of CDM has been found effective in uncovering expert knowledge and reasoning strategies in domains from nursing to the military to management (Ross et al, 2006). The use of CDM enabled a preliminary investigation of the context-dependent situation of board IT governance decision-making. Observation of study subjects making decisions in their natural setting is often used to study context-dependent situations such as expertise and decision-making; however, CDM was selected as the research method for this research instead of the observation method because of the difficulty of gaining access to board meetings due to confidentiality and other concerns. CDM was also selected because, according to Klein et al. (1989), CDM does not require an extensive amount of time with a domain expert to elicit knowledge, and time was at a premium given the schedule of the interview targets. Also, CDM, unlike other expert elicitation approaches, does not require extensive front-end effort in understanding the domain. This is important for elicitation of board knowledge because access to extensive information on the board or their activities was limited. Briefly, CDM was carried out as follows: (1) the critical incident was selected by the interviewee; (2) I asked for a brief description of the incident; (3) I used semi-structured questions to probe different aspects of the decision making process (e.g. cues used to make the decision) and outcomes of the decision (e.g. performance outcomes).

The interviews were audio-taped, transcribed and analyzed using a consistent schema that was developed based upon the theoretical framework. The interview data was analyzed with respect to the variables in the theoretical framework in order to determine the values for each of the variables. Then the data for each of the variables was used to reflect upon the theoretical framework.

The semi-structured questions and the discussion of an IT governance decision enabled the capture of descriptions of how these boards actually govern IT and the antecedents and performance consequences of their actions. Literature findings were triangulated with the interview observations to increase the understanding of board IT governance and facilitate the development of measures for the study's constructs and the establishment of construct validity. This phase also enabled a preliminary assessment of the theoretical framework.

5.2 Phase Two - Survey of Directors

The second phase of the field research consisted of a survey of directors. This quantitative phase was informed by findings from the interviews conducted in the first phase. The survey enabled analysis of broad relationships between the antecedents and consequences of board IT governance.

Ordinary Least Squares multiple regression was used to analyze the results; however, since the variables consisted of measured and latent variables, Exploratory Factor Analysis (EFA) was first conducted on the latent variables to analyze the sets of items that measure those constructs. EFA is useful for data reduction by condensing the information contained in a number of original variables into a smaller set of new, composite dimensions, with a minimum loss of information (Hair et al, 1998).

EFA based on the Maximum Likelihood Extraction method, combined with varimax rotation was used for each of the latent variables. Convergent and discriminatory validity tests were performed on the factors to assess construct validity. Convergent validity is testing whether the measures of constructs that theoretically should be related to each other are, in fact, observed to be related to each other. In other words, it assesses the degree to which multiple measures of the same concept are correlated. High correlations indicate that the scale is measuring its intended concept (Hair et al, 1998). It is argued that correlations above 0.4 indicate good convergent validity (Hayes, 1998). Discriminatory validity is testing whether measures of constructs that theoretically should not be related to each other are, in fact, observed to not be related to each other. In other words, it is the opposite of convergent validity. Therefore, both convergent and discriminatory validity are present when each item loads highest on its related factor and loads very low on unrelated factors.

In addition, Cronbach's Alpha was calculated for the factors to assess internal consistency reliability. In internal consistency reliability estimation, the reliability of the factors are assessed by estimating how well the items that reflect the same construct yield similar results. In other words, how consistent the results are for different items for the same construct within the measure being assessed. Cronbach's Alpha tends to be the most frequently used estimate of internal consistency. Values of Cronbach's alpha range from 0 to 1, with values of 0.6 and 0.7 deemed to be the lower levels of acceptability (Hair et al., 1998).

5.3 Summary

Overall, the combination of richer qualitative results from interviews and the objective survey results provided both valuable insights on how and why boards enact different types of IT governance in different situations and the possible resulting impacts.

Chapter 6 discusses the interviews conducted in phase one of the data collection process, Chapter 7 then discusses the survey.

Chapter 6
Phase One – Interviews with Directors

As noted in Huff et al. (2006), there appears to be little understanding of how boards govern IT. There were only three academic studies found in the literature which have directly examined how boards govern IT and there are many unanswered questions (refer to Table 1). Therefore, 10 in-depth interviews were conducted with corporate directors to probe how they govern IT, what influences their involvement in IT governance, and what have been the performance consequences.

The corporate directors were recruited via emails from the Director of Communications and Member Services at the Institute of Corporate Directors (ICD) to selected directors of its membership. The ICD membership consists of: directors, former directors, and aspiring directors; professionals who advise or serve boards such as auditors, legal counsel, pension specialists, management consultants; senior executives who report directly to a board member; educators in business schools and other disciplines; and others who have demonstrated a commitment to corporate governance. The ICD's Director of Communications and Member Services randomly selected 70 directors from the ICD's membership in the financial services industry and 35 directors in the hi-tech and telecommunications industries, these directors were sent an initial email inviting them to participate in an interview, and a reminder email was sent one week later. Directors who were interested in participating in an interview contacted me directly. Ten directors out of the 105 contacted volunteered to participate in the interview process and will be given a report summarizing the main findings from the research.

As shown in Figure 6, the 10 directors interviewed were on a total of 47 boards, with each director on an average of five boards. The boards were from a variety of industry sectors, with banks, savings and other financial institutions representing the largest proportion of the sample. Additionally, the directors interviewed had an average of 13 years experience on boards, and only three out of the 10 identified themselves as having no prior experience working in an IT role or in the management of IT in an organization.

Figure 6 - Interviews – Demographics of Respondents

Distribution of boards represented by sector

47 **Total**

8	Other
3	Education
3	Prof Services
3	Adv Tech
3	Energy / Utilities
4	Healthcare
7	Insurance
16	Banks, Savings and Other Financial

# of boards represented and tenure of directors

# of Boards (left axis: 0–20) / Tenure (years as board member) (right axis: 0–25)

Tenure values: A 18, C 15, D 15, E 20, J 20; # of Boards bar values: A 6, B 6, C 7, D 7, E 1, F 3, G 5, H 8, I 3, J 1. Points labeled: B 9, F 9, G 5, H 9, I 6.

Categories: A B C D E F G H I J

Directors' IT Experience

	A	B	C	D	E	F	G	H	I	J
IT Role						✓	✓		✓	✓
Mgmt of IT	✓		✓		✓	✓	✓		✓	✓

Each interview took an average of 75 minutes to complete and consisted of an in-depth discussion of one IT governance decision and/or incident with which the director was involved while serving on a board, and a semi-structured questionnaire to discuss IT governance on all of the boards of which the director was a member (refer to Appendix A for the Interview Protocol).

During the interview each director was asked to provide a novel IT incident with which the board was involved, where standard operating procedures could not be used to address the problem, and where the same outcome would not have occurred without board involvement. Using CDM, the incident was then discussed with the director focusing on understanding and disambiguating the decision-making. Specifically, the factors that directors used to identify an incident, such as past experience or discussions with management, were probed, the mechanisms used to assess the situation and generate a solution were analyzed, and the consequences of the incident were discussed. Finally, a semi-structured questionnaire was completed with the director during the interview to identify his/her boards' general approaches to IT governance.

6.1 Data Analysis

The interviews were analyzed using a consistent schema that was developed based upon the theoretical framework. First, categories were developed for each variable, then, where necessary, sub-categories were developed. The sub-categories were developed for the latent (unmeasured) variables. For example, IT

competency was a category that consisted of the sub-categories IT expertise and IT governance mechanisms. These sub-categories were then further divided as needed. For example, the sub-category IT expertise was divided into IT knowledge, IT experience, and IT education, and the sub-category IT governance mechanisms was divided into structures, processes and relational mechanisms. Codes were developed for each sub-category and the interview data was coded and assigned to the categories. Next, the coded data for each respondent was organized according to the appropriate sub-category and category, and this data was used to assign an answer to each question used to measure the variables. The coding methodology and an example of the coding are found in Appendix B. Additionally, the critical incidents were analyzed according to the type, cause, and consequences of the incident. Finally, within-participant and cross-participant analysis was performed.

The data analysis is presented as follows:

- Section 6.1.1 Values of Variables - The interview data is analyzed to determine the values for each of the variables in the theoretical framework. This analysis helped to determine if the measures of the latent variables corroborate the measures presented in the literature. The analysis also enabled the further development of measures for use in the survey.

- Section 6.1.2 Preliminary Confirmation (Disconfirmation) of Theoretical Framework - The interview data is analyzed in order to reflect upon the theoretical framework.

The data analysis is summarized below with the detailed analysis presented in the following sections.

Analysis of the interview data appeared to provide support for categorizing IT governance activities into offensive and defensive groupings. Offensive IT governance focuses on strategic IT issues (communication of IT strategy, alignment of business/IT strategies, IT governance self-assessment) versus operational issues (IT risk management, oversight of projects and investments) which are the focus of defensive IT governance. While there might be some ambiguity in separating the activities into the two groups at a managerial level, the separation of activities into strategic and operational at the board level was relatively straightforward. For example, strategic activities were future oriented, with much of the focus on planning for future IT functions; whereas operational activities were oriented in execution of the current IT functions. The majority of the boards' overall level of offensive IT governance was at least a Medium (13/15 or 87%), with only two boards at a low level of offensive governance. Similarly, the majority of the boards' overall level of defensive IT governance was at least a Medium (9/15 or 60%); however, a relatively large number of the boards received a rating of Low (6/15 or 40%).

Analysis of the board attributes in the data revealed the following:

- most of the boards discussed in the interviews had a low proportion of insiders (i.e. less than one third of the total directors);

- most of the boards were large (i.e. more than 8 members), and;

- the boards were evenly split between high and low levels of IT expertise, and the boards were evenly split between high, medium and low levels of IT governance mechanisms

Analysis also appeared to provide support for capturing the level of IT competency for each board using multiple questions to measure the presence of IT expertise and IT governance mechanisms. Broadly speaking, the interview data suggested that IT expertise may consist of knowledge of IT inside and outside of the organization. It also appears that it is possible to capture the extent to which the board receives sufficient information and the amount of training in IT and IT governance. Additionally, the interviews revealed that IT governance mechanism at the board level may in fact include structures, processes and relational mechanisms, and that these mechanisms are enacted inside and outside of the boardroom.

Analysis of the data revealed the following for the organizational factors:

- most of the directors interviewed were on boards of large organizations (i.e. greater than 500 employees);

- most of the organizations were formed more than 10 years ago, and;

- most of the organizations rated the role of IT in the organization as high.

In addition, analysis of the interview data appeared to provide support for Nolan and McFarlan's (2005) categorization of the role of IT along two dimensions – operational reliance on IT and strategic reliance on IT.

Furthermore, as shown in Table 4, the interview data showed mixed support for the proposed relationships between board attributes, organization factors and board IT governance.

Table 4 - Summary of Interview Data and Propositions

Proposition	Description of Interview Data	Conclusion
1	Only 47% (7/15) of the boards had the proposed positive relationship between proportion of insiders and board IT governance	Not supported
2	A positive relationship was suggested to exist between board size and IT governance (11/15 or 73%)	Contradictory
3	A positive relationship was suggested to exist between board IT competency and board IT governance (12/15 or 80%)	Supported
4	A negative relationship was suggested to exist between organization size and board IT governance (10/15 or 67%)	Supported
5	A negative relationships was suggested to exist between organization age and IT governance (11/15 or 73%)	Supported
6	A positive relationships was suggested to exist between operational role of IT in the organization and defensive board IT governance (10/15 or 67%)	Supported
7	A positive relationships was suggested to exist between strategic role of IT in the organization and offensive board IT governance (11/15 or 73%)	Supported
8	Only 53% (8/15) of the boards tended to have a positive relationship between role of IT in the organization and board IT governance	Not supported

Finally, the interview data did not allow for a detailed examination of the firm performance consequences of board IT governance; however, data gathered during the directors' descriptions of critical IT governance decisions that they faced while on boards suggested operational and strategic impacts of IT decisions and indicated how board governance, or lack thereof, has impacted firm performance.

6.1.1 Values of Variables

Some of the measures of the variables have been adapted from the research literature, and some have been created for this study. This section discusses the measures for each variable in the theoretical framework, and presents the values for each variable for each board. The discussion starts with the board IT governance variable and continues with the independent and dependent variables.

The values for each variable are reported for each of the 10 directors interviewed. Each director is assigned a letter, A to I, to distinguish his/her responses from the others. Most directors answered the questions for one board, and thus have one response for each question; however, directors B and H responded to the questions for four and three boards respectively and thus have multiple responses for each question. Thus, values of the variables are reported for 15 boards based upon the responses of 10 directors. Refer to Appendix C for an illustration of how the data is presented.

6.1.1.1 Board IT governance

Board IT governance is operationalized as a multi-item involvement measure on two dimensions: offensive and defensive IT governance. An effort was made to include IT governance activities from prior literature

for each dimension (ITGI, 2003; Nolan and McFarlan, 2005). The analysis of the interview data for offensive and defensive IT governance are discussed in turn.

6.1.1.1.1 Offensive IT governance

Offensive IT governance focuses on strategic IT issues, such as IT strategy, rather than operational issues, such as systems reliability. Three questions were developed to assess a board's level of offensive IT governance: (1) Is IT strategy adequately communicated to the board?; (2) Is business/IT strategic alignment adequate?, and; (3) Does the board perform IT governance self-assessment? Each director's responses to the questions can be seen in Appendix C - Table 1, and a summary of the responses is provided in Figure 7 below.

Figure 7 - Interviews - Number of Boards who Practice Offensive IT Governance Activities
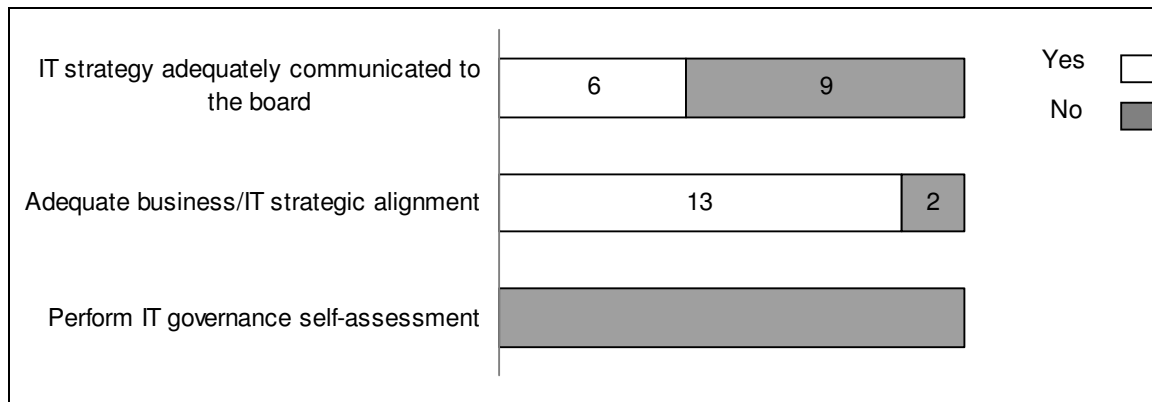
In response to the first question, most of the directors indicated that on their board(s) IT strategy <u>is not adequately communicated</u> to the board (9/15 or 60%). However, those boards where the interviewee thought that IT <u>is adequately communicated,</u> commented that IT strategy is communicated to the board as part of the business strategy as opposed to separate from the business strategy. This is how one director described the process:

> Director E: "IT strategy is communicated to the board as part of the total
> strategy of the company, linked into the business side. So there's a strategy
> document produced once every 3 years, it's a 3-year rolling plan, and its
> updated and a critical component of that is, here's what we want to do,
> here's where we need to go and here's what we need to do to get there, and
> IT is very much a part of that – its not a separate plan... its very clear where
> the systems parts are because they are identified in the document."

Furthermore, when asked how the communication of IT strategy to the board could be improved, many directors mentioned this joint reporting of business and IT strategy because as one director said, when the

strategies are presented separately it is "…up to the president and the board members to see the link between the IT and the business strategy" (Director B).

In response to the second question, most of the directors indicated that their board(s) (13/15 or 87%) has adequate business/IT strategic alignment. Additionally, the results seem to indicate a relationship between joint business/IT strategy reporting and business/IT strategic alignment because all of those boards where IT strategy is adequately communicated to the board, the business/IT strategic alignment is also rated as High.

In response to the third question measuring the offensive IT governance activities, all of the directors indicated that their board(s) did not perform an IT governance self-assessment. This is interesting given that the leading IT governance research (e.g. ITGI, 2003; Nolan and McFarlan, 2005) recommends that boards perform such assessments.

To determine the boards' overall practicing of offensive IT governance, each board was assigned an overall level of offensive governance (Appendix C – Table 2) based on analysis of the directors' responses to the questions in Appendix C – Table 1. The overall level of offensive governance is used in the assessment of IT governance fit in a subsequent section, and to calculate an overall level of IT governance for each board. The majority of the boards' overall level of offensive IT governance was at least a Medium (13/15 or 87%), with only two boards at a low level of offensive governance (Figure 8).

Figure 8 - Interviews - Number of Boards at Each Level of Offensive IT Governance
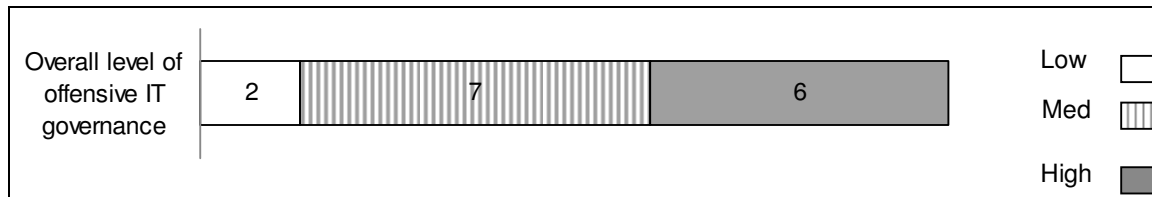
6.1.1.1.2 Defensive IT governance

Operational reliability is the focus of defensive IT governance. Each director's responses to the questions developed to measure a board's level of defensive IT governance can be seen in Appendix C - Table 3, and a summary of the responses is provided in Figure 9 below.

Figure 9 - Interviews - Number of Boards who Practice Defensive IT Governance Activities
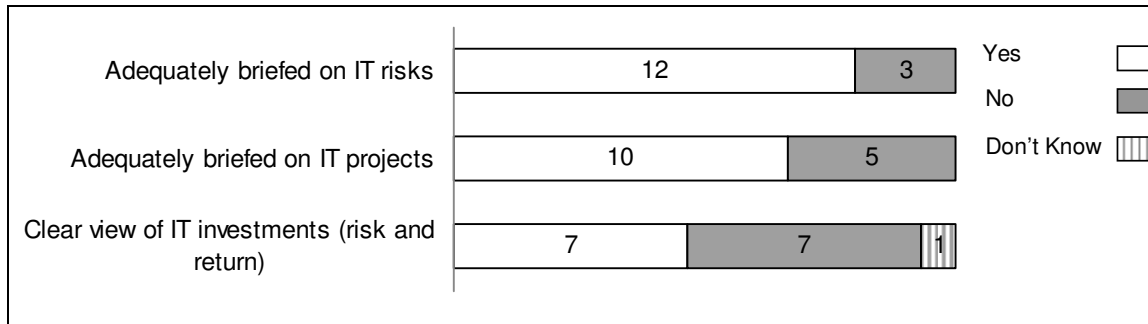
For the first two questions, most of the directors indicated that their board(s) is adequately briefed on IT risks (12/15 or 80%) and IT projects (10/15 or 67%). In fact, in response to the first question only one director indicated that IT risks associated with current operations are not currently reported at the board level at all. This director explained that:

> Director J: "…those are a management responsibility, not a governance issue. That is the age old decision - balancing act that has to be made all the time is to focus the board on governance not on management. And so I will argue quite strongly that the direction of the company is truly a governance issue but the supporting systems are a management issue."

Those who indicated that there are ways their boards could improve the communication of IT risks and projects suggested that the process of reporting could be changed from ad hoc to a regular item on the agenda of the board. One director indicated that the briefing on IT projects was improved by instituting an independent review and reporting process after a major project failure where the project reporting was not found to be accurate (Director C).

In response to the third question, approximately half of the boards (7/15 or 47%) have a clear view of IT investments. Furthermore, the results indicate that there is a relationship between an adequate briefing on IT risks and IT projects and having a clear view of IT investments. Six out of the nine boards who had an adequate briefing of IT risks and projects also had a clear view of IT investments. It is unclear why this relationship does not hold for all boards (Director B – board 3, Director C and Director F), but several explanations were offered by directors. For example, Director B when talking about the third board he is on indicated that the board is adequately briefed on IT risks and IT projects, but it does not have a clear view of IT investments. The director suggested that this may be because the organization is a subsidiary and "…it's probably the Audit Committee more than the board that's involved in systems. I think in reality its more that board of the parent company has a clearer view of systems." Alternatively, director C attributed his board's unclear view of IT investments, despite the fact that the board is adequately briefed on IT risks and projects,

to the difficulty in determining the business value of IT projects, and to the fact that the board is often only notified if an IT project is over budget or schedule, and does not necessarily receive feedback if an IT project fails to deliver the promised value.

To summarize the boards practicing of defensive IT governance, each board was assigned an overall level of defensive IT governance (Appendix C - Table 4) based on analysis of the directors' responses to the questions in Appendix C - Table 3. Like with the overall level of defensive governance calculated previously, the overall level of offensive governance is used in the assessment of IT governance fit in a subsequent section, and to calculate an overall level of IT governance for each board. The majority (9/15 or 60%) of the boards' overall level of defensive IT governance was at least a Medium; however, a relatively large number of the boards (6/15 or 40%) received a Low (Figure 10).

Figure 10 - Interviews - Number of Boards at Each Level of Defensive IT Governance
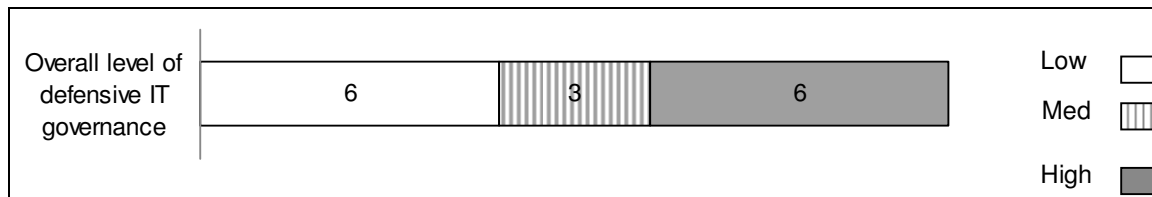
Most of the boards (10/15 or 67%) had the same levels for offensive and defensive IT governance; however, some boards did differ. For example, Director J's board had a high level of offensive governance and a low level of defensive governance, and Director G's second board had a medium level of offensive governance and a low level of defensive governance.

6.1.1.1.3 Overall Levels of IT Governance

Each board was assigned an overall level of IT governance (Appendix C - Table 5) based on the overall levels of offensive and defensive IT governance computed in Appendix C - Tables 2 and 4 respectively. This overall level of IT governance is used in the preliminary examination of the theoretical framework. Most of the boards had an overall level of IT governance of at least medium-low (13/15 or 87%), and only two of the boards had a low level of overall IT governance (Figure 11).

**Figure 11 - Interviews - Number of Boards at Each Level of Overall IT Governance**
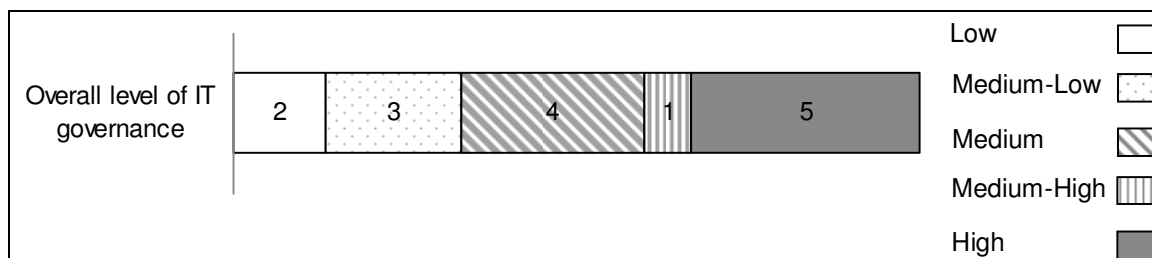
To assess the completeness of the overall level of IT governance construct, its ability to predict the measured "overall IT governance effectiveness" was examined. In an additional question, directors were asked to assess their overall level of IT governance effectiveness (Appendix C - Table 6). The computed "overall level of IT governance" factor was the same as the self-assessed "overall IT governance effectiveness" for thirteen of the fifteen boards[4] (different for boards H and I). This result indicates that the computed "Overall level of IT governance" construct captures the IT governance practiced by the boards.

The following are some of the directors' comments that were made regarding their boards' IT governance effectiveness:

> Director A: "…governance on all of the boards that I sit are best-in-class…"

> Director C: "In general, in this area of their accountability [IT governance effectiveness is rated at] a medium, or a 3 on a 1-5 scale. So they're not as effective as they might be in other areas."

> Director D: "Marginal – it's an area that we need to spend more time on, that we need to understand better and it's one of those things - how much should the board know and how much they should place reliance on management to deal with it. So I think it's an area that boards need to reassess and decide whether or not they have enough knowledge and understanding of the IT environment, the efficiencies, the effectiveness, the risks and exposures. So I really don't know the answer to that question. It's a good question and I want to explore it some more."

> Director E: "Top marks now [since dealing with a major project failure]… I've been so impressed on how it's turned around and this project management thing that after 5 years it's the state of the art. We've brought sophistication to it, we've got an IT culture there that links up with the business side and works effectively - I think we should outsource it."

> Director F: "Fine at oversight. But partly because there are no problems, or situations where we can't do something because of IT - [for example], losing competitive edge because of lack of nimbleness on the IT side - we just haven't had anything like that."

> Director G (board 3): "IT is mostly discussed at the Audit Committee and includes disaster recovery and privacy from a strategic stand point."

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[4] A value of "High" or "Medium-High" for "Overall level of IT governance" was treated as Very Effective, "Medium" and "Medium-Low" was treated as Effective, and "Low" was treated as Not Effective in order to correspond to the self-effectiveness ratings of IT governance.

Interestingly, as shown in Figure 12 overall the directors ranked their corporate governance higher than IT governance (see Appendix C - Table 7 for detailed responses), and all indicated that their boards performed corporate governance self-assessments (whereas none performed IT governance self-assessments).

Figure 12 - Interviews – Overall Effectiveness of IT Governance vs. Corporate Governance
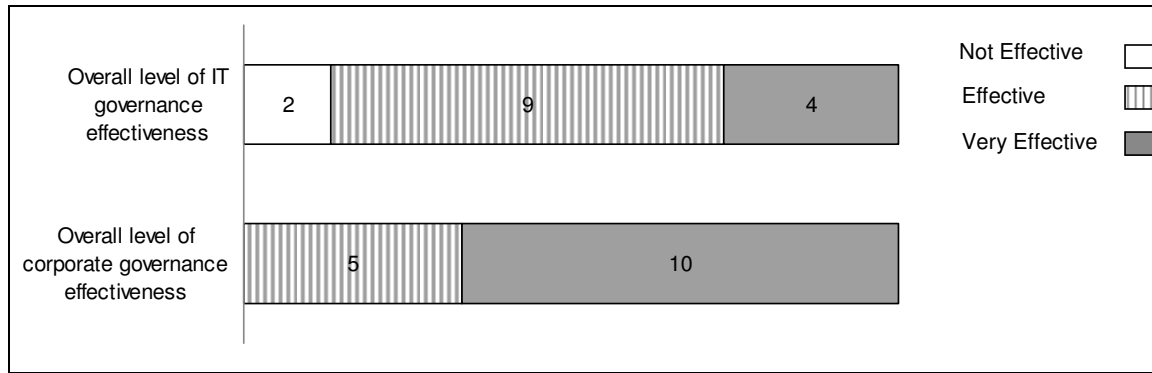
This suggests that IT governance is an area for improvement within corporate governance. In fact, when asked if there are ways the board could improve IT governance, all but one of the directors (Director A) said yes. Areas for improvement identified by the directors included: improving collective knowledge of IT, increasing the business management's ownership of IT strategy, and instituting a regular reporting process for IT at the board level. Some of the directors' comments are included below:

> Director B (board 1): "I think it is critical that the members of the board and the Audit Committee or whatever committee is charged with overseeing the systems area have collective knowledge of IT systems. Because you do get into some technical areas at different points and there needs to be an appreciation – I'm not saying there needs to just be one person, I think that's dangerous for only one person to have that technical knowledge… So I think that is how to improve is to ensure is that whether your board is charged or whether your committee is charged (audit committee or separate IT committee) then there must be people who understand different aspects of the systems area, otherwise you're just blown away. There's jargon…jargon can scare people, and even then you're not going to know everything… And if there are boards that don't have a collective knowledge either at the full board or the committee that's charged then they are at high risk."

> Director C: "…more ownership of the IT strategy by the businesses themselves is crucial. Because we spend a lot of time on the business strategy … we don't force enough discussion by those business leaders [on IT strategy] …the IT strategy generally doesn't get a high enough attention."

> Director D: "Make IT a regular item [on the board agenda], establish some sort of a regular reporting environment that means that rather than it being a

haphazard report it becomes a scheduled report that is maybe part of
enhanced risk evaluation – I'm not quite sure what form it takes, but get it
on the regular agenda."

6.1.1.2 Antecedents to Board IT Governance

The discussion of the interview data analysis now turns to the independent variables – board attributes and organizational factors.

6.1.1.2.1 Board Attributes

In the theoretical framework board attributes consist of proportion of insiders, board size and IT competency.

The first two board attributes (Appendix C - Table 8) use common measures from the research literature. The proportion of insiders refers to the number of insiders to total number of directors. Most of the directors interviewed (11/15 or 73%) described their boards as having a low proportion of insiders (i.e. less than one third of the total directors). Board size refers to the number of directors on a board. Most of the boards (9/15 or 60%) were large (i.e. more than 8 members). A summary of the responses is provided in Figure 13 below.

Figure 13 – Interviews – Proportion of Insiders and Size of Boards
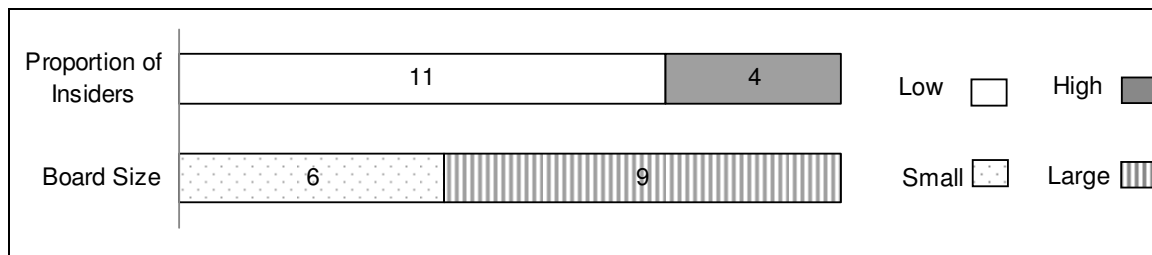
The third board attribute is IT competency. The measures for this attribute were created for this research. As discussed in Chapter 4, IT competency consists of IT expertise and IT governance mechanisms. The level of IT competency for each board is captured using an index comprised of multiple items to measure the presence of IT expertise and IT governance mechanisms. Each of these is discussed in turn.

IT Expertise – To assess the level of IT expertise on the board, the directors were asked to indicate if overall the directors of their board(s) are knowledgeable of IT, if there is IT leadership on the board, if the board receives sufficient information on IT, and if the board receives training in IT governance (Appendix C - Table 9). A summary of the responses is provided in Figure 14 below.

Figure 14 - Interviews - Number of Boards with IT Expertise
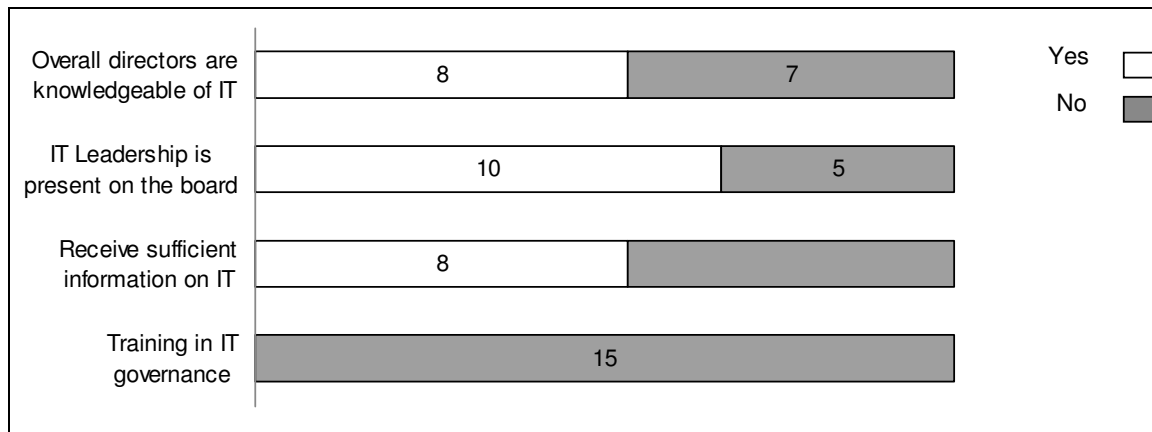
Approximately half (8/15 or 53%) of the boards were composed of directors who overall were knowledgeable of IT. Commenting on the IT knowledge of their board(s), the following are some of the remarks that were made:

> Director A: "Most of these people are CEOs or former, so what CEO or former CEO didn't have their finger in the IT pie on an ongoing basis because it's so important from operational and strategic issues for a company."

> Director H: "From an operational standpoint, [the directors] have themselves operated entities or been close to working with an IT system. So they understand much from an operational standpoint, but from a technical standpoint – less, obviously. I think that's one of the problems, we're not aware of the issues surrounding the maintenance and implementation of an IT system, there must be a lot of frustrated CTOs out there saying boards don't understand the difficulties I face."

> Director I: "Short of excellent, but pretty good and certainly compared to most companies, but you partly expect that. It's an IT company, it's a bunch of people with IT experience sitting on the board – they're harder to smoke and they waste far less time on asking questions that anybody who's been in the industry is going to know the answer to."

More specifically, speaking about the board's knowledge of IT strategies in the organization one director described it as:

> Director D: "Not better than 50-50... If you walked around the board-room table and asked the question, what's the companies' IT strategy, I don't think you would get a coherent answer from more than half of the people around the table…[It's a] combination of individual understanding and comfort level with the IT environment and then degree to which at some

point during the year, the IT strategy is presented to the board. That's probably why you need to have IT as a regular agenda item so that maybe once a year somebody says to the board, this is our IT strategy. And reminds everybody what it is."

Finally, when asked to describe the characteristics of an IT knowledgeable director, one director stated that it includes:

Director C: "someone who came from the industry…somebody who has managed major IT projects and a CFO, CEO, or unit head over major projects…we assume that if you've been the CEO or CFO of a large organization you've pretty much had some IT experience, so as an example, we determined 3 or 4 years ago that we didn't have anybody that represented a business that made anything, all we had was financial people, and …so we hired [a new director]."

Moving to the second question on IT expertise, it was indicated that IT leadership was present on 10 of the 15 boards (67%). IT leadership refers to one or more directors on the board who lead discussions on IT among the board and/or with IT management. The results suggest that IT leaders in the boardroom do play an important role in the governance of IT. For example:

Director A: "The chair would always have to be active, and if there are people on the board (and there are in just about every board that I'm on) that have particular expertise in IT, then they would probably take the lead in the questions."

Director C: "I would say 2 or 3 [directors lead the discussions]. The Head of the Audit Committee tends to be a strong view because they tend to look at a lot of the results, the financial part of the books; I tend to play a strong role because of my IT background. I was brought onto this board as an IT expert."

Director H: "Directors with IT knowledge lead discussions at [the company]. When they talk about "well the costs in this area should be 70% of revenue because other companies are doing it and I'm aware of blah, blah, blah, so-in-so is doing it, are we doing that?" They really put management's feet to the fire. More insightive questioning. I don't know the ratios, they do."

Moving to the third question on IT expertise, approximately half of the boards (8/15 or 53%) indicated that they receive sufficient information on IT. One director commented:

Director H: "One thing I find a problem for me as a director is finding out in the reports from the CTO the purpose of the systems that we are introducing. I do find in some of the fine print that we are introducing [a certain type of system], but it has all kinds of letters and stuff in front of it and it's hard to figure out the purpose of the system. … My first criticism

really is – I have difficulty about reading right through the report and really digging into it, and determining what on earth these systems are supposed to be doing."

Similarly, when asked why he stated that his board received insufficient information on IT, one director stated:

> Director C: "Most boards are very cynical when it comes to IT... projects fail, cost more than you expect, they're late. The IT organization communicates very poorly with boards - they can't get it in English. Its always in technology speak and I would say that in general there is a cynicism by boards that IT is not the most interesting subject to get into because you're going to feel "am I going to get scammed again?", they're going to ask for a lot of money and I'm going to look back in a year and this project will be off track and we'll have to do something or suck-it-up and pay for it."

One director who indicated that his board does not receive sufficient information on IT commented on the importance for management to provide the board with information, especially about how competitors use IT to support the business:

> Director D: "Boards would be as knowledgeable as what management brings to us. If you're on one [company in a particular regulated industry] you can't be on another one because of competitive issues, so what I see is the company I'm involved with. We have to rely on management to let us know what is happening in the industry."

Finally moving to the last question on IT expertise, all of the boards indicated that they had not received any training in IT governance. However, many of the directors indicated that such training would be beneficial. In fact, one director whose organization recently experienced a major IT system implementation failure even commented that if the board had training in IT governance before the incident it may have helped avoid the situation (Director E).

Overall Level of IT Expertise - Thus when considering all four questions measuring IT expertise, an overall level of IT expertise was computed for each board (Appendix C - Table 10). This overall level of IT expertise is used to compute an overall IT Competency level which is used in the preliminary examination of the theoretical framework. Seven boards had a high level, one board had a medium level, and seven boards had a low level (Figure 15).

Figure 15 - Interviews - Number of Boards at Each Level of Overall IT Expertise

Overall IT Expertise	7	1	7	Low ☐
				Med ▥
				High ▦
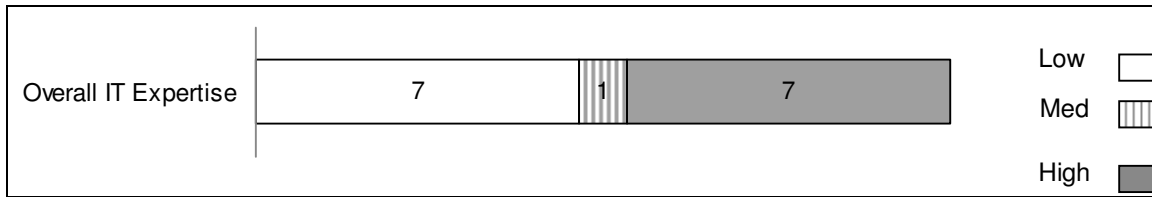
IT Governance Mechanisms - The second item used to measure board IT competency is a board's use of IT governance mechanisms - structures, processes and relational mechanisms. To measure boards' use of such mechanisms, questions were asked to uncover the extent to which the types of mechanisms are used (Appendix C - Table 11). Relevant IT governance mechanisms from prior literature were included and to some extent were used to constrain the construct to items mentioned in the literature. A summary of the responses is provided in Figure 16 below.

Figure 16 – Interviews – Number of Boards with IT Governance Mechanisms

Structures

IT Champion on board	14	1
Director recuitment considers IT	5	10
IT strategy committee		15

Yes ☐
No ▦

Processes

IT regular item on board agenda	9	6
Regular sessions of directors to discuss IT	8	7

Relational Mechanisms

Directors and IT mgmt communicate between meetings	9	6
CIO regularly attends board meetings	9	6
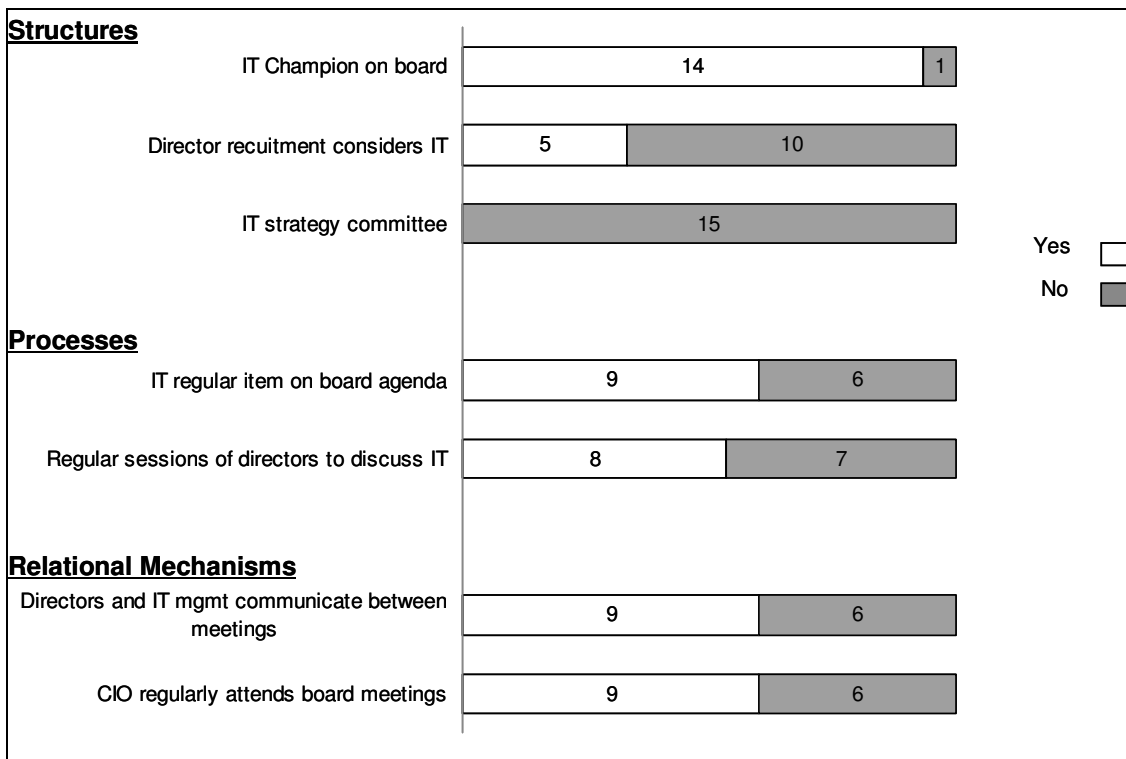
Structures - Three questions were asked to measure the presence of IT governance structures on boards. The questions were: who is the key champion of IT on the board, does director recruitment considers IT expertise, and is there an IT Strategy Committee at the board level (Appendix C - Table 11). The responses to each of these questions are discussed in turn.

The majority of the directors interviewed identified the CIO as the key champion of IT, with some also identifying a key role for the CEO, for example,

> Director B: "I suppose it has to be the CIO, but with the full support and leadership from top-down of the CEO. The easy answer is that it always is the CEO, because without the CEO's endorsement and leadership nothing will get done, however, there has to be a champion that can challenge the CEO and I would say that's the CIO."

One director, G, identified himself rather than the CIO as the champion of IT for all the boards of which he is a member. He had extensive IT expertise in the implementation and management of IT and thus initiates and leads most of the discussions and questions on IT governance.

In response to the second question, only five of the fifteen boards (33%) specifically consider IT expertise in the recruitment of directors. However, it was recognized as something that maybe should be considered in future recruitment efforts.

One director whose board does consider IT expertise in director recruitment described the kinds of IT expertise they look for as follows:

> Director C: "We look for somebody who has … come from the industry ... somebody who has managed major IT projects and a CFO, CEO, or unit head over major projects. And we ask the directors to self-assess themselves each year we send a survey out we have these 22 competencies and we say do you have a 1 level skill, or 2 level, 3 being the highest, which means you're quite competency. And then when we get that we look for holes as we have retirements. IT is one of the competencies. Because we have 22 competencies and 17 directors you're not expecting all of the directors to have IT, but we probably look for 2 or 3 and we assume that if you've been the CEO or CFO of a large organization you've pretty much had some IT experience…"

Finally, when asked about the last IT governance structure - IT Strategy Committee - none of the boards had such a committee and only one board had even considered creating such a committee. However, in the end the board decided against it because "there was no clear direction in industry and they decided they wanted to involve the whole board in IT oversight" (Director B). In fact, some of the directors were strongly opposed to an IT Strategy Committee commenting:

> Director A: "Do you have a marketing committee of the board, do you have a commercial banking committee, no – you'd have 100 committees."

> Director C: "No. Boards avoid more committees… [there] used to be lots of committees, most of us are spending our time shrinking such committees, as opposed to creating another category."

Director E: "We do strategy sessions at the board level and the CTO is part of those strategy sessions, but no specific committee. And it wasn't really a consideration. Who has time? It's a huge problem."

Processes - Two questions were asked to measure the use of IT governance processes on boards: is IT a regular item on the board agenda, and are regular sessions held for directors to discuss IT (Appendix C - Table 11).

In response to the first question, nine of the fifteen boards (60%) were identified as having IT as a regular item on the board agenda. Commenting on the difference between two of the boards he is on, director B said that IT is a regular item on the agenda of the board at one organization which relies on IT for competitive edge; whereas at another organization that depends on IT for operations, there is more reliance on Internal Audit and IT is discussed more so on the agenda of the Audit Committee. Another director commented that his board makes use of committees to discuss an IT issue before deciding whether a discussion is needed in the boardroom. For example, "…Sarbanes Oxley would have gone to the Audit Committee and Information Security goes through the Audit Committee" (Director C).

Finally, in response to the second question, eight of the fifteen boards (53%) were identified as holding regular sessions for directors to discuss IT. For the most part it is the same boards that have IT as a regular item on the board agenda that hold regular sessions for directors to discuss IT. Two directors commented that these sessions to discuss IT are often informal occurring over dinner and consisting of "…free wheeling discussion about IT – much better than doing it formally…" (Director H).

Relational Mechanisms - Two questions were asked to measure the presence of relational mechanisms on boards: do directors and IT management communicate between schedule meetings, and does the CIO regularly attend board meetings (Appendix C - Table 11).

In response to the first question, most of the directors (9/15 or 60%) indicated that of the boards they are on directors and IT management do communicate between scheduled meetings. Director C indicated that because of his background in IT he has regular discussions with the CIO and that it could take the form of a pre-review before making a presentation to the board. Commenting on communications between directors and management outside of the boardroom, one director said:

Director B: "The boards that I sit on the president encourages board members to talk with senior management and all of the boards that I've been with encourage that and management welcomes that. It's for better interaction and it does happen and I think it should happen. As good governance it works both ways. Based on the boards perspective to get an understanding of the business and the issues and a better understanding of the people involved, because we have to assess senior management. Then from senior management's perspective what's on our minds. And so all the

boards I've sat on the CEO has encouraged us to talk to senior management and we get a lot of presentations by senior management by the board."

Conversely, the directors that indicated that their board(s) did not communicate between scheduled meetings (6/15 or 40%) pointed to the importance of maintaining a separation between the board and management. For example:

Director A: "There's a very important line here with boards not wanting to get involved in the management of the company. "

Director D: "No – nor should they. Why would the board meet with the CIO?"

Director J: "[The board communicates with management] at board meetings and through the president. We're very careful and I personally honor those communication lines very diligently, the board communicates through the board chair to the president. The president and board chair are in touch very frequently. And before every board meeting, the president and the board secretary are very careful on how to prepare and touch base with the board members."

In response to the second question measuring the use of relational mechanisms, nine of the fifteen directors (60%) indicated that the CIO does regularly attend their board meetings. One director noted that the CIO attendance at board meetings differs for organizations because of the strategic nature of IT.

Director A: "On one board [the CIO] attends all meetings, and the committee meetings. On another board the CIO attends when there's an IT relevance to what we're discussing. On some of the boards they don't show up at all - unless there's an issue. Don't show up because IT is not relevant to the strategic nature of the discussions of the board. It's not that the governance is different; it's just that the relevance of the IT to the strategic nature of the board discussions is not as high in some companies as in others. And so if the CIO was attending all those meetings he'd literally be wasting his time, whereas if IT is important, the CIO is attending strategic discussions, not related in any way to IT and low and behold he becomes an important part of the discussion."

The same director noted that CIO attendance at board meetings builds a relationship between directors and the CIO which enables the directors to accurately assess the level of comfort the directors should have in IT management and its decisions. The director stated:

Director A: "The CIO attends most of the board meetings, makes presentations to the board meetings, so that you are able to get a good sense of their knowledge, what they're doing, how they're doing it, how they present what they're doing and that person's interaction with the CEO and the rest of the management team. Those kinds of judgments are some of the most important judgments that the board can make, not just about the CIO,

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but they're doing that about all the senior management who are sitting around the table. If you continually ask the CIO some due diligence questions and get four answers, then there are red lights going on all over the place."

Overall Level of IT Governance Mechanisms - When considering all questions measuring presence of IT governance mechanisms – structures, processes and relational mechanisms - an overall level of IT governance mechanism usage was computed for each board (Appendix C - Table 12). This overall level is combined with overall IT expertise to compute an overall IT competency level which is used in the preliminary examination of the theoretical framework. Two boards had a low level usage of IT governance mechanisms, nine had a medium level, and four boards had a high level (Figure 17).

Figure 17 - Interviews - Number of Boards at Each Level of Use of IT Governance Mechanisms
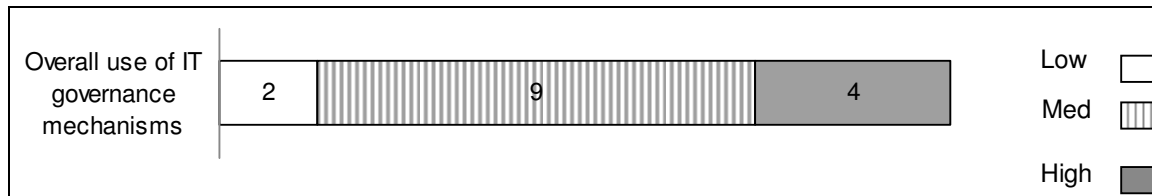
Overall IT Competency **-** Finally, an overall IT Competency value was calculated for each board based on the computed overall IT Expertise and IT Governance Mechanism value for each board (Appendix C – Tables 10 and 12). This overall level of IT Competency (Appendix C - Table 13) is used in the preliminary examination of the theoretical framework in the following section. Most of the boards had an overall level of IT Competency of at least medium (9/15 or 60%), and only six of the boards had a medium-low or low level of IT Competency (40%) (Figure 18).

Figure 18 - Interviews - Number of Boards at Each Level of Overall IT Competency
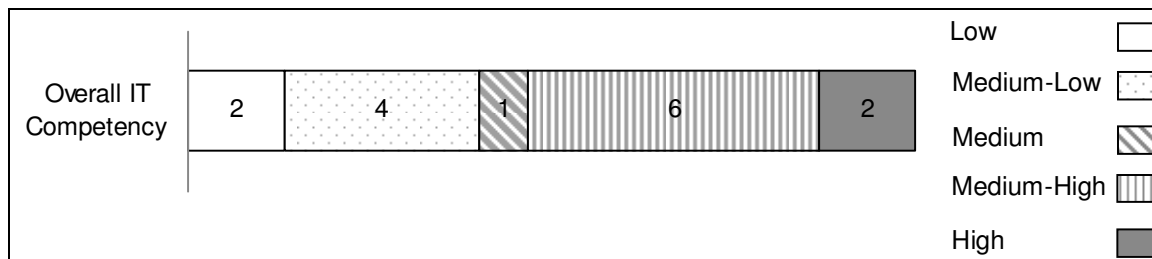
To assess the completeness of the overall IT Competency construct (Appendix C - Table 13), its ability to predict a measured overall IT Competency was examined. In an additional question, participants were asked to assess whether the "IT Competency of the overall board meets their strategic needs" (Appendix C - Table

14). The computed "overall IT Competency" factor was the same as the self-assessed "IT Competency of overall board meets the strategic needs" for all of the boards[5].

6.1.1.2.2 Organization Factors

   The organization factors use common measures from the research literature. The first factor, organization size refers to the number of employees (Appendix C - Table 15). Most of the directors (10/15 or 67%) were on boards of large organizations (i.e. greater than 500 employees). The second factor, organization age refers to the number of years since the organization was founded. Most of the organizations (9/15 or 60%) were formed more than 10 years ago (i.e. classified as old). A summary of the responses is provided in Figure 19 below.

Figure 19 – Interviews – Number of Boards at Different Organization Sizes and Ages

   The third organization factor, role of IT is measured on two dimensions – operational reliance on IT versus strategic reliance on IT (Appendix C - Table 16). This is based upon Nolan and McFarlan's IT Strategic Impact Grid (2005), which delineates four modes of IT reliance based on where an organization fits on the grid – Support, Factory, Turnaround and Strategic. A summary of the responses is provided in Figure 20 below.

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[5] A value of "High", "Medium-High" or "Medium" for "Overall IT Competency" was treated as equivalent to Yes for "IT Competency of overall board meets the strategic needs", and "Medium-Low" or "Low" was treated as equivalent to No.

Figure 20 – Interviews – Number of Boards with Operational and Strategic Reliance on IT

Operational reliance on IT

How important do your consider IT to be to the successful operations of your organization?

| 5 | 10 |

Low ☐
High ◼ (shaded)

Strategic reliance on IT

How important do you consider IT to be to the successful delivery of this strategy or vision?

| 4 | 11 |
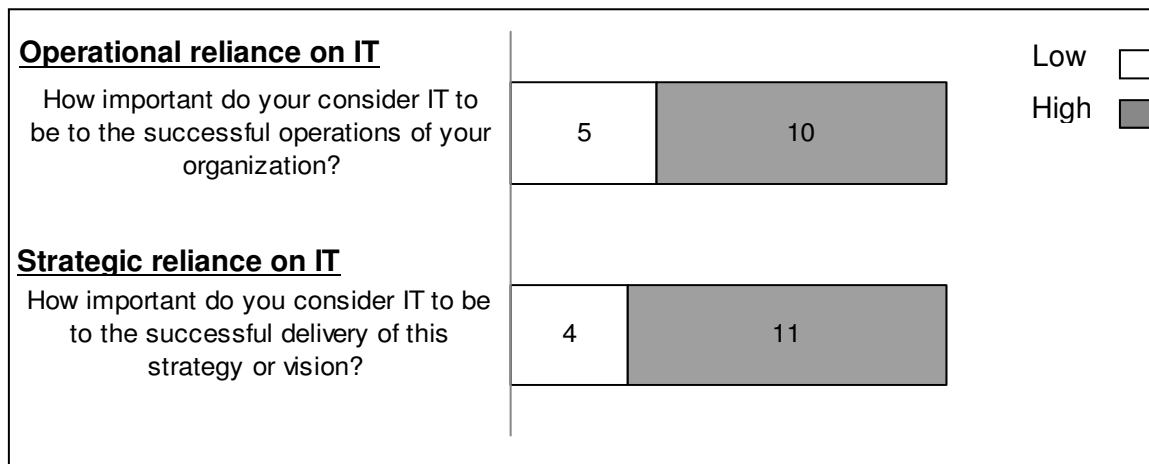
The results of the interviews identified organizations in each of the modes (Figure 21), with the majority, eight of the fifteen organizations (53%), having a high operational and strategic reliance on IT (Strategic Mode).

Figure 21 - Interviews – Boards Mapped onto the IT Strategic Impact Grid

Defensive | Offensive

G2 G3

A B1 C
D E F
G H

Factory Mode | Strategic Mode

I J

B2 B3 B4

Support Mode | Turnaround Mode

Low to High Need for Reliable Information Technology

Low to High Need for New Information Technology
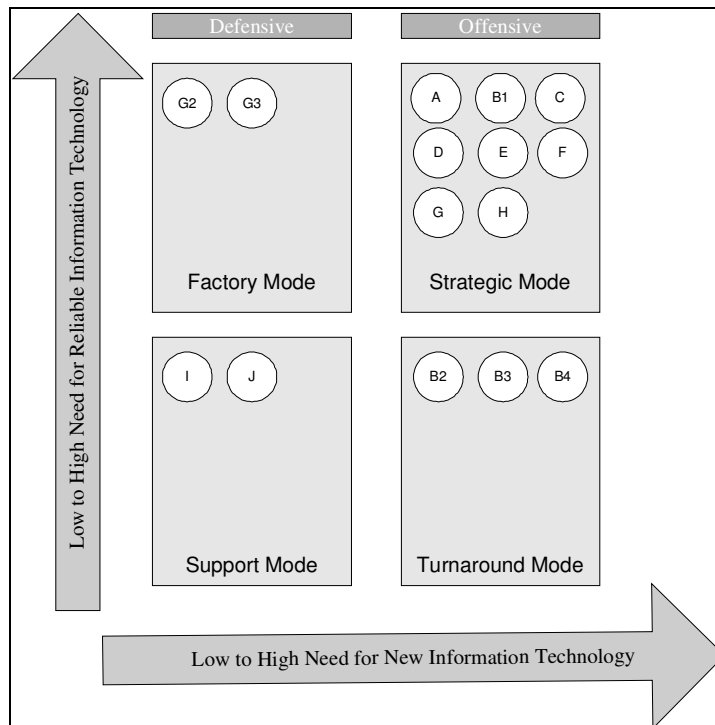
A director of an organization in the Strategic mode commented that IT is "…critical to your strategy and it's critical to your reputation and it's critical to your competitiveness. So it couldn't be more critical" (Director A). However, a director of a company in the Support mode stated "IT just isn't that big an issue for [our company] except for the product strategy. The number of transactions is small, the criticality of the

information is just not there as long as you can recover and the strategic use of IT just isn't that important" (Director I).

Overall Role of IT in the Organization **-** Finally, an overall role of IT in the organization value was calculated for each board based on the "operational reliance on IT" and "strategic reliance on IT" value for each board (Appendix C - Table 16). This overall role of IT in the organization (Appendix C - Table 17) is used in the preliminary examination of the theoretical framework in the following section. Most of the organizations had an overall role of IT in the organization of at least medium (13/15 or 87%), and only two of the boards (13%) had a low overall role of IT (Figure 22).

Figure 22 – Interviews – Number of Boards at Different Levels of Role of IT in the Organization
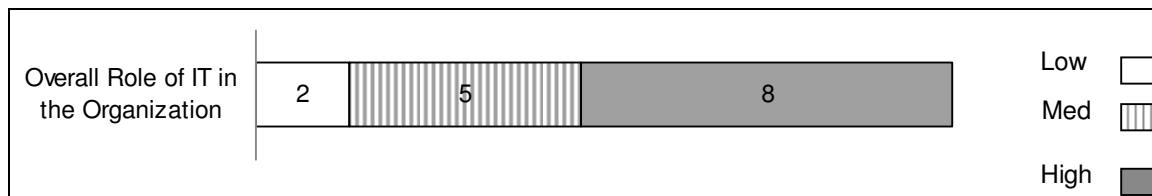
6.1.1.3 Consequences of Board IT Governance

It was not possible to quantify the firm performance consequences of board IT governance with a group of 10 directors; therefore, the data gathered during the directors' telling of a critical IT governance decision that they faced while on a board was used to examine the consequences of board IT governance for specific IT decisions. Most of the directors (8/10) were able to identify an IT governance decision that they were involved with while serving on a board, and two of the directors discussed two decisions. In this section a brief synopsis of the 10 IT governance decisions that were discussed by the directors are presented. Then these decisions are grouped by cause and consequence of the problem in order to help understand the variety of IT decisions faced by boards and the potential operational performance outcomes of those decisions.

A brief synopsis of the IT Governance decisions discussed by the directors is given in Table 5. The decisions ranged from problems with the current systems functionality, to decisions with whether to implement new systems, to problems with the implementation of new systems. The responses were as varied as the decisions. The responses ranged from the creation of new procedures to deal with this problem and potential future problems, such as the creation of a senior IT position, the firing of the current CIO, and the creation of a new process of reporting on IT projects, to the following of standard management and board reporting practices such as the reporting of a system failure and subsequent periodic updates on the status of the problem until it was resolved.

Table 5 - Interviews – Synopsis of Critical IT Governance Decisions

Synopsis of IT Governance Decision		
Critical Decision	**Description of IT Governance Decision**	**Board's Response**
1.	The systems "went down" and were not accessible to customers. The problem was reported in the media.	The board was notified of the incident by the CEO within hours and held a conference call to discuss immediate action. Then at the next board meeting, the CIO presented why the incident occurred, what has been done to fix it, and why it won't happen again. The board actively questioned and probed management on the incident. In the past when incidents like this have occurred that had a reputation impact the board has hired outside consultants to investigate the incident and to report to the board. The incident is resolved when the board has comfort that the incident won't happen again. This comfort is based on the CIO's presentation and answering of questions on the incident, and based on the CIO's previous contact with the board. The comfort is also based on confidence in the CEO. The CIO does not just go to board meetings when there's an incident to discuss, the board must see the CIO as part of the management team.
2.	A new IT product was to be developed for external sale – considered creating a new subsidiary to manage the new IT product.	CEO recommended hiring a new VP of IT to primarily oversee the new subsidiary but also all the IT of the organization, including the system upgrade (see decision number 3). The recommendation was brought to the HR Committee who brought the idea to the board. There used to be a senior IT position, but not as senior as this new position (reporting to the CEO). The board and CEO determined that there was too much risk involved with the new project not to have a senior management position in IT to manage the IT operations and strategy of the organization.
3.	Systems upgrade needed to make systems more robust. (Note: same board as number 2).	See board's response for number 2.
4.	Failed IT project – system was unable to deliver promised results, it was over budget and over schedule. In the end after two years of effort, the project was cancelled.	CIO would report annually to the Board on the major capital IT projects. After two years of reporting that everything was fine, it was discovered that the CIO was not reporting the problems with the project. So due to the reporting on this project status and other projects, the decision was made to fire the CIO, hire someone from within the company and then get the CFO to report on the schedule and budget of IT projects (with the CIO present to answer questions). Reporting on the project occurred every meeting and the board hired an outside consultant to review the project and report to the CIO and management who reported to the board. The project has since been cancelled.
5.	Loss of customer data creating privacy, information security concerns. The problem was reported in the media.	The board was notified of the problem by the CEO who sent out an email immediately. He informed the board of the loss and told the board that the problem would likely be reported in the media. The board followed the incident for 6-9 months afterwards as part of every update, and it also employed an external consulting firm to review the information security process and to hold an education session for the board for an hour on the latest thinking for security.
6.	Systems didn't support current operations and thus resulted in higher operation costs for manual labor. Also the systems didn't support planned future business operations. Finally, there were control weaknesses with the current systems that had been identified by Internal Audit.	Board found out about the problems from financial reporting (higher than expected operating costs) and internal audit at the Audit Committee reporting the control weaknesses. This problem went on for 2-3 years and the IT Director was promising to fix the problems. However the problems remained and the CEO, with input from the board decided to fire the IT Director and create a new CIO position, reporting to the CEO. The CEOs standing was increased because he recognized a weakness the IT Director and the need to hire a new CIO. Now the CIO reports at board meetings.
7.	System implementation problems were experienced. It was discovered that neither external consultants nor the VP of IT communicated IT project implementation problems with the board over a two year period.	Board found out about the system implementation problems from the CEO and the VP of IT (did not report to a C-level executive) when a major part of the new system was missing. The CEO fired the VP of IT, the CEO did not get a bonus, and a new CTO was hired who reported to the CEO. The board didn't have any input into the firing of the VP IT. The board told the CEO that he needed to fix what was happening, but the board was not involved with the creation of the CTO position– it was the CEO's decision. Now the CEO is much more involved, as is the CTO. The CEO gives quarterly reports to the Audit and Finance committee and to the board because he gives the sate of the nation report.

Synopsis of IT Governance Decision		
Critical Decision	**Description of IT Governance Decision**	**Board's Response**
8.	Need for creation of a new application which would represent a new line of business.	CEO asked one of the directors to mentor the VP of Strategic Initiatives through the process of developing and implementing the new system. The CEO knew he had the skill-set at the director level so he didn't have to hire an outside consultant. Bi-weekly the director met with the VP of Strategic Initiatives to guide the VP through the process and to put the VP in contact with others with domain expertise.
9.	Development of several new systems over a four to five year period. There were cost overruns and delays with the systems.	The CTO proposed to the board what was going to be developed and the advantages that would come from introduction of the new system. The board was given a summary type report of the service providers who would be used, and, later on, why we've changed and who's performing who's not. The board approved the budget and approved the time schedule. The system implementation was delayed by about a year. Updates were given to the board about once a year and sometimes more frequently. The board is often updated in the budget meeting because of the high expense. All the basic decisions are at the board level, but maybe go to the Audit Committee first with more detail. The Audit Committee's interests are in the control area, that everything is tested.
10.	Proposal for new system brought to the board for approval.	Conventional corporate governance approaches were used. Management brought forward the request for a new system, brought forward the business case, and explained why it was a good idea. The board didn't want to make the decision in isolation and decided to compare the system request with other priorities in its strategic planning session. The whole board was involved in the decision.

The decisions can also be organized into three categories that capture the cause of the problem. As seen in Table 6, the three causes of the problems are: problems with IT functionality, problems caused by IT personnel, and problems caused by situational factors. Problems with IT functionality refer to problems that can be primarily attributed to technical reasons. For example, problems where the IT system went down (decision 1), or the system was unable to support current operations resulting in higher manual labor costs (decision 6). Problems caused by IT personnel include problems whereby management of the system was flawed in some way and was primarily responsible for the problems. For example, management did not adequately report problems to the board (decisions 4 and 7). Problems caused by situational factors refers to problems where situations outside of the current operations of the organization necessitated an IT decision at the board level, such as a new IT product (decision 2) or a new line of business (decision 8).

Table 6 - Interviews – Causes of Critical IT Governance Decisions

Critical Decision	Cause of IT Governance Decision		
	Problems with IT Functionality / Operations	**Problems Caused by IT Personnel**	**Problems Caused by Situational Factors**
1.	X		
2.			X
3.	X		
4.		X	
5.		X	
6.	X		
7.		X	
8.			X
9.	X		
10.	X		

Finally, as can be seen in Table 7 the consequences of the critical IT governance decisions have been organized into seven categories. The IT governance decisions had operational impacts - affecting the current business operations, and strategic impacts - affecting future operations of the organization. Additionally, some of the problems had both operational and strategic impacts. Other consequences included increased negative reputational impacts, loss of information, increased risk exposure, project cost overruns, and failed projects.

Table 7 - Interviews – Consequences of Critical IT Governance Decisions

Critical Decision	Consequences of IT Governance Decision						
	Operational	Strategic	Increased Negative Reputational Impact	Loss of Information	Increased Risk Exposure	Project Cost Overruns	Failed Project
1.	X		X				
2.		X			X		
3.	X		X		X		
4.		X			X	X	X
5.	X		X	X	X		
6.	X	X		X			
7.	X	X					X
8.		X					
9.	X	X			X	X	
10.	X	X					

So while it is difficult to quantify the operational performance consequences of IT governance for the organizations of the directors interviewed, the sometimes far-reaching consequences of the critical IT governance decisions discussed by the boards do suggest the extent of the impact of IT decision and how board governance, or lack thereof, can influence the impacts. One of the best examples of how board IT governance may influence the success of IT projects and thus potentially impact operational performance is the systems implementation project failure (decision 7). In this example, it was discovered that neither external consultants nor the VP of IT communicated IT project implementation problems with the board over a two year period and this resulted in a $100 million project failure. As a result of this problem, the organization created a C-level IT position and involved the CEO and CTO in increasing information sharing between management and the board. As the director commented:

> "But one thing it did do at the board level was it woke the CEO up to the fact that there has to be a better link bringing his management team to the board and developing that team and creating a good atmosphere at the board. And the board has worked on that too… focus was put on how the board interacts as well as how management interacts – and we've had a couple of retreats and that's helped and [the CEO's] put a big focus on the development of [the management] team and we can see as a board some very positive changes in the whole thing…So the happy upside is that [the CEO's] built a good team, we're happy with that team, we interact far better and it's another happy consequence of a major systems problem. On the

operational side we are great. Because there's the reporting at the Audit and Finance Committee by the IT group – here's our IT plan for the year, here's what we're doing, here's what's happening. The bigger focused picture on IT as an organization its better communication and its put it on the front burner and he's very open and if he has a problem he tells us and explains why, there's no cover ups and we ask better questions, having been burnt badly once we ask a lot of questions and he must get sick of it, but its part of the governance."

This organization currently is developing a new system and the process is being handled differently at the board level. The director described this board as now having very effective IT governance and described how the process is different:

"It's part of the strategic plan, IT has been very, very much been built into the strategic plan and so there's quarterly report specific to that system, related to the strategic plan, and …we get more detailed hands on involved in, in terms of questioning."

Another director talked about how his board's experience with a failed $250 million IT project that resulted in improvements in the board's governance of IT (decision 4). Since this project, the board has instituted a third party review and reporting of IT projects, and changed the reporting structure for IT outsourcers, with outsourcers now reporting to management instead of the board, and management being ultimately responsible for the work of outsourcers. This director now describes his board's governance of IT as very effective.

6.1.2 Preliminary Confirmation (Disconfirmation) of Theoretical Framework

The preliminary and exploratory nature of these findings is emphasized. The interviews resulted in detailed information on the variables in the theoretical framework for 15 boards. While a significant amount of qualitative data was collected, the sample is not appropriate for the use of rigorous statistical analysis; therefore, a simple descriptive showing the level of agreement among the boards for each independent variable was used.

6.1.2.1 Antecedents to Board IT Governance

The relationships between the board attributes, organizational factors and board IT governance were identified in the interview data, and then the level of agreement with the expected relationships, based upon the propositions, was calculated for each independent variable (Table 8).

Table 8 - Interviews – Preliminary Confirmation (Disconfirmation)

	Actual Relationship with Board IT Governance											Level of Agreement with Expected Relationship (# of boards in agreement / 15)
Expected Relationship with:	**Director**											
ITG	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**		
Board Attributes												
P1: Proportion of Insiders	+	-	- + + +	-	-	-	-	- + +	+	+	-	7/15 = 47%
P2: Board Size	_	+	+ + + +	+	+	+	+	- - -	+	-	+	4/15 = 27%
P3: IT Competency	+	+	+ + - +	+	+	-	+	+ + +	-	+	+	12/15 = 80%
Organizational Factors												
P4: Organization Size	_	+	- - - +	+	-	+	+	- - -	-	-	-	10/15 = 67%
P5: Organization Age	_	+	- - - -	+	-	+	+	- - -	-	-	-	11/15 = 73%
P:8 Overall Role of IT	+	+	+ - + +	-	-	+	-	+ + -	+	-	-	8/15 = 53%
	Defensive ITG											
P6: Operational Reliance on IT	+	+	+ + + -	+	-	+	+	+ - -	+	-	+	10/15 = 67%
	Offensive ITG											
P7: Strategic Reliance on IT	+	+	+ - + +	+	+	+	+	+ - +	+	-	-	11/15 = 73%

Coding Scheme:
In order to determine the direction of the relationship between the dichotomous Independent Variables (IV) - Proportion of Insiders, Board Size, Organization Size and Organization Age - the variable "overall level of IT governance" was transformed. A level of "High", "Medium-High", or "Medium" for "Overall level of IT governance" was assigned a level of High, and a level of "Medium-Low" or "Low" for "Overall level of IT governance" was assigned a level of Low. Then the direction of the relationship was determined. For example, a high proportion of insiders and a high level of overall IT governance (board H) is a positive relationship.

In order to determine the direction of the relationship between the IVs with more than two possible responses – overall IT competency and role of IT – the following rules were used. A positive relationship was specified in the following cases; otherwise a negative relationship was specified. A value of "High" for level of IT governance and a level of "High" or "Medium-High" for the two IVs, a value of "Medium-High" for level of IT governance and a level of "High", "Medium-High" or "Medium" for the IVs, a value of "Medium" for level of IT governance and a level of "Medium-High", "Medium" or "Medium-Low" for the IVs, a value of "Medium-Low" for level of IT governance and a level of "Medium", "Medium-Low" or "Low" for the IVs, and finally a value of "Low" for level of IT governance and a level of "Medium-Low" or "Low" for the IVs. For example, a level of High for overall level of IT governance and Medium-High for overall IT competency (board A) is a positive relationship.

Board Attributes and IT Governance – First, looking at the relationship between board attributes and board IT governance, it can be seen that there is mixed support for the variables (Table 8). The highest level of agreement is with IT Competency (80%), followed by Proportion of Insiders (47%), and Board Size (27%).

The relationship between board IT competency and IT governance (Proposition 3) was the strongest out of all the independent variables with the proposed positive relationship not holding for only three out of the fifteen boards. As described previously in this chapter, there were a number of comments by directors indicating a positive relationship between IT competency and IT governance at the board level. Some additional comments that specifically speak to this relationship have been included here. Many directors attributed much of their board's involvement in IT governance to the IT competencies of directors. For example, commenting on the IT governance at one board, Director G (org 3), who has a great deal of IT experience commented, "If I wasn't there it would be nonexistent." He went on to describe his role as a "pot-stirrer – because I have some experience in the space I ask questions."

The proposed positive relationship between proportion of insiders and IT governance (Proposition 1) was found to be true for about half of the boards. One director indicated that insiders are usually better informed and more likely to be involved in governance of IT (Director I), in fact an inside director commented:

> Director G: "I'm a significant shareholder at [one organization] so I have a
> real interest in creating value for the other shareholders in that company. So
> I do think that some of the thought process that directors have to take is
> what is my responsibility to shareholders, I know the fiduciary duties to the
> company, but who owns the company? Shareholders."

The relationship between board size and IT governance (Proposition 2) was the weakest out of all of the independent variables. In fact, the results suggest that the relationship between board size and IT governance is opposite to that of the relationship proposed, with a positive relationship existing between board size and IT governance for 73% of the boards. However, some comments from directors do indicate that the proposed negative relationship may hold for a larger sample. For example, one board had recently undergone a review which resulted in the board size being reduced to half and now describes the smaller board as much more effective. The director (J) described the bigger board as "…unweilding and somewhat dysfunctional because you didn't get a coherent thinking around the table, we also found that attendance was poor, and people who couldn't attend and sent alternates, and that is no longer accepted…"

Organizational Factors and IT Governance - Examining the relationship between organizational factors and overall board IT governance it can be seen that, like with board attributes, there is mixed support for all variables. The highest level of agreement is with Organization Age (73%), followed by Organization Size (67%), and Role of IT in the Organization (53%).

As proposed, boards of the newer organizations interviewed were more likely to be involved with IT governance than older organizations (Proposition 5). Similarly, as proposed, boards of smaller organizations tended to be more involved in IT governance (Proposition 4). Commenting on the relationship between organization size and board IT governance, two directors said:

> Director G: "I think this is because of the difference between the smaller and larger companies. I think that a small or medium-sized enterprise director – yes its nose in but out – you have to know when to cross the line and how to help in a supportive manner to the CEO recognizing that the CEO can't be all things to all people, but your small or medium-sized enterprise may not be able to afford to do some of the things – if Royal Bank needs to do something, they hire IBM or McKinsey – in a small company sometimes the directors are the shareholders."

> Director I: "It's actually easier in a smaller company – I can go off, in fact I've just spent the better part of two weeks dealing with a specific issue for the company – its harder to do in a larger company where the lines are more rigid and its harder to get real-time to an issue, outside of the formal meetings."

Somewhat related to organizational size is the structure of an organization. Interviews revealed that a subsidiary organization may be less involved in IT strategy and strategy overall because the board of the parent organization would take on that strategic oversight role. For example:

> Director D: "A couple of the boards I'm on are subsidiaries of US companies so a lot of them have a North American strategy, and Canada's strategy is set from the US and to varying degrees they ask us about our input on it."

Finally, probably the most surprising finding was that for only one-half of the boards was the overall role of IT in the organization positively related to overall IT governance (Proposition 8). This suggests that, as proposed in the theoretical framework, factors other than role of IT might in fact influence board IT governance.

As previously discussed, in the interviews, many of the directors indicated that there is a relationship between role of IT and overall board IT governance. Some of the comments speaking directly to this relationship have been included below:

> Director A: "If you were interviewing someone who was on a medium-sized publicly traded board where IT was more operational then you might reach the conclusion, versus what I'm saying that "oh my god that company does not pay near as much attention to IT than the boards [this director] is on" but the answer to that is that IT is not as strategic... the more strategic the IT is the more attention the board pays to it….all boards don't pay equal attention to it, but it's not because there governance is different but because all boards

pay more attention to strategic issues whatever area they're in, including IT."

Director B: "[This organization] is changing. Up until now most of the discussion certainly would be at the audit and finance committee and presentations would be made chiefly by the CFO, and that would be sufficient because really the systems that are being utilized have not been as sophisticated as you would get at a bank. But things are changing, this is a whole new topic, there is increasing investment in computer technology in [this industry]…So we're spending more and more of the money on IT and there's more money being put into the budget and indeed the [organization] has hired a person to be in charge of the systems and we've seen him at more and more executive meetings than we ever had before. So it's in a process of change, we're hearing more at the executive level and the board level on what we are doing with our systems, what changes are going to be made and how much is it going to cost."

Finally, examining the relationship between specific role of IT in the organization and type of IT governance practiced (fit) it can be seen that there is support for both types of fit. As proposed, there is a positive relationship between operational reliance on IT and board defensive IT governance (67%, Proposition 6), and there is a positive relationship between strategic reliance on IT and board offensive IT governance (73%, Proposition 7).

6.1.2.2 Consequences of Board IT Governance

While it was possible to probe the theoretical constructs related to the antecedents of IT governance via the interview method, it was not possible to similarly exam the theoretical aspects related to the consequences of board IT governance. Nonetheless, most of the organizations were able to give examples of IT decisions that were discussed at the board level, and as illustrated by the various quotes and examples given in the above subsection, many of these IT decisions resulted in negative financial consequences. The relationship between board IT governance and financial performance are examined in more detail in the second phase of this research.

6.2 Summary

One major outcome related to this first phase was a better understanding of board IT governance in practice. The interviews were transcribed and coded, and values for each independent variable in the theoretical framework were analyzed for each board. Finally, the relationships between the variables in the theoretical framework were examined.

Results from the interview phase informed the next phase of research. The data on antecedents and consequences of IT governance, and the context variable measures were used to customize a survey instrument as described in the next chapter. Specific attention was paid to develop measures for the

constructs where measures have not been developed in past literature, namely board IT governance and IT competency. The interview results suggested that board IT governance and IT competency are multi-dimensional constructs and should be measured as such in the survey. The transcribed interviews were used to augment the questions for the IT governance and IT competency constructs in the survey such that IT governance has two dimensions – offensive and defensive IT governance – and that IT competency has two dimensions – IT expertise and IT governance mechanisms. The intention was to ensure that the components of board IT governance and IT competency provide an adequate coverage of the constructs.

The interview phase provided some preliminary evidence to justify the next phase of research – investigating the propositions in a more quantitative fashion. Specifically:

- the preliminary data suggests <u>support</u> of the propositions for the relationships between IT competency (Proposition 3), organization size (Proposition 4), organization age (Proposition 5) and overall IT governance, the relationships between fit of role of IT and type of IT governance (Propositions 6 and 7), and the propositions for the relationship between overall board IT governance and firm performance (Propositions 9 and 10).

- the <u>unsupported</u> relationships between proportion of insiders (Proposition 1), overall role of IT in the organization (Proposition 8) and board IT governance, and the <u>contradictory</u> relationship found between board size (Proposition 2) and IT governance suggest that the antecedents to board IT governance require further research to examine what role these variables play in influencing board involvement in IT governance.

Chapter 7
Phase Two - Survey of Directors

In the second phase of the field research, a survey was conducted with corporate directors to investigate the antecedents and consequences of board IT governance. This chapter describes: the process of collecting the data through an online survey, the demographics of the survey respondents, the development of measures using EFA for the latent variables, the descriptive statistics and bivariate correlations of the sample, and the results of the multiple regressions.

7.1 Data Collection

Pre-testing of the survey was conducted with the pre-test participants asked to respond to the survey questions and give feedback. Refer to Appendix D for the details of the pre-test and how the survey was redesigned to address the comments of the pre-test participants.

An electronic survey (refer to Appendix E for the survey questions and the survey method) was administered to the membership of the Institute for Corporate Directors (ICD). This is the same organization that was involved in the recruitment of directors for the interviews conducted in phase 1 of this research.

7.1.1 Respondent Demographics

3200 members of the ICD were invited to complete the survey; and 193 responses were received. It is difficult to determine the response rate because the survey was limited to respondents who were currently serving on a board of directors (self identifying). The ICD's Director of Communication indicated that 83 percent of the membership classifies themselves as a director; however this does not necessarily mean that the person is currently serving on a board. Therefore, a conservative estimate of the response rate would be 7 percent (193 out of 2656 members – 83% of 3200 members). However, it is likely that the response rate is higher as not all of the 2656 members that classify themselves as directors were currently serving on a board. A survey of directors on IT governance in the professional literature reported a response rate of 0.046% (Deloitte Consulting LLP and Corporate Board Member Magazine, 2006). That survey, with 455 responses, is the largest survey of directors on the topic of IT governance reported in the professional literature. The other academic studies on IT governance of boards of directors consisted of interviews of l3 (Jordan and Musson, 2004), 17 directors (Huff et al., 2006), a field study of one organization (DeHaes and VanGrembergen, 2005), and an empirical study of a matched sample of 84 US companies (Boritz and Lim, 2007).

Of the 193 responses to the survey, 4 responses were omitted because they contained little or no answers to the survey questions. One additional response was deleted because multiple regression of board attributes and organization factors on board involvement in IT governance revealed that the response was an influential outlier. Multiple regression is highly sensitive to such responses as they can overstate the coefficient of determination, give erroneous values for the slope and intercept and lead to false conclusions about the model (refer to Appendix F). Therefore, this response was deleted and 188 responses were included in the final analysis.

Table 9 provides an overview of the general characteristics of the sample. Since directors often serve on more than one board, directors were asked to respond for the board of the largest organization they served. The responses were from many different industries with no industry representing more than 11.2% of the sample. The largest percentages of respondents were from energy/utilities (11.2%), other service company (10.1%), other financial services company (7.4%), insurance (6.9%), and advanced technology (6.4%). In addition, no one ownership type dominated the responses. Ownership of the organizations was almost evenly divided among non-profit (27.7%), privately (30.9%) and publicly (27.7%) held companies, with the rest of the responses from governmental organizations (13.3%) (Table 10).

Table 9 – Survey Findings - Industry Composition of Survey Respondents

Industry	Number	Percent	Industry	Number	Percent
Advanced technology	12	6.4	Healthcare provider/Managed care	10	5.3
Agriculture	2	1.1	Industrial/Agricultural equipment	3	1.6
Bank and Savings institutions	10	5.3	Insurance	13	6.9
Chemicals	3	1.6	Metals and Metal products	8	4.3
Construction services and building materials	3	1.6	Non-profit	5	2.7
Consumer products	2	1.1	Other	8	4.3
Crown Corporation	4	2.1	Other financial institutions	14	7.4
E-commerce	4	2.1	Other healthcare	4	2.1
Education	2	1.1	Other manufacturing	4	2.1
Electronics/Electrical equipment	2	1.1	Other service company	19	10.1
Energy/Utilities	21	11.2	Professional services	10	5.3
Entertainment/Hospitality	5	2.7	Publishing	1	.5
Forest and Paper products	1	.5	Retail	3	1.6
Healthcare product/Pharmaceuticals	7	3.7	Transportation/Distribution/Packaging	8	4.3
Total: 188					

Table 10 – Survey Findings - Ownership of the Organizations

	Number	Percent
Ownership		
Government	25	13.3
Non-profit	52	27.7
Privately held	58	30.9
Publicly traded	52	27.7
Total	188	100

Respondents were also asked to identify some information about themselves. Respondents were first asked to identify their current role(s) on the board (Table 11). Please note that the total percent is greater than 100 because respondents were able to select multiple roles on the board. Notably, 46.3% of the respondents indicated that they were outside directors. This reflects guidelines in the literature that recommend that boards composition consist of a large proportion of outside directors. In addition, only 0.5% and 2.1 % were CTOs and CIOs, respectively. This is characteristic of the small proportion of CTOs and CIOs that sit on boards (e.g. Burson-Marsteller, 2005).

Table 11 - Survey Findings - Respondents' Title on the Board

Current title or Status with the board	Number	Percent
Board Chairman	29	15.4
President	11	5.9
CEO	21	11.2
General Counsel	7	3.7
Vice Chairman	11	5.9
CFO	7	3.7
CTO	1	0.5
CIO	4	2.1
Corporate Secretary	18	9.6
Academic	2	1.1
Consultant	7	3.7
Outside director / Independent director	87	46.3
Inside director	16	8.5
Other	8	4.2
Missing	0	0
	Total Percent	121.6

As shown in Table 12, 78.4% of the respondents had served for more than two years on the board for which they were answering the survey. Therefore, it seems reasonable to assume that most of the respondents were familiar with their board's approach to governance. Most of the respondents had little or no experience working directly in IT (less than two years) (66.8%). This relatively low level of director experience in IT roles is indicative of what has been found in previous studies (e.g. Burson-Marsteller, 2005; Huff et al, 2006). The respondents were split between those who had no or less than two years experience in the general management of IT (48.4%) and those who had two or greater years of this type of experience (51.6%).

Table 12 - Survey Findings - Respondents' Board and IT Experience

	Number	Percent
Number of Years on the Board		
Less than 2 years	40	21.6
More than 2 years	145	78.4
Total	185	100
Number of Years in an IT Role		
None	113	60.4
Less than 2 years	12	6.4
2 - 10 years	19	10.2
More than 10 years	43	23
Total	187	100
Number of Years of General Management of IT Experience		
None	84	44.7
Less than 2 years	7	3.7
2 - 10 years	37	19.7
More than 10 years	60	31.9
Total	188	100

7.1.2 Missing Data

In order to deal with missing data, pairwise deletion, which excludes cases from any calculations involving variables for which they have missing data, was used instead of listwise deletion, which excludes cases if there is a missing value on any of the variables. It is advantageous to use pairwise deletion over listwise deletion when there is a relatively small dataset; however, it is important to ensure that the missing data is missing at random so that you have a representative sample after removing the cases with missing values (Keith, 2006, p. 394). Examination of the missing data revealed that the subjects with missing values were not different than the subjects without missing values. Also, a comparison of the EFA results using listwise and pairwise deletion revealed negligible differences in some of the factor scores, but did not reveal any changes in the factors themselves. Therefore, pairwise deletion was used in the analysis.

7.2 Measures

This section discusses the measures for each of the variables in the theoretical framework. First the measures for the board IT governance variable are presented; this is followed by the measures for the board attributes, organizational factors, and firm performance.

The measures are a combination of measured and latent variables. For the latent variables, EFA was used to analyze the sets of items that measure the constructs. EFA indicated that there was strong convergent and discriminatory validity in the data with the items included in each scale having moderate to very high factor loadings (all above 0.537). This indicated that the scales were measuring the intended concepts. In addition,

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reliability analysis (Cronbach's alpha) tended to indicate excellent reliability (0.692 to 0.943), thus suggesting that the items in each scale reflected the same construct.

7.2.1 Board IT governance

Drawing on the literature on IT governance, and consistent with the findings from the interviews conducted with directors, two dimensions of board involvement in IT governance were proposed: (1) the degree to which the board is involved in defensive IT governance activities, and; (2) the degree to which the board is involved in offensive IT governance activities. Board involvement in IT governance was measured by asking questions in the survey about the level of involvement in each of the two dimensions (refer to Appendix E - survey questions 18 and 19).

EFA revealed that there are in fact two dimensions of board IT governance – **offensive** and **defensive**. This is in line with both the literature and what is proposed in this research. As can be seen in Table 13, the EFA extracted one factor each for the offensive and defensive dimensions. The items included in each factor tend to have very strong factor loadings (all loadings over 0.669) and produce strongly reliable inter-item reliabilities with Cronbach's alphas ranging from 0.878 to 0.920.

The separate defensive and offensive IT governance factors are used as independent variables, dependent variables, and controls to test some of the propositions. However, where overall IT governance (both defensive and offensive IT governance) is a dependent variable in the propositions (propositions 1 to 5, and 8) one variable is needed since multiple regression requires only one dependent variable. Therefore, an overall level of involvement in IT governance measure was computed. As shown in Appendix G, an overall board involvement measure was created using EFA. One factor was extracted and the items have moderate to very strong factor loadings (all loadings over 0.656) and produce a strongly reliable inter-item reliability of 0.943.

Table 13 - Survey Findings - Factor Analysis - Board IT Governance Involvement

Analysis 1: Level of Involvement in Defensive IT Governance Maximum Likelihood Solution (One Factor Extracted)	
	Factor 1 **Defensive IT Governance**
Eigenvalue:	**5.472**
Variance Explained:	**60.802%**
Cronbach's Alpha:	**0.920**
Indicate the degree to which the board monitors the following issues or activities (scale 1 – 4):	
IT project governance/management methodologies	0.870
Workforce planning and investment to ensure recruitment and retention of skilled IT staff	0.837
Training and development to ensure the needs are fully identified and addressed for all staff	0.834
Compliance with the agreed organizational risk profile of IT	0.824
Organization's progress or performance toward better IT governance	0.799
Compliance with IT to laws, regulations, industry standards and contractual commitments	0.770
Stakeholders' satisfaction with IT (e.g. measured through a survey and/or number of complaints)	0.694
IT risks to which the organization is exposed	0.691
Contribution from IT to a competitive advantage	0.669

Analysis 2: Level of Involvement in Offensive IT Governance Maximum Likelihood Solution (One Factor Extracted)	
	Factor 1 **Offensive IT Governance**
Eigenvalue:	**3.366**
Variance Explained:	**67.322%**
Cronbach's Alpha:	**0.878**
Indicate the degree to which the board is involved in the following activities (scale 1 – 4):	
Monitors that IT delivers against the strategy through clear expectations and measurement	0.863
Identifies possible IT threats and opportunities critical to the future of the organization	0.830
Advises during major IT decisions	0.818
Shapes the business/IT strategic alignment	0.815
Performs IT governance assurance and self-assessment	0.774

7.2.2 Antecedents to Board IT Governance

7.2.2.1 Board Attributes

The board attributes **proportion of insiders** (Appendix E, survey questions 25 and 26) and **board size** (survey question 25) are common measures from the research literature. The **proportion of insiders** is the number of insiders divided by the total number of directors on the board, and the **board size** is the total number of directors. The measure for **IT competency** was created for this research and consists of the constructs **IT expertise** and **IT governance mechanisms**.

Although there are no existing measures of IT expertise and IT governance mechanisms in the context of board IT governance, there are several measures that provide a starting point. Basellier et al. (2003) developed IT expertise scales for business managers and I used these IT expertise scales as a basis for the measure of IT expertise of directors in this research. IT governance research has also pointed to the presence of IT governance mechanisms such as structures, processes and relational mechanisms as imperative to the proper governance of IT. Most of this research has focused at the managerial level; however, several studies have also been conducted at the board level (e.g. Boritz and Lim, 2007; DeHaes and VanGrembergen, 2005).

Survey questions were crafted for each of the IT competency constructs – **IT expertise** (survey questions 6(vi), 29, 30, 32, 33, 34, 35) and **IT governance mechanisms** (survey questions 6, 7, 8, 9, 11). The IT expertise and IT governance mechanisms measures in the literature were added to and modified, to ensure that all measures were appropriate for the board of directors in the context of providing IT governance. EFA was performed to create factors for IT expertise and IT governance mechanisms.

IT Expertise: Using EFA iterative modifications were made to the items to measure IT expertise (see Appendix H for the details of the process). Any items that did not have strong convergent and discriminate validity were deleted from the EFA until satisfactory levels were reached. The final three-factor model is presented below in Table 14. The items in the final constructs show strong convergent and discriminate validity. In addition, the items included in each factor tend to have moderate to very strong factor loadings (all loadings over 0.537), and produce strongly reliable inter-item reliabilities with Cronbach's alphas ranging from 0.840 to 0.914.

The three factors comprising the level of IT expertise on the board represent three types of IT expertise. The first factor, **internal knowledge**, captures the extent to which board members are knowledgeable about IT policies, performance, budget, or other information within the organization. The second factor, **external information**, focuses on the extent to which board members are knowledgeable about information outside of the organization or technology in general. The third factor, **experience and training**, consists of the extent of experience and training of directors on the board.

Table 14 - Survey Findings - Factor Analysis - Level of IT Expertise

Analysis 1: Level of IT Expertise on the Board
Maximum Likelihood Solution / Varimax Rotation

	Factor 1 Internal Knowledge	Factor 2 External Information	Factor 3 Experience and Training
Eigenvalue:	8.417	1.957	1.374
Variance Explained:	46.760	10.872	7.632
Cronbach's Alpha:	0.914	0.885	0.840
IT policies in the organization [a]	.801	.270	.081
Performance of IT [a]	.791	.358	.092
IT risks to which the organization is exposed [a]	.789	.251	.092
Overall IT budget of the organization [a]	.788	.056	.049
Overall IT strategy/vision of the organization [a]	.782	.281	.195
IT resources (people, systems, financials) in the organization [a]	.775	.285	.190
Existing IT used in the organization [a]	.637	.366	.151
IT or business people to contact within the organization as sources of information about IT [a]	.551	.344	.190
Indicate the degree to which information from management about the organization's IT operations and management practices is sufficient [b]	.537	.107	.200
Secondary sources of knowledge as source of information about IT [a]	.277	.810	.210
Applications in general (i.e. internet, electronic data interchange, e-commerce, Groupware) [a]	.244	.797	.130
IT or business people to contact outside of the organization as sources of information about IT [a]	.213	.789	.181
Technology in general (i.e. personal computer, client-server, LAN, imagery technology, multimedia technology) [a]	.282	.721	.038
Systems development in general (i.e. traditional systems development life cycle, end-use computing, prototyping, outsourcing, project management practices) [a]	.224	.640	.333
Other directors to contact as sources of information about IT [a]	.309	.567	.333
How many directors have worked directly in an IT role within an organization or as a consultant or academic (e.g. in areas such as IT development, IT implementation, participation or leadership in new IT projects, management of IT projects)? [c]	.142	.173	.885
How many directors have received formal training in IT (i.e. certificates, diplomas, undergraduate or graduate degrees)? [c]	.111	.188	.837
How many directors have experience in the general management of IT within an organization or as a consultant or academic (e.g. in areas such as participation in the creation of an IT vision statement, IT strategy, IT policies, or IT budgets)? [c]	.237	.244	.743

[a] *The extent to which the board members are knowledgeable about…(Scale 1: Not Knowledgeable - 5: Very Knowledgeable)*
[b] *Scale 1: Not Knowledgeable - 5: Very Knowledgeable*
[c] *Scale None, 1 director, 2-5 directors, more than 5 directors, don't know*

IT Governance Mechanisms: Using EFA iterative modifications were also made to the items to measure the level of IT governance mechanisms present on the board (see Appendix I for the details of the process). As with the IT expertise construct any items that did not have strong convergent and discriminate validity for the IT governance mechanisms construct were deleted from the EFA until satisfactory levels were reached. The final two-factor model is presented below in Table 15. The items in the final constructs show strong convergent and discriminate validity. In addition, the items included in each factor tend to have moderate to

very strong factor loadings (all loadings over 0.528) and produce strongly reliable inter-item reliabilities (ranging from 0.828 to 0.846).

The first factor, **internal activities**, captures the structures, processes and relational mechanisms that involve activities which include the consideration of IT inside the boardroom. The second factor, **external activities**, refers to the processes that occur outside of the boardroom.

Table 15 - Survey Findings - Factor Analysis – Presence of IT Governance Mechanisms

Analysis 1: Level of IT Governance Mechanisms Presence on the Board Maximum Likelihood Solution / Varimax Rotation	Factor 1 Internal Activities	Factor 2 External Activities
Eigenvalue:	4.283	1.176
Variance Explained:	53.536	14.694
Cronbach's Alpha:	0.846	0.828
IT is an item on the agenda of the board [a]	0.870	0.134
The board encourages the inclusion of IT on the meeting agenda [a]	0.855	0.239
The board works well with senior IT management [b]	0.753	0.213
Some board members and IT management (including CIO) communicate between scheduled meetings [b]	0.672	0.216
The recruitment of board members includes consideration of IT expertise [c]	0.582	0.374
The board gets independent assurance on the containment of IT risks [a]	0.144	0.910
The board gets independent assurance on the achievement of IT objectives [a]	0.254	0.899
There are regular sessions for outside directors to discuss IT [a]	0.486	0.591

[a] Indicate the degree to which the following items describe the board's processes. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".
[b] Indicate the degree to which the following items describe the board's relationship and communication with management. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".
[c] Indicate the degree to which the following items describe the board/management structure. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".

7.2.2.2 Organization Factors

As discussed in the previous section, the organization factors use common measures from previous research. **Organization size** (Appendix E, survey question 40) refers to the number of employees in the organization, **organization age** (survey question 41) refers to when the organization was founded, and **role of IT** refers to the **strategic** and **operational** reliance on IT in the organization (survey questions 14 and 15).

EFA of the role of IT revealed factors that are consistent with those proposed by Raghunathan et al. (1999). Another existing replication of their work was not found during the literature review. Raghunathan et al. (1999) proposed one factor with six items to capture the importance of current systems to the achievement of the organization's operating objectives (operational reliance on IT), and three factors with seven items to capture the importance of planned IT to the future success of the organization (strategic reliance on IT). The EFA of the responses to the survey of the directors (Appendix J) revealed the same one and multi-dimensional measures for the operational and strategic reliance on IT respectively with high factor loadings and high inter-item reliabilities.

As Raghunathan et al. (1999) found, I also found that the items comprising the operational reliance on IT capture the importance of the organization's current systems to the achievement of its current operations. Additionally, the three factors comprising the strategic reliance on IT represent three ways that new IT can have a future role in an organization. The first factor, which Raghunathan et al. (1999) coined **managerial support**, captures IT's usefulness in aiding managerial decision making. The second factor, **differentiation**, focuses on the use of IT for differentiation. The third factor, **enhancement**, refers to activities related to the maintenance and enhancement of existing systems.

The items in the two constructs – operational and strategic reliance on IT - show strong convergent and discriminate validity (Appendix J). In addition, the items included in each factor tend to have moderate to very strong factor loadings (all loadings over 0.576) and produce strongly reliable inter-item reliabilities with Cronbach's alphas ranging from 0.692 to 0.917.

7.2.3 Consequences of Board IT Governance

Multiple measures of firm performance were used to assess the consequences of board IT governance. This section first describes the process by which the different measures were selected for use in this research, and then the EFA used to create the firm performance measures is explained.

The relationship between corporate governance and firm performance has been widely investigated in the literature; however, in a review of the corporate governance research, Johnson et al. (1996) found that "there is no consensus on what constitute appropriate measures." In fact, there is much debate regarding how to measure firm performance and it has been described as "one of the thorniest issues confronting the academic researcher today" (Venkatraman and Ramanujam, 1986).

There are two main categories of firm performance measures: (1) financial performance and (2) operational performance. Financial performance measures include outcome-based indicators such as growth, profitability, or earnings per share; whereas, operational performance measures include non-financial measures such as market share, product quality, or measures of operating efficiency. Venkatraman and Ramanujam (1986) advised the use of operational performance measures, in addition to financial performance measures in order to adequately measure firm performance. Therefore, this research includes both categories to measure firm performance, and each category is discussed in turn.

Financial Performance Measures: Financial performance measures are the most widely used measures of firm performance in the corporate governance literature. Primarily such measures are from secondary sources (e.g. COMPUSTAT) and include a combination of some of the following: return on equity (ROE), earnings per share (EPS), net income, sales, return on assets (ROA) (e.g. Cochran et al., 1985; Daily and Johnson, 1997; Pearce, 1983; Pearce and Zahra, 1992; Zahra and Stanton, 1988). It was not possible to use

financial performance measures from secondary sources in this research because a large portion of the responding organizations are not publicly traded and therefore financial information is not publicly available. Therefore, this research uses subjective measures of financial performance. Such measures have been used in previous research (e.g. Burgeois, 1980; Croteau and Raymond, 2004; Gupta and Govindarajan, 1984) and results similar to objective measures have been found. The subjective measures of financial performance used in this research are a self-report of growth and profitability (Appendix E, survey questions 21 and 22). These questions were developed by Venkatraman (1989) and used by Croteau and Raymond (2004) to measure the performance outcomes of strategic and IT competencies alignment.

Operational Performance Measures: Operational performance measures have not been as widely used in the literature; however, as with financial performance measures there are both secondary and primary sources of such data. Since many of the respondents are from non-public organizations this research uses primary (subjective) sources of operational performance data. The operational performance measure used in this research is a self-report of the degree to which IT contributes to seven operational performance measures (Appendix E, survey question 23), they are: (i) return on investment (ROI), (ii) sales revenue increase, (iii) market share increase, (iv) cost savings, (v) operating efficiency, (vi) process improvement, and (vii) customer satisfaction. These operational performance measures have been derived in previous research. Initially, many of these operational performance measures were identified as important dimensions of IS performance in a delphi study by Saunders and Jones (1992). Next, Premkumar and King (1992) used a weighted average of five of these operational performance measures (ROI, sales revenue, market share, operating efficiency, and customer satisfaction) to determine the contribution of IS to operational performance. Finally, seven operational performance measures were used by Preston et al. (2008) in a study in which they asked CIOs and business executives to rate these measures on a five-point scale in order to study of the consequences of CIO strategic decision-making authority. I use Preston et al.'s measures (2008) in this research.

In summary, this research recognizes that the contribution of IT to firm performance may be difficult to measure in terms of the traditional measures of **financial performance measures**– growth and profitability – and that IT's contribution may be also measured in terms of **operational performance measures**.

7.2.3.1 Financial Performance Measures

Growth and **profitability** measures developed by Croteau and Raymond (2004) were used in the survey to measure financial performance. Examination of the survey data revealed that there were a large percentage of answers of "not applicable" for the growth and profitability variables. The three growth questions (survey question 21) had 42, 40 and 42 responses of "not applicable", and the five profit questions (survey question 22) had 45, 37, 47, 52 and 46 such "not applicable" responses. Crosstabs between the ownership and growth

and profit variables revealed that almost all of the "not applicable" responses belonged to non-profit and government organizations. Therefore, these organizations were eliminated from this growth and profit analysis and only privately held and publicly traded organizations were included (consisting of 110 responses). Additionally, any remaining "not applicable" responses in the new reduced dataset were assigned as missing. Examination of the descriptive statistics for the complete dataset and this reduced dataset of private and public companies revealed that there were no significant differences between the two datasets.

EFA of the growth and profitability constructs revealed factors that are consistent with those of Croteau and Raymond (2004). As can be seen in Appendix K, the EFA of the responses to the survey of the directors revealed the same one-dimensional measures for growth and profit with high factor loadings (all loadings over 0.735) and high inter-item reliabilities (Cronbach's alphas ranging from 0.897 to 0.910.). The items in the two constructs show strong convergent and discriminate validity.

Finally, since multiple regression requires one dependent variable, an overall financial performance measure was computed by summing the standardized scales of the growth and profit dimensions. A similar technique was used in the dissertation by Baack (2000).

7.2.3.2 Operational Performance Measures

Operational performance measures developed by Preston et al. (2008) were used in the survey. As with the previous measures of growth and profitability, examination of the survey data revealed that there was a large percentage of answers of "not applicable" for the operational performance variables for non-profit and government organizations. Therefore, these organizations were eliminated from this analysis and only privately held and publicly traded organizations were included (consisting of 110 responses) in this analysis. Additionally, any remaining "not applicable" responses in the new reduced dataset were assigned as missing.

EFA of the operational performance construct (Appendix L) revealed that although Preston et al. (2008) found only one dimension for this construct, two dimensions are found in this research. However, the items show strong convergent and discriminate validity and the items included in each factor tend to have moderate to very strong factor loadings (all loadings over 0.655) and produce strongly reliable inter-item reliabilities with Cronbach's alphas ranging from 0.880 to 0.882; therefore, this two-dimensional construct is used. In fact, the two-factor measure represents two dimensions of operational performance. The first factor captures the **external performance** metrics and the second factor captures the **internal performance** metrics.

Finally, since multiple regression requires one dependent variable, an overall operational performance measure was computed by summing the standardized scales of the external and internal performance dimensions.

7.2.4 Control Variables

In an effort to control for as much as possible the systematic variances not attributed to the independent variables, two control variables were planned to be included in the analysis of the antecedents to board IT governance involvement. These included: (1) duality (Appendix E, survey question 27) – a variable indicating shared CEO and board chair positions which has been shown to influence the board power (e.g. Mallette and Fowler, 1992), and has been found to be a significant control in two studies that examined the antecedents of board corporate governance (Baack, 2000; Westphal, 1999), and; (2) role of the respondent (survey question 1) – inside or outside director – which was found to be a significant control in Baack's study (2000). However, analysis of the data revealed that it would not be possible to use these control variables. First, 86.6% of the respondents indicated that their board does not have duality (i.e. the CEO is not the Chair of the Board). Therefore, this variable would not be appropriate as a control. Second, analysis of the role of the respondent variable revealed that 41% of respondents did not indicate if they were an insider or outside director, therefore this control could not be used in the analysis. To test Propositions 6 and 7 the organizational factors size and age were included as control variables in the analysis.

A review of prior literature revealed possible control variables for the consequences of board IT governance. First, examination of the self-report of firm performance measures (growth and profitability) revealed that the measures control for industry by asking the respondent to rate the growth and profitability relative to their principal competitor. Croteau and Raymond (2004) used the "built-in" control in these measures of firm performance in their analysis of the performance outcomes of strategic and IT competencies alignment. Therefore, no additional controls were added to this analysis of firm performance. Second, a review of the two studies which used the self-report measures of operational performance revealed mixed use of controls. Premkumar and King (1992) did not use controls, however Preston et al. (2008) did use controls and found that firm ownership was a significant control. They also examined firm size, firm age, geographic location and industry as possible controls, but found that none of them were significant. This research controls for ownership (private versus public), organization size and organization age in the relationship between board IT governance and operational performance.

7.3 Data Analysis

7.3.1 Data Transformations

Using the SPSS package, the data were analyzed for frequencies. A number of transformations of the data were needed before the analysis could begin. First, two of the independent variables were transformed. Board size is a continuous variable and proportion of insiders is calculated using the board size variable and the continuous variable for the number of outside directors on the board ((Number of Directors – Number of

Outside Directors) / Number of Directors). The board size and the proportion of insider variables were transformed by taking their natural log. This logarithmic transformation was performed to adjust for the nonlinearity between the dependent and independent variables and thus to ensure that the regression of assumption of linearity was not violated.

In addition, the categorical independent variables, organization size, organization age, and ownership were transformed into a set of nominal scales using dummy variables so that they were amenable to regression.

7.3.2 Descriptive Statistics

7.3.2.1 Antecedents to IT Governance

The descriptive statistics and Pearson bivariate correlations for the antecedents to IT governance are provided in Tables 16 and 17. Refer to Appendix M for the descriptive statistics of the independent and dependent variables that are contained in the factors for board IT governance, IT expertise, IT governance mechanisms and role of IT in the organization.

Overall, the directors indicated moderate levels of involvement in offensive and defensive IT governance, and board IT governance demonstrated bivariate correlation with all of the independent variables except for proportion of insiders and number of directors, indicating that these constructs appear to be important in understanding board involvement in IT governance.

In terms of the board attributes, the mean board size is 10.3 directors, and the mean proportion of insiders on the board was 24%. Furthermore, for the IT expertise construct, directors indicated a moderate level of internal and external knowledge, with the majority of boards having experience and training in IT.

In terms of the organizational factors, organizations included in the survey tended to have 101 – 500 employees (32.4%), less than 50 employees (19.7%), or 1001 – 5000 (19.7%). Furthermore, organizations tended to have been founded more than 40 years ago (32.1%), or 11 – 20 years ago (22.8%). Directors indicated that their organizations had a slightly higher operational versus strategic reliance on IT in the organization. In addition, it is important to note that the strategic reliance on IT factors are all correlated with the offensive and defensive IT governance factors; however, the operational reliance on IT factor is correlated with the offensive IT governance factor but not with the defensive IT governance factor. This is surprising given that prior literature would suggest that when IT is relied upon operationally and plays an important current role in the organization, the board will tend to practice more defensive IT governance. This relationship is investigated further in Proposition 6.

For a detailed analysis of the descriptive and bivariate statistics refer to Appendix N.

Table 16 - Survey Findings - Descriptive Statistics of Antecedents to IT Governance

Descriptive Statistics	Mean	Number	Percent
Board Attributes			
Board Size	10.13		
Proportion of Insiders	24%		
Organization Factors			
Organization Size (# employees)			
Less than 50		37	19.7
51 – 100		14	7.4
101 – 500		61	32.4
501 – 1000		15	8.0
1001 - 5000		37	19.7
5001 - 10000		12	6.4
More than 10000		12	6.4
Total		188	100
Organization Age (when was organization founded)			
Less than 5 years ago		20	10.9
5 – 10 years ago		27	14.7
11 – 20 years ago		42	22.8
21 – 30 years ago		23	12.5
31 – 40 years ago		13	7.1
More than 40 years ago		59	32.1
Total		184	100

Table 17 - Survey Findings - Correlations of Antecedents to Board IT Governance

	Proportion of Insiders	Number of Directors	IT Expertise Factor 1	IT Expertise Factor 2	IT Expertise Factor 3	ITG Mechanisms Factor 1	ITG Mechanisms Factor 2	Operational Reliance on IT Factor 1	Strategic Reliance on IT Factor 1	Strategic Reliance on IT Factor 2	Strategic Reliance on IT Factor 3
Proportion of Insiders											
Number of Directors	-.435**										
IT Expertise Factor 1	.021	-.068									
IT Expertise Factor 2	-.011	.011	.014								
IT Expertise Factor 3	-.105	.256**	-.004	.044							
ITG Mechanisms Factor 1	-.223*	.132	.611**	.127	.270**						
ITG Mechanisms Factor 2	.104	.032	.325**	.210*	.103	-.008					
Operational Reliance on IT Factor 1	-.120	.084	.260**	-.137	-.071	.202*	.073				
Strategic Reliance on IT Factor 1	.026	.031	.220**	.006	-.157	.151	.267**	.284**			
Strategic Reliance on IT Factor 2	-.117	.059	.354**	.160	.244**	.359**	.150	.348**	-.004		
Strategic Reliance on IT Factor 3	-.081	.060	.229**	.016	-.061	.293**	-.067	.409**	.001	-.002	
ITG	-.163	.009	.641**	.293**	.239**	.577**	.422**	.190*	.307**	.326**	.182*
Offensive ITG								.217**	.270**	.277**	.171*
Defensive ITG								.150	.301**	.316**	.181*

Legend: ITG = IT Governance
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

7.3.2.2 Consequences of IT Governance

The descriptive statistics for the controls used in the analysis of the consequences of IT governance are displayed in Table 18. The Pearson bivariate correlations for the consequences of IT governance are provided in Tables 19. The descriptive and bivariate statistics are on the reduced file of 110 respondents from private and public organizations. In addition, refer to Appendix M for the descriptive statistics of the firm performance variables that are contained in the factors for financial and operational performance.

Overall, financial performance was reported to be at a moderate to high level for growth and profitability and financial performance demonstrated bivariate correlation with the defensive IT governance factor but not with the offensive IT governance factor.

Operational performance was reported to be at a moderate level for external performance and a moderate to high level for internal performance. Overall operational performance demonstrated bivariate correlation with defensive and offensive IT governance.

For a detailed analysis of the descriptive and bivariate statistics refer to Appendix N.

Table 18 - Survey Findings - Descriptive Statistics of Controls for Consequences of IT Governance

Descriptive Statistics - Controls	Mean	Number	Percent
Ownership			
Private		58	52.7
Public		52	47.3
Total		110	100
Organization Size			
Less than 50		23	20.9
51 – 100		8	7.3
101 – 500		34	30.9
501 – 1000		10	9.1
1001 - 5000		21	19.1
5001 - 10000		6	5.5
More than 10000		8	7.3
Total		110	100
Organization Age			
Less than 5 years ago		17	15.5
5 – 10 years ago		20	18.2
11 – 20 years ago		24	21.8
21 – 30 years ago		14	12.7
31 – 40 years ago		4	3.6
More than 40 years ago		30	27.3
Missing		1	0.9
Total		110	100

Table 19 - Survey Findings - Correlations of Consequences of IT Governance

	Offensive IT Governance	Defensive IT Governance	Board IT Governance	Operational Reliance on IT Factor 1	Strategic Reliance on IT Factor 1	Strategic Reliance on IT Factor 2	Strategic Reliance on IT Factor 3	Financial Performance	Operational performance
Offensive IT Governance									
Defensive IT Governance	.798**								
Board IT Governance	.948**	.948**							
Operational Reliance on IT Factor 1	.353**	.332**	.375**						
Strategic Reliance on IT Factor 1	.340**	.338**	.354**	.317**					
Strategic Reliance on IT Factor 2	.343**	.354**	.365**	.432**	.000				
Strategic Reliance on IT Factor 3	.216*	.192	.226*	.405**	.000	-.002			
Financial Performance	.008	.242*	.159	.130	.205*	.147	-.122		
Operational performance	.455**	.411**	.447**	.410**	.210*	.485**	.086	.302**	
**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).									

7.3.3 Multiple Regression

Ordinary Least Squares multiple regression was used to analyze the results. In order to test the propositions in group I, overall board IT governance was regressed on board attributes and organization factors, and board offensive and defensive IT governance were regressed on the operational and strategic reliance on IT respectively. Next, to test the first two propositions in group II, firm performance, both financial and organization performance were regressed on overall board IT governance, with and without the control variables. Then the remaining propositions in group II were tested by regressing financial and operational performance on: (1) offensive board IT governance while controlling for the strategic reliance on IT in the organization, and (2) defensive board IT governance while controlling for the operational reliance on IT in the organization.

7.3.4 Confirmation (Disconfirmation) of Theoretical Framework

As shown in Table 20, overall one-half of the propositions are supported.

Regression diagnostics were performed to assess the model's adherence to the regression assumptions and to identify any data problems. The analysis showed that the model supported the assumptions that underlie multiple regression such as linearity, independence of errors, homoscedasticity, and normality of residuals. Furthermore, the analysis of the data problems focusing on the distance, leverage and influence indicated that there were no problems present.

Table 20 - Survey Findings - Summary of Findings

	Proposition	Prediction (IV → DV)	Results Table	Findings and Direction	Conclusion
Group I – Antecedents to IT Governance	1	Proportion of Insiders → Board IT Governance	21	** (negative)	contradictory
	2	Board Size → Board IT Governance	21	* (negative)	supported
	3	IT Competency → Board IT Governance	21	** to *** (positive)	supported
	4	Organization Size → Board IT Governance	21	not significant	not supported
	5	Organization Age → Board IT Governance	21	** (negative)	supported
	6	Operational Reliance on IT → Board Defensive IT Governance	22	+ (positive)	supported
	7	Strategic Reliance on IT → Board Offensive IT Governance	23	* to *** (positive)	supported
	8	Overall Role of IT → Board IT Governance	21	* to *** (positive)	supported
Group II – Consequences of IT Governance	9	Board IT Governance → Financial Performance	24	not significant	not supported
	10	Board IT Governance → Operational performance	25	*** (positive)	supported
	11	Offensive Board IT Governance → Financial Performance (moderated by strategic reliance on IT)	26	not significant	not supported
	12	Offensive Board IT Governance → Operational performance (moderated by strategic reliance on IT)	27	not significant	not supported
	13	Defensive Board IT Governance → Financial Performance (moderated by operational reliance on IT)	26	not significant	not supported
	14	Defensive Board IT Governance → Operational performance (moderated by operational reliance on IT)	27	not significant	not supported
$+\ \ p < .1,\ *\ \ p < .05,\ **\ \ p < .01,\ ***\ \ p < .001$					

7.3.4.1 Antecedents to Board IT Governance

Hierarchical multiple regression was used to test the antecedents to board IT governance with the organizational factors entered first in the regression, followed by the board attributes. This allowed analysis of the impact of each group of variables on the model. The variables were entered in this order because the predominate IT governance literature suggests that organizational factors, predominately, the role of IT in the organization, have the largest influence on the level of board involvement in IT governance. By entering the well-grounded variables that have been proposed in past studies to be important, before entering the variables that will be first tested in this study, the

analysis model controls for those variables and allows the separate analysis of the impact of organization factors and board attribute variables on the board involvement in IT governance.

Table 21 shows the model summary at each step in the hierarchical regression of board involvement in IT governance on organization factors and board attributes. The first set of variables entered in the hierarchical regression, the organization factors, resulted in a statistically significant, explanation of variance (R^2 = 0.284, p < 0.001). The second set of variables entered into the regression equation, board factors, explained a statistically significant increase in the board involvement in IT governance (ΔR^2 = 0.394, p < 0.001), for a total explained variance of R^2 = 0.678, p < 0.001. This indicates that organization factors are insufficient in explaining board involvement in IT governance – explaining only 28.4% of the variance in board IT governance involvement - and that by also including board attributes approximately 68% of the variance is explained.

The regression coefficients of the organization factors show that organization size is not statistically significant (Table 21); therefore Proposition 4 is rejected. It cannot be concluded that smaller organizations have higher levels of board involvement in IT governance.

Organization age of 20 years or less was marginally significant and positively related to board involvement in IT governance at the 0.1 level (Table 21). Organizations that formed 20 years ago or less tended to have higher levels of board IT governance than organizations that formed more that 20 years ago; therefore, organization age is negatively related to board IT governance, supporting Proposition 5.

The operational reliance on IT factor is not statistically significant; however, the managerial support, differentiation and enhancement factors for the strategic reliance on IT are significant at the 0.001, 0.001 and the 0.05 levels respectively (Table 21). Removing the operational reliance on IT factor from the regression reduces the overall R^2; therefore, this factor is kept in the model and Proposition 8 is accepted.

The regression coefficients of the board attributes show that the proportion of insiders is significantly and negatively related to board IT governance at the 0.01 level (Table 21). Therefore, Proposition 1 is rejected as it cannot be concluded that as the proportion of insiders on the board increases, so too does the level of board involvement in IT governance. In fact, the opposite was

found to be true, contradicting Proposition 1. Supplemental analysis was performed to investigate the contradictory finding.

As discussed in Chapter 1, the literature review revealed that the study of the relationship between insiders and board involvement in corporate governance has yielded mixed results. Therefore to investigate the contradictory finding for Proposition 1 I investigated two alternate arguments concerning the relationship between insiders and board involvement in governance.

First, it has been argued that boards rely on outside directors to reduce agency costs associated with monitoring managerial decision making and performance. Whereas, insider directors are relied on as the main source of advice on strategic issues (Baysinger and Butler, 1985). To investigate whether this argument holds and whether it might help explain the negative relationship found between proportion of insiders and overall board IT governance, I analyzed the relationship between insiders and type of board IT governance – offensive versus defensive. According to Baysinger and Butler's argument (1985) there should be a negative relationship between inside directors and defensive IT governance (involving the monitoring of management) and a positive relationship between inside directors and offensive IT governance (involving the provision of advice). However, I found that insiders were significantly and negatively related to both defensive (R^2 = 0.025, p < 0.1, the regression coefficient for proportion of insiders was significant and negatively related at the 0.1 level) and offensive IT governance (R^2 = 0.029, p < 0.05, the regression coefficient for proportion of insiders was significant and negatively related at the 0.05 level) (refer to Appendix O – Analysis 1). Therefore, Baysinger and Butler's argument (1985) does not appear to help explain the contradictory finding of Proposition 1.

Second, I proposed an alternate argument that boards with a larger proportion of insiders may have more knowledge of IT management and have more comfort in IT management and thus do not feel as much of a need to be involved in IT governance as would boards with a smaller proportion of insiders. To examine this argument, board IT governance was regressed on proportion of insiders and various measures of level of comfort the board has in IT management. A cross-product term (Proportion of Insiders X Level of Comfort Measure) was added to the model to test the possible interaction between proportion of insiders and level of comfort (low and high levels for four types of comfort – competency, integrity, transparency and reliability) and their effects on board IT governance. The regressions resulted in statistically significant explanations of variance; however, the interaction terms were not statistically significant (refer to Appendix O – Analysis 2). This suggests

that the proportion of insiders has the same effect on board IT governance for both low and high levels of comfort in IT management. Possible explanations for this contradictory finding are discussed further in Chapter 8.

The discussion now turns back to the discussion of the relationship between board attributes and IT governance. As can be seen in Table 21, board size is significantly and negatively related to board IT governance at the 0.05 level. Therefore Proposition 2 is accepted, smaller boards tended to have a greater involvement in IT governance.

Finally, the coefficients of the IT competency constructs show that all but one of the coefficients is significantly and positively related to board IT governance (Table 21). The internal knowledge, external knowledge, experience and training, and external activities factors are significant at the 0.001, 0.01, 0.01 and the 0.01 levels respectively. The IT governance mechanisms internal activities factor is not significant; however, removing this factor from the regression reduces the overall R^2; therefore, this variable is kept in the model. Proposition 3 is accepted as boards with higher levels of IT competency tend to have higher levels of involvement in IT governance.

Table 21 - Survey Findings – Regression –IT Governance on Board Attributes and Organization Factors

Variables	Propositions 4, 5 and 8	Propositions 1, 2 and 3
Intercept	.109 (.245)	.498 (.412)
Organization Size - Small[a]	-.268 (.315)	-.286 (.223)
Organization Size – Medium[a]	-.467 (.291)	-.408+ (.205)
Organization Size -Large[a]	-.152 (.293)	-.091 (.208)
Organization Age – 20 years or less[b]	.307+ (.181)	.167 (.137)
Operational Reliance on IT	-.119 (.109)	-.002 (.079)
Strategic Reliance on IT – Factor 1 – Managerial Support	.335*** (.093)	.170* (.070)
Strategic Reliance on IT – Factor 2 - Differentiation	.380*** (.093)	-.003 (.076)
Strategic Reliance on IT – Factor 3 - Enhancement	.221* (.096)	.042 (.072)
Proportion of Insiders		-.573** (.194)
Board Size		-.785* (.369)
IT Expertise Factor 1 – Internal Knowledge		.435*** (.095)
IT Expertise Factor 2 – External Knowledge		.210** (.065)
IT Expertise Factor 3 – Experience and Training		.218** (.072)
IT Governance Mechanisms Factor 1 – Internal Activities		.146 (.098)
IT Governance Mechanisms Factor 2 – External Activities		.185** (.074)
Step 1		
F Value	4.962***	
Model R-Square	.284***	
Adjusted R-Square	.227***	
Step 2		
F Value		13.049***
Model R-Square		.678***
Adjusted R-Square		.626***
Change in R-Square		.394***

Coefficients listed are unstandardized betas. Standard errors are in parenthesis.
*+ $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$*
[a] Dummy variable for organization size with "small" composed of those organizations with less than or equal to 100 employees, "medium" composed of those with 101-500 employees, "large" composed of those with 501-5000 employees, and the contrast group is those with 5001 or greater employees.
[b] Dummy variable for organization age with 0 = formed more than 20 years ago, 1 = formed 20 years ago or less.

Hierarchical multiple regression was also used to test whether the role that IT plays in the organization – operational or strategic – was related to the type of IT governance practiced by the board – defensive or offensive. The organizational factors – size and age - were entered first in the regression, followed by the role of IT tested in the regression. Therefore, the analysis model controls

for those organization factors and allows the analysis of the impact of the specific role of IT on the specific type of board involvement in IT governance.

Table 22 shows the model summary at each step in the hierarchical regression of board <u>defensive</u> involvement in IT governance on <u>operational reliance</u> on IT. Model 1 presents the control variables for the regression, and Model 2 adds the independent variable, operational reliance on IT, representing the full model. The control variables entered in the first step of the hierarchical regression (Model 1) resulted in a slight statistically significant, explanation of variance ($R^2 = 0.060$, $p < 0.05$). The operational reliance on IT variable entered in the second step of the regression equation (Model 2) explained a slight statistically significant increase in the board involvement in defensive IT governance ($\Delta R^2 = 0.018$, $p < 0.1$). This indicates that the operational reliance on IT results in a very small, 1.8%, increase in explanation of variance of board involvement in defensive IT governance.

The regression coefficient of the operational reliance on IT shows that it is marginally significant and positively related to board involvement in defensive IT governance at the 0.1 level. Therefore, Proposition 6 is accepted as it can be concluded that as the operational reliance on IT increases, so too does the level of board involvement in defensive IT governance.

Table 22 - Survey Findings – Regression –Defensive IT Governance on Operational Reliance on IT

Variables	Proposition 6 Model 1	Proposition 6 Model 2
Intercept	.432+ (.220)	.396+ (.219)
Organization Size - Small[a]	-.733** (.274)	-.654* (.276)
Organization Size – Medium[a]	-.750** (.263)	-.737** (.261)
Organization Size -Large[a]	-.459+ (.264)	-.457+ (.262)
Organization Age – 20 years or less[b]	.246 (.164)	.264 (.164)
Operational Reliance on IT		.140+ (.080)
Step 1		
F Value	2.465*	
Model R-Square	.060*	
Adjusted R-Square	.036*	
Step 2		
F Value		2.610*
Model R-Square		.078
Adjusted R-Square		.048
Change in R-Square		.018+

Coefficients listed are unstandardized betas. Standard errors are in parenthesis.
*+ p < .1, * p < .05, ** p < .01, *** p < .001*
[a] *Dummy variable for organization size with "small" composed of those organizations with less than or equal to 100 employees, "medium" composed of those with 101-500 employees, "large" composed of those with 501-5000 employees, and the contrast group is those with 5001 or greater employees.*
[b] *Dummy variable for organization age with 0 = formed more than 20 years ago, 1 = formed 20 years ago or less.*

Table 23 shows the model summary at each step in the hierarchical regression of board <u>offensive</u> involvement in IT governance on <u>strategic reliance</u> on IT. Model 1 presents the control variables for the regression, and Model 2 adds the independent variable, strategic reliance on IT, representing the full model. The control variables entered in the first step of the hierarchical regression (Model 1) resulted in statistically significant, explanation of variance ($R^2 = 0.066$, p < 0.05). The strategic reliance on IT variables entered in the second step of the regression equation (Model 2) explained a statistically significant increase in the board involvement in offensive IT governance ($\Delta R^2 = 0.166$, p < 0.001). Therefore, the strategic reliance on IT explains almost 17% more variance of the board involvement in offensive IT governance.

The regression coefficients of the strategic reliance on IT - managerial support factor, differentiation factor, and enhancement factor, shows that they are significant and positively related to board involvement in IT governance at the 0.001, 0.001 and 0.1 levels respectively. Therefore, Proposition 7 is accepted.

Table 23 - Survey Findings – Regression –Offensive IT Governance on Strategic Reliance on IT

Variables	Proposition 7 Model 1	Proposition 7 Model 2
Intercept	.463* (.208)	.208 (.195)
Organization Size - Small[a]	-.702** (.259)	-.333 (.251)
Organization Size – Medium[a]	-.792** (.249)	-.583* (.231)
Organization Size -Large[a]	-.623* (.249)	-.380 (.232)
Organization Age – 20 years or less[b]	.310* (.155)	.357* (.144)
Strategic Reliance on IT – Factor 1 – Managerial Support		.264*** (.070)
Strategic Reliance on IT – Factor 2 – Differentiation		.289*** (.068)
Strategic Reliance on IT – Factor 3 – Enhancement		.163* (0.068)
Step 1		
F Value	3.046*	
Model R-Square	.066*	
Adjusted R-Square	.044*	
Step 2		
F Value		7.339***
Model R-Square		.232
Adjusted R-Square		.200
Change in R-Square		.166***
Coefficients listed are unstandardized betas. Standard errors are in parenthesis. *+ p < .1, * p < .05, ** p < .01, *** p < .001* *[a] Dummy variable for organization size with "small" composed of those organizations with less than or equal to 100 employees, "medium" composed of those with 101-500 employees, "large" composed of those with 501-5000 employees, and the contrast group is those with 5001 or greater employees.* *[b] Dummy variable for organization age with 0 = formed more than 20 years ago, 1 = formed 20 years ago or less.*		

7.3.4.2 Consequences of Board IT Governance

<u>Amount of Board IT Governance and Firm Performance</u> - Table 24 shows the model summary of <u>financial performance</u> regressed on board IT governance. Board IT governance did not result in statistically significant explanation of variance. Therefore, Proposition 9 is rejected.

Table 24 - Survey Findings – Regression –Financial Performance on IT Governance

	Proposition 9
Variables	
Intercept	.000 (0.185)
IT Governance	.149 (.099)
F Value	2.271
Model R-Square	.025
Adjusted R-Square	.014
Coefficients listed are unstandardized betas. Standard errors are in parenthesis. *+ p < .1, * p < .05, ** p < .01, *** p < .001*	

Table 25 shows the model summary at each step in the hierarchical regression of <u>operational performance</u> on board involvement in IT governance. Model 1 presents the control variables for the regression, and Model 2 adds the independent variable, IT governance, representing the full model. The control variables entered in the first step of the hierarchical regression (Model 1) did not result in statistically significant, explanation of variance. However, the board IT governance variable entered in the second step of the regression equation (Model 2) explained a statistically significant increase in operational performance (ΔR^2 = 0.190, p < 0.001). Therefore, board IT governance explains 19% more variance of operational performance.

The regression coefficient of board IT governance shows that it is significant and positively related to operational performance at the 0.001 level. Therefore, Proposition 10 is accepted.

Table 25 - Survey Findings - Regression – Operational performance on IT Governance

	Proposition 10 – Model 1	Proposition 10 – Model 2
Variables		
Intercept	.197 (0.424)	-.075 (.385)
Ownership[a]	.567+ (0.325)	.423 (.294)
Organization Size - Small[b]	-.687 (0.626)	-.192 (.573)
Organization Size – Medium[b]	-.490 (0.569)	.035 (.524)
Organization Size - Large[b]	-.948 (0.547)	-.587 (.497)
Organization Age – 20 years or less[c]	.294 (0.366)	.155 (.330)
IT Governance		.337*** (.073)
F Value	1.104	21.004***
Model R-Square	.062	.251***
Adjusted R-Square	.006	.197***
Change in R-Square		.190***
Coefficients listed are unstandardized betas. Standard errors are in parenthesis. *+ p < .1, * p < .05, ** p < .01, *** p < .001* *[a] Dummy variable for ownership with 0 = publicly traded, 1 = privately held.* *[b] Dummy variable for organization size with "small" composed of those organizations with less than or equal to 100 employees, "medium" composed of those with 101-500 employees, "large" composed of those with 501-5000 employees, and the contrast group is those with 5001 or greater employees.* *[c] Dummy variable for organization age with 0 = formed more than 20 years ago, 1 = formed 20 years ago or less.*		

<u>Appropriateness of Board IT Governance and Firm Performance</u> – Table 26 shows the findings of the regression equations with <u>financial performance</u> as the dependent variable, to test Propositions 11 and 13 - the moderating effect of role of IT on the relationship between <u>appropriate</u> board IT governance and financial performance.

Financial performance was regressed on the two types of board IT governance – offensive and defensive - and the two types of organizational reliance on IT – strategic and operational. Cross-

product terms (type of board IT governance X type of organizational reliance on IT) were added to the model to test the possible interactions between type of board IT governance and type of organizational reliance on IT ('fit') and their effects on financial performance. As shown in Table 26, the regressions did not result in statistically significant explanations of variance; and, the interaction terms were not statistically significant. This suggests that the level of IT governance (for both offensive and defensive) has the same effect on financial performance for both low and high levels of organizational reliance on IT (strategic and operational). Therefore, Propositions 11 and 13 are rejected because there is no support for the proposed moderating effect of role of IT on the relationship between appropriate IT governance and financial performance.

Table 26 - Survey Findings - Regression – Moderating Effect of Role of IT on the Relationship between Board Involvement and Financial Performance

	Proposition 11	Proposition 13
Variables		
Intercept	-.330 (.291)	.045 (.290)
High Strategic Reliance on IT[a]	.433 (.401)	
Offensive IT Governance	-.311 (.269)	
Offensive IT Governance and High Strategic Reliance on IT Interaction	.515 (.406)	
High Operational Reliance on IT[b]		-.079 (.379)
Defensive IT Governance		.450 (.280)
Defensive IT Governance and High Operational Reliance on IT Interaction		-.030 (.387)
F Value	.943	1.786
Model R-Square	.030	.059
Adjusted R-Square	-.002	.026
Coefficients listed are unstandardized betas. Standard errors are in parenthesis. $+ \ p < .1, * \ p < .05, ** \ p < .01, *** \ p < .001$ [a] *Dummy variable for strategic reliance on IT in the organization, composed of those responses with strategic reliance greater than or equal to the average strategic reliance on IT.* [b] *Dummy variable for operational reliance on IT in the organization, composed of those responses with operational reliance greater than or equal to the average operational reliance on IT.*		

Table 27 shows the findings of the regression equations with <u>operational performance</u> as the dependent variable, to test Propositions 12 and 14 - the moderating effect of role of IT on the relationship between <u>appropriate</u> board IT governance and operational performance.

Like the regression performed above to test the moderating effect on financial performance, operational performance was regressed on the two types of board IT governance – offensive and defensive - and the two types of organizational reliance on IT – strategic and operational. Cross-

product terms (type of board IT governance X type of organizational reliance on IT) were added to the model to test the possible interactions between type of board IT governance and type of organizational reliance on IT ('fit') and their effects on operational performance. Control variables were not included in the regression because as seen above in Table 25, the control variables did not result in a statistically significant explanation of variance in operational performance.

As shown in Table 27, the regressions did result in statistically significant explanation of variance ($R^2 = 0.216$, $p < 0.001$ and $R^2 = 0.237$, $p < 0.001$); however, the interaction terms were not statistically significant. This suggests that, like with financial performance, the level of IT governance (for both offensive and defensive) has the same effect on operational performance for both low and high levels of organizational reliance on IT (strategic and operational). Therefore, Propositions 12 and 14 are rejected because there is no support for the proposed moderating effect of role of IT on the relationship between appropriate IT governance and operational performance.

Table 27 - Survey Findings - Regression – Moderating Effect of Role of IT on the Relationship between Board Involvement and Operational performance

	Proposition 12	Proposition 14
Variables		
Intercept	-.117 (.213)	-.312 (.210)
High Strategic Reliance on IT[a]	.244 (.293)	
Offensive IT Governance	.520* (.197)	
Offensive IT Governance and High Strategic Reliance on IT Interaction	.168 (.296)	
High Operational Reliance on IT[b]		.636* (.274)
Defensive IT Governance		.763*** (.203)
Defensive IT Governance and High Operational Reliance on IT Interaction		-.418 (.280)
F Value	8.361***	8.881***
Model R-Square	.216***	.237***
Adjusted R-Square	.190***	.210***
Coefficients listed are unstandardized betas. Standard errors are in parenthesis.		
*+ p < .1, * p < .05, ** p < .01, *** p < .001*		
[a] *Dummy variable for strategic reliance on IT in the organization, composed of those responses with strategic reliance greater than or equal to the average strategic reliance on IT.*		
[b] *Dummy variable for operational reliance on IT in the organization, composed of those responses with operational reliance greater than or equal to the average operational reliance on IT.*		

7.4 Summary

The main findings of the survey can be summarized as follows. The first set of results examining the antecedents to IT governance found that six of the eight propositions were supported. However, the

second set of results examining the consequences of IT governance found that only one of the six propositions was supported.

The results with respect to the antecedents to IT governance are discussed in terms of the board attributes and organizational factors. With respect to the board attributes, as proposed a significant negative relationship at the .05 level was found between board size and board IT governance (Proposition 2), a significant positive relationship at the .01 to the .001 levels was found between IT competency and board IT governance (Proposition 3); however, a higher proportion of insiders on the board did not result in a significant positive effect on board IT governance (Proposition 1). Instead the opposite effect was found – the lower the proportion of insiders on the board the more likely the board would be involved in IT governance, contradicting Proposition 1. As noted previously in this chapter, supplemental analysis was conducted to help interpret this result, and this finding is discussed further in Chapter 8.

With respect to the organization factors, organization size was not a significant predictor of board IT governance (Proposition 4). However, the rest of the propositions with respect to the relationship between organization factors and IT governance were supported. Age was found to be significantly and negatively related to board IT governance at the .01 level (Proposition 5), a significant positive relationship at the .05 to .001 levels was found between overall role of IT in the organization and overall IT governance involvement (Proposition 8), and a significant positive relationship at the .1 level was found between operational reliance on IT and board defensive IT governance (Proposition 6), and between strategic reliance on IT and offensive IT governance (at the .05 to the .001 levels) (Proposition 7).

Turning now to the consequences of board IT governance, Proposition 10 was supported - a significant positive relationship at the .001 level was found between board IT governance and operational performance (Proposition 10). However, the rest of the propositions were not supported. Further discussion and speculation on why Propositions 9, 10, 11, 13 and 14 were not supported can be found in the next chapter.

Chapter 8
Findings

The overarching questions for this research were as follows:

1. How do boards govern IT?

2. What are the expertise areas, and governance mechanisms that represent board IT competencies?

3. Are there systematic relationships between board attributes (proportion of insiders, size and IT competency), organizational factors (size, age and role of IT) and board IT governance?

4. Is there a relationship between IT governance and firm performance? Is the relationship between board IT governance and firm performance moderated by the role of IT in the organization, such that the relationship is significant when there is a fit between the type of board IT governance practiced and the role of IT in the organization, and not significant when there is not a fit?

The findings of this research are discussed in relation to each of these research questions. The discussion focuses on how the findings are supported by and contribute to the current literature.

This research investigated these questions from two perspectives - qualitative and quantitative. On some research concepts, these research approaches revealed different findings, but overall there is complementarity and agreement. The discussion of the findings with respect to research questions 3 and 4 pays specific attention to how the two research approaches converged and/or disagreed.

8.1 Research Question 1 – Board IT Governance Construct

This research explored how boards govern IT. This research is distinct in that it not only operationalizes board involvement in IT governance, but also operationalizes it in a way that measures distinct dimensions of board involvement. Thus, enriching the understanding of how boards govern IT.

Based upon interview and survey data of boards' actual behaviors and actions in IT strategic decision making and oversight of IT, two dimensions of board IT governance were identified: (1)

offensive IT governance, and (2) defensive IT governance. Activities such as: monitoring that IT supports business strategy; shaping the business/IT strategic alignment; identifying IT threats and opportunities; advising during major IT decisions, and; performing IT governance assurance and self-assessment, form offensive board IT governance. Defensive IT governance is conceptualized as the extent to which the board monitors activities such as: IT project governance/management methodologies; workforce planning and investment; training and development; compliance; the organization's IT governance; stakeholders' satisfactions with IT; IT risks, and; contribution from IT to a competitive advantage.

Measurement instruments for offensive and defensive board IT governance that have satisfactory levels of convergent and discriminate validity and reliability were developed using EFA. These two dimensions of board IT governance were originally proposed by Nolan and McFarlan (2005); however, based on the literature review, this appears to be the first operationalization of these constructs. This may be considered an advance for the field because these constructs can now be used with greater confidence in future studies to measure board IT governance involvement. Therefore, rather than relying exclusively on proxy variables as indicators of board IT governance, these objective criteria can be used.

8.2 Research Question 2 – IT Competency Construct

The push for IT governance at the board level has focused attention on the IT competency of directors, and prior literature has suggested the need to explore how IT competency contributes to board IT governance. However, the literature lacks an in-depth discussion of board-level IT competency and its measures. Therefore, this research explored the concept of IT competency and defined it as the extent to which a board has IT expertise and uses IT governance mechanisms to govern IT. It is proposed that while these concepts are separate, both are required for IT competency. This research contends that while IT expertise increases directors' level of decision-making ability, IT governance mechanisms increase the capacity of the board to acquire, interpret and disseminate information, thus both increase the ability of the board to govern IT.

EFA results showed that IT expertise has three factors representing three types of expertise: (1) internal knowledge, (2) external information, and (3) experience and training. While EFA results showed that IT governance mechanisms has two factors: (1) internal activities, and (2) external activities. Measures resulting from the analysis meet the requirements of convergent and discriminate

validity and reliability. With a better understanding of board-level IT competency and the development of measures for this construct, further investigation of these measures and the impact of IT competency is now possible.

8.3 Research Question 3 – Antecedents to IT Governance

Based on this research question, the interview and survey data was analyzed for the first eight propositions. The data suggested interesting implications. In this section, first the results of the analysis regarding board attributes as antecedents to IT governance are discussed, and then the discussion turns to the results of the analysis regarding the organization factors as antecedents to IT governance.

8.3.1 Board Attributes

This research used strategic choice theory to propose relationships between board attributes and board IT governance. Although prior research has not applied this theory to board involvement in IT governance, it appears that it may be an appropriate theoretical lens through which to examine the impact of board attributes on IT governance. The data analysis seems to suggest that, as proposed, board composition may influence its involvement in IT governance.

Contrary to what was proposed in Proposition 1, a negative relationship was found between the proportion of insiders and board IT governance. As discussed in the previous chapter, supplemental analysis performed to investigate this relationship did not resolve this contradictory finding. I suggested that perhaps the association between the proportion of insiders and IT governance would differ based on the type of IT governance, with insiders relied on for strategic issues (i.e. offensive IT governance) versus outsiders relied on to provide oversight (i.e. defensive IT governance). However, I found that insiders were significantly and negatively related to both types of IT governance, so this argument did not help to clarify the contradictory finding. I also suggested that boards with a larger proportion of insiders may have more comfort in IT management and thus would not feel as much of a need to be involved in IT governance as would boards with a smaller proportion of insiders. However, again, this argument was not supported. Therefore, it appears, as others have found in the corporate governance literature (Baack, 2000; Judge and Zeithaml, 1992), that there is a negative relationship between proportion of insiders and board involvement in governance. The reasons for this negative relationship are not clear.

The theoretical framework proposed that there is a negative relationship between board size and IT governance. However, my analysis of the interview data revealed that the relationship was opposite to that which was proposed - with a positive relationship existing between board size and IT governance for 73% (11/15) of the boards. However, as noted in Chapter 6, some comments from directors during the interviews indicated that the proposed negative relationship may hold for a larger sample. In fact, my analysis of the survey data confirmed the proposed negative relationship. Board size was found to be significantly and negatively related to board IT governance (Proposition 2). As proposed using strategic choice theory, it may be that the level of board involvement increases as the size of the board decreases because the smaller board size enhances the ability of the board to work together and contribute to deliberations. Given that this is the only study examining this relationship, the survey results are compelling evidence for the negative effect of board size on IT governance; however, further research is needed.

The strong support for the positive relationship between IT competency (IT expertise and IT governance mechanisms) and board IT governance is important because it offers the first empirical support for this relationship. This finding confirms the conceptual IT governance literature on the importance of IT expertise and IT competency for board IT governance (e.g. Burson-Marsteller, 2005; Huff et al., 2006; Jordan and Musson, 2004; ITGI, 2003; Nolan and McFarlan, 2005). Analysis of the interview data revealed that for 80% of the boards (12/15), the positive relationship between IT competency and IT governance was supported. Furthermore, the strong statistical significance of this relationship in the survey data confirmed the importance of directors' IT competency in contributing to their involvement in IT governance. These findings support Proposition 3, which based on strategic choice theory proposed that competence may push back limits on the exercise of choice by decision-makers and thus encourage board IT governance. Therefore, the argument that structures, processes and relational mechanism enable decision-makers to access relevant information in a timely fashion, and that expertise enables decision-makers to deal with the information when making strategic choices is supported.

8.3.2 Organization Factors

I used institutional theory to propose relationships between organization factors and board IT governance. As a result of the focus on organization factors of size and age, in addition to the role of IT in the organization as antecedents to IT governance, this study contributes to the existing IT governance literature in several ways.

The proposed negative relationship between organization size and board IT governance was not supported in the survey data; however the interview data seemed to suggest that the negative relationship does exist (Proposition 4). The interviews revealed that for 67% of the boards (10/15), boards of smaller organizations tended to be more involved in IT governance than boards of larger organizations. Mixed results have also occurred in the literature. The relationship between organization size and corporate governance was examined by Baack (2000) in a study in which she found a positive relationship existed. However, the level of differentiation in an organization (I used organization size as a proxy for level of differentiation) was found to be negatively related to corporate governance (Judge and Zeithaml, 1992). The mixed findings of the interviews and survey in this research and the conflicting findings from the literature with respect to board involvement in corporate governance indicate that future research is needed to investigate this relationship further.

The analysis of the relationship between organization age and board IT governance yielded interesting insights. As proposed, the interview and survey data revealed that boards of younger organizations (20 years or younger) were more likely be involved in IT governance than boards of older organizations (Proposition 5). This is in-line with prior literature which has used institutional theory to suggest that organizational processes reflect the practices at the time of founding because the organization adopts the predominant practices in that time and because organizational processes are resistant to change (e.g. Eisenhardt, 1988; Stinchcombe, 1965; Tolbert and Zucker, 1983).

This research offers early, if not the first, empirical support for the normative literature regarding the role of IT in the organization and board IT governance (ITGI, 2003; Nolan and McFarlan, 2005). Specifically, prior research has proposed that a positive relationship would exist between *operational* reliance on IT and board *defensive IT governance*, and between *strategic* reliance on IT and board *offensive IT governance.* The interview and survey results indicated that these relationships do, in fact, hold (Propositions 6 and 7). Analysis of the association between the *overall* reliance on IT and *overall IT governance* (Proposition 8) revealed interesting findings. The interview results indicated that for only one-half of the boards was the overall role of IT in the organization positively related to overall IT governance; however, the survey data indicated that the proposed positive relationship holds.

8.4 Research Question 4 – Consequences of IT Governance

There are two sets of propositions regarding the performance consequences of board IT governance – (1) <u>amount</u> of board IT governance and (2) <u>appropriateness</u> of board IT governance – each of these sets of propositions is discussed in turn.

Examining the consequences of the <u>amount</u> of board IT governance it was found that one of the two propositions was supported. To my knowledge this is the first study that directly examined the performance consequences of board IT governance. As noted in Chapter 7, there is much debate regarding how to measure firm performance. I recognized that the contribution of IT to firm performance may be difficult to measure in terms of the traditional measures of financial performance measures and for this reason, I also used operational performance measures. The results of the survey are interesting because the proposed positive relationship between board IT governance and financial performance was not supported (Proposition 9); however, IT governance was found to be significantly and positively related to operational performance (Proposition 10). In fact, board IT governance explained 19 percent of the variance in operational performance.

The results indicate that the selection of appropriate firm performance measures is important. However, at this point in time it remains unclear which measures of performance are better suited to studying the impact of board IT governance. Future research is needed in this area. It would also be interesting to conduct a longitudinal study in the future to examine the performance consequences because it may be that such a study would be more appropriate to capture the true effects of board IT governance on performance. Many board decisions are strategic in nature and may not have immediate impacts on performance, and therefore are not reflected in current financial performance measures. As noted in Chapter 4, Boritz and Lim (2007) found a positive relationship between proxies for board IT governance and financial performance measures that included growth measured as the percent change in sales from one year to the next. This suggests that there are financial consequences of board IT governance. In addition, in my interviews with directors they identified and discussed IT decisions with which they had been involved at the board level. Many of these decisions had operational and/or strategic impacts and included consequences such as negative reputational impacts, loss of information, increased risk exposure, project cost overruns, and failed projects. All of these could have potential impacts on firm performance; however, it may be difficult to quantify their impacts.

Examining the consequences of the <u>appropriateness</u> of board IT governance it was found that none of the propositions were supported (Propositions 11 to 14). This is significant because Nolan and McFarlan (2005) argue that boards should align their approach to IT governance (offensive versus defensive) with the role of IT in the organization (strategic versus operational reliance) in order to avoid unnecessary risk and improve its competitive position. This is the first empirical test of the performance consequences of this concept of 'fit' between approach to IT governance and role of IT in the organization. It remains unclear why none of these relationships were supported. It may be that a moderating effect is not the best explanation for the impact of the role of IT. A more mediating or intervening effect might be more explanatory. The unsupported findings may also have occurred because the measures of performance are at one point in time versus over a longer period. For all these reasons, future research is needed in this area.

Chapter 9
Contributions, Limitations and Future Directions

This chapter discusses the theoretical and practical contributions, and limitations of this research. Areas of future research are also discussed.

9.1 Contributions

The research embodied in this dissertation has several contributions to theory and to boards' practice of IT governance. The theoretical model developed and explored in this research is characterized as more exploratory than confirmatory and can be viewed as an early step toward understanding antecedents and consequences of IT governance. This somewhat limits the explanatory ability, thus while not offering a prescriptive solution for all boards this research will help identify key antecedents and consequences that may be applicable in selected settings. The contributions to theory and practice are discussed in turn.

9.1.1 Theoretical Contributions

As stated in the introduction, the research agenda was to advance and test relationships predicated by: (i) strategic choice theory; (ii) institutional theory, and; (iii) Ashby's Law of Requisite Variety, in order to better explain why and how boards become involved in IT governance and the consequences of this involvement. This research extends prior work in four ways:

1. focuses on the board of directors' role in IT governance;

2. examines antecedents and consequences of board IT governance not previously studied in the literature by relying on guidance from corporate and IT governance literature, and with a multi-theoretic viewpoint;.

3. develops measures of board IT governance and board IT competency that have not previously been studied, and;

4. empirically assesses the antecedents and consequences of board IT governance.

First, this research makes a contribution to theory by responding to the recognized need for more research on board IT governance.

The second contribution is the multi-theoretic viewpoint used to examine the antecedents and consequences of IT governance. From a theoretical perspective, the extant literature does not adequately describe and explain why some boards are involved in IT governance or why some firms with board IT governance appear to have superior firm performance. Using strategic choice theory, institutional theory and Ashby's Law of Requisite Variety to study antecedents to actual board governance of IT and its consequences this research investigated these questions.

The first set of propositions in this research examined the direct board and organizational antecedents to board IT governance. Strategic choice and institutional theories appear to offer complementary views of why boards decide to become involved in the governance of IT. Board and organizational antecedents as strategic adaptations or institutional responses to IT governance needs are explored. Use of the two theories allowed the inclusion of antecedents to board IT governance which have not been investigated in prior research and therefore offer a richer view of board IT governance. The results of the survey showed that organizational factors explain 28.4% of the variance in board IT governance, and that board attributes explain 39.4% more of the variance, for a total explained variance in board IT governance of approximately 68%. Therefore, as proposed, each theory gives only a limited explanation of the whole phenomenon regarding the antecedents to board IT governance. Taken together organizational factors and board attributes provide a richer, more complex view of the antecedents to IT governance. This may encourage researchers of board IT governance to explore the impact of organizational factors in addition to role of IT on board IT governance, and to continue to explore the impact of board attributes on board IT governance. In addition, the results of the survey suggested a relationship contrary to the one proposed for proportion of insiders and board IT governance. The negative relationship found suggests that a theory other than strategic choice may be applicable.

The second set of propositions examined the consequences of board IT governance using strategic choice theory and Ashby's Law of Requisite Variety. The survey confirms the positive impact of board IT governance on operational performance, explaining 19% of the variance in operational performance; however, the impact on financial performance can not be confirmed. Therefore, there is some evidence that strategic choice theory might provide a theoretical foundation on which to investigate the firm performance outcomes of board IT governance. However, the propositions

incorporating the concept of 'fit' between role of IT and board IT governance approach into the extent of performance consequences were unsupported. Therefore, further research is needed to investigate whether Ashby's Law of Requisite Variety offers an explanation of this concept.

The third theoretical contribution is the conceptualization and measurement of two new constructs – board IT governance and board IT competency.

This research explored the construct of board IT governance directly. This is important because a review of the governance literature did not find any empirical studies that examined board IT governance directly; in addition, it was found that the majority of prior research in corporate governance has focused on proxies for board processes rather than directly examining how boards conduct corporate governance. It has been suggested that this lack of attention to the processes of corporate governance may be why contradictions and unanswered questions appear in board research (Johnson et al., 1996; Zahra and Pearce, 1989). To address this issue, I developed a board IT governance construct and generated its measures using actual directors' behaviors and actions in IT strategic decision making and oversight of IT. This construct was well supported by the survey data. Future research could refine this construct and use it to empirically examine the antecedents and consequences of IT governance.

A sound measurement instrument for director IT competency was developed in this research. The academic IT governance literature has stressed the importance of directors' IT competencies; however this is the first attempt to my knowledge to define the IT competency construct, develop its measures and to test the validity and reliability. Further refinement of this construct could be conducted and the construct could be used to measure director IT competency and its impacts on board IT governance.

The fourth theoretical contribution is the empirical assessment of the antecedents and consequences of board IT governance. As discussed, the survey results offer support for many of the antecedents and the operational performance consequences of board IT governance proposed in prior literature and in this research's theoretical framework. Additionally, this research makes a contribution by being possibly the first to empirically test Nolan and McFarlan's IT Strategic Impact Grid (2005). The survey results suggested that as Nolan and McFarlan (2005) proposed, the type of board IT governance is influenced by the role of IT in the organization.

This research also makes a methodological contribution by offering an additional approach to studying boards by opening up the black-box of board decision-making through the use of CDM to overcome the challenges to studying boards.

9.1.2 Practical Contributions

For practice, perhaps the greatest motivation for board involvement in IT governance is the significant contribution that board IT governance was found to have on operational performance for the survey respondents.

On average the survey respondents rated their boards' overall IT governance effectiveness at 53% (an average of 2.6 on a 5 point scale), therefore there appears to be much room for improvement in this area. Therefore, the significant relationship between board size, IT competency and IT governance may encourage boards to manipulate factors which are under their control in an attempt to increase their involvement in IT governance. For example, they could reevaluate the size of their board, or the level of IT competency on the board. Furthermore, the identification of director IT competencies as antecedents of board IT governance may encourage boards to recruit directors with formal IT training (42% of the survey respondents had no directors with formal IT training) or to enlist their board in IT governance training programs (86% of the survey respondents identified their board as not having received IT governance training). Moreover, the identification of specific IT competencies may help boards to identify the types of investments in board IT expertise or IT governance mechanisms that may be beneficial for their organization. This could be advantageous to boards or to educators for the development of training programs that provide guidance to boards on how to increase their involvement in IT governance. For example, training programs could be developed that not only focus on raising the level of IT expertise in specific areas, but also address IT governance mechanisms that influence board involvement. The identification of board IT competencies may also help boards when determining their director recruitment needs.

The evidence obtained from the interviews and surveys offer practitioners a framework for understanding the conditions under which boards are involved in IT governance and the types of IT governance activities with which boards are involved. The evidence may also enable boards to understand when specific approaches to board IT governance are likely to be most effective – defensive IT governance when the organization relies operationally on IT, versus offensive IT governance when the organization relies strategically on IT. This may help boards to assess when and

under what conditions specific board IT governance activities should be encouraged and how they can change their IT governance activities to fit their organizational needs.

9.2 Limitations

There are some limitations in this exploratory research which should be mentioned. The limitations are discussed exclusively with respect to the survey as the interviews were conducted primarily to inform the creation of the survey.

First, the relatively small sample and the inclusion of only members of the ICD in the sample limit the capacity to generalize the research findings. However, demographics of the respondents suggested that organizations from a variety of industries and ownership types were represented, and that the directors held a variety of positions on their boards.

The second limitation is the possible response bias due to the fact that the survey relies on a single respondent. To assess validity and reliability it would have been preferable to obtain multiple respondents per board. However, given the difficulty of obtaining responses to surveys in field research and particularly with respect to board members, this was accepted as a limitation.

The third limitation is the potential for bias in the data due to self-reporting. It would have been helpful to have correlated the self-report, especially the self-report of firm performance, with objective performance measures gathered from an independent source. However, as discussed in Chapter 7 it was not possible to use performance measures from secondary sources in this research because a large portion of the responding organizations were not publicly traded and therefore financial information was not publicly available. As noted in Chapter 7, the subjective measures of financial and operational performance have been used in previous research and results similar to objective measures have been found.

The final limitation in this research is the cross-sectional versus longitudinal nature of this study. In particular, a longitudinal study of the effects of board IT governance on financial performance would have provided more information and may have enabled a more accurate portrayal of the performance consequences.

9.3 Future Research Directions

In response to the limitations in the research, future research efforts should increase the sample size and include multiple respondents per board; this would increase the generalizability and reduce the response bias of the survey. Future research should also use performance measures from secondary sources and conduct a longitudinal study; this may improve the confirmation of the consequences of board IT governance.

Some research areas have emerged during the course of this research. As discussed, there was one proposition in this research for which a contradictory relationship was found - a negative relationship was found between the proportion of insiders and board IT governance. Supplemental analysis performed to investigate this relationship did not resolve this contradictory finding and it was suggested, as others have found in the corporate governance literature (Baack, 2000; Judge and Zeithaml, 1992), that there is a negative relationship between proportion of insiders and board involvement in governance. This negative relationship suggests that a theory other than strategic choice may be applicable; therefore, future research is needed to investigate the relationship between insiders and board IT governance.

This research has attempted to model constructs of board IT governance and IT competency. Although the models are based on an examination of the IT governance and corporate governance literature, and appear to offer sound measurement instruments, because of the complexity of these constructs and the exploratory nature of this study, further research is needed to refine and develop these constructs.

Only one of the propositions regarding the consequences of board IT governance was accepted. Strategic choice theory and Ashby's Law of Requisite Variety were proposed to explain the relationship between IT governance and performance; however, with unsupported propositions regarding appropriate IT governance and firm performance it may be that these rational arguments of Ashby's Law do not apply, and that instead institutional theorist arguments such as normative or mimetic pressures may influence board IT governance. To investigate this further, future research could include deterministic, in addition to, non-deterministic theories in the exploration of IT governance performance outcomes. Another argument is that Ashby's Law does apply and that the control mechanisms and factors lie deeper beneath the surface and require a different style of research to be uncovered – such as a longitudinal ethnographic study.

Other areas for future research have also emerged during the course of this research. This research focused exclusively on IT governance at the board level. Future research could investigate how IT governance fits within the greater board role of corporate governance. Furthermore, future research could expand the scope of investigation to the management level. For example, researchers could explore the IT competency construct more completely by examining the knowledge that when shared among the board of directors and top business/IT executives contributes to appropriate board IT governance. In addition, one area that was mentioned throughout many of my interviews with directors was the importance of trust that the board has in IT management with respect to how the board governs IT. For reasons of scope this concept was not included in this research; however, future research is needed to explore the activities that build trust between the board and IT management, and the impacts of the level of trust. Finally, the normative IT governance research has recommended the use of board-level IT Strategy Committees to aid decision making; however, as other studies have found (e.g. DeHaes and VanGrembergen, 2005; Ernst & Young, 2006; Huff et al., 2006) I also found that most boards do not have such committees - 91 percent of the survey respondents indicated that their board did not have such a committee. In fact, as discussed in Chapter 6, during my interviews, some of the directors were strongly opposed to an IT Strategy Committee. Future research could investigate the role of such committees further.

Appendix A
Interview Protocol

The exact questions asked depended on the conversation between the participant and researcher. Below is a general overview of the CDM method and sample questions.

Participant no: _____   Date: _____

Time: (start) _____ (end) _____

Thank you for meeting with me. As you know, I am conducting this research as part of my PhD at the University of Waterloo. Before we begin, I would like to thank you for taking time out of your schedule for this interview.

Let's start by reviewing the information letter and consent form.

Have signed consent form? _____YES   _____NO

I will start the interview by giving you some background information on Information Technology Governance (ITG). ITG is defined as: *the responsibility of the board of directors and executive management. It is an integral part of enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategies and objectives.*

ITG is the provision of oversight of:

- Oversight of business/IT strategic alignment – ensure strategic integration between the current and future IT organization and the current and future organization;

- IT value delivery – ensure on-time and within-budget delivery of appropriate quality;

- IT resource management – ensure optimal investment, use and allocation of IT resources, including: people, applications, technology, facilities, and data;

- IT risk management – ensure the safeguarding of IT assets and disaster recovery;

- IT performance management – ensure project delivery and IT services are monitored.

The format of the interview will be focused and somewhat structured and take place in three steps:

Step 1: Your general background and experience.

Step 2: A critical ITG incident with which you were involved and where director decision making altered the outcome.

Step 3: The board's general approach to IT Governance

You can take your time to collect your thoughts and respond and I may ask follow-up or clarifying questions based on your response. The interview will take approximately one hour and a half and you will have the opportunity to provide general comments, thoughts and feedback both throughout the interview and at the end.

Step 1: Your general background and experience.

Board Experience

What boards are you a member of?

What is your role on these boards? (chairman, CEO, executive director, non-executive director, audit committee member, etc)

How many years have you served on these boards?

How many years have you served on boards?

How many boards have you served on?

Work Experience

What is your usual work or occupation (What do you do for a living)?

Approximately how many years of total work experience do you have?

Are you now or have you ever been employed by any of these companies (other than as a director)? If so, in what capacity? For how many years?

Have you worked in an IT organization before? What role? How many years?

Have you worked in an IT role in an organization before? What role? How many years?

Education

What is your highest level of education completed?

Step 2: Discuss a critical ITG incident with which you were involved and where director decision making altered the outcome using the CDM.

The discussion of the critical incident will take place in four phases, or sweeps:

1. Incident Identification

2. Timeline Verification

3. Deepening

4. "What it" Queries

We will discuss an ITG decision in which director decision making altered the outcome, in which things would have turned out differently had the director(s) not been there to intervene, or in which the director's skills were particularly challenged.

The incident must have taken place in the last two years. The incident must involve your own lived experience as decision maker. You should bypass incidents that are memorable for tangential reasons and incidents that are memorable but did not involve you in key decision-making roles.

<u>Sweep 1: Let us begin with identifying and selecting the incident.</u>

Ask:

Can you think of an ITG incident in which director decision making altered the outcome?

Can you think of a time when the board's skills were really challenged in ITG?

Tell me about the last unexpected or novel ITG incident that occurred.

Can you think of an ITG decision when the directors' skills really made a difference – maybe things would have gone differently if those directors were not involved in the decision?

Listen For:

An incident that is an ITG decision that took place in the last two years.

An incident where the directors' decision making had a direct impact on the outcome.

Is the Director is struggling to come up with an incident? If so, I will repeat the background and add a bit of description, or rephrase my opening query in a slightly different way, and again give him/her time to produce something for me.

Does the incident not seem to fit the criteria of an ITG decision? If so, I will say "That sounds interesting, but we are looking more for incidents that involve …" and I will restate my criteria with some rephrasing. "Could you think of one that has more of that flavour to it?"

Do I need to move the Director along to get through the initial account of the incident? If so, I will keep the Director on track by saying, "We're very interested in that, and I'd like to talk more about it in a bit; for now, can you give me a quick overview of this particular incident, so I have a sense of what happened from beginning to end?"

If the Director is not able to identify an appropriate IT Governance decision after all of the above prompts, then, a semi-structured interview will be conducted with the Director to get an understanding of the board's general approach to IT Governance.

If the Director is able to identify an appropriate IT Governance decision then I will continue the interview.

Sweep 2- Timeline Verification and Decision Point Identification

Ask:

Will you give me a quick run through the incident telling me the approximate time of key events?

Go through the incident saying it back to the Director exactly as it was told to me. Ask, "Do I have the sequence and the details right so far?"

As I draw the sequence diagram I will ask "Do I have this right? About where on the timeline should we put _____?"

Listen For:

Decision points, shifts in situation assessment, places to probe, gaps in the story, gaps in the timeline, conceptual leaps, anomalies/violated expectations, errors, ambiguous cues.

<u>Sweep 3 – Deepening</u>

Using the timeline and working from notes of the interview, the interviewer takes the participant back to the beginning of the incident and moves through it once again, taking the story one segment at a time. For each segment, the interviewer probes for additional detail. Some of the probes are identified below; they will be used as necessary.

Ask:

<u>Cues</u>

What were you noticing at that point?

What were you seeing and hearing?

What information did you use in making this decision?

How did you get this information?

What knowledge was necessary or helpful in this situation or at this point?

<u>Information</u>

What information did you use in making this decision and how was it obtained?

What did you do with the information?

<u>Analogues</u>

Were you reminded of any previous experience?

What about the previous experience seemed relevant for this case?

<u>Standard Operating Procedure</u>

Does this case fit a standard or typical scenario?

Does it fit an event you were trained to deal with?

<u>Goals</u>

What were your specific goals and objectives at the time?

What were you hoping/intending to accomplish at this point?

Options

What other courses of action were considered or were available?

How was this option chosen or others rejected?

Was there a rule that you were following in choosing this option?

Mental modeling

Did you imagine the possible consequences of this action?

Did you imagine the events that would unfold?

Did you create some sort of picture in your head?

Experience

What specific training or experience was necessary or helpful in making this decision?

Decision making

What let you know that this was the right thing to do at this point in the incident?

How much time pressure was involved in making this decision?

How long did it take to actually make this decision?

Situation Assessment

If you were asked to describe the situation to someone else at this point, how would you summarize the situation?

What was it about the situation that let you know what was going to happen?

What was it about the situation that let you know what to do?

What led up to this decision?

What were your overriding concerns at that point?

How would you summarize the situation at this point?

Guidance

Did you seek any guidance at this point in the incident?

How did you know to <u>trust</u> the guidance you got?

Listen For:

Critical decisions, cues and their implications, ambiguous cues, strategies, anomalies/violated expectations.

When a probe doesn't elicit the information expected, ask the same question in a variety of ways.

<u>Sweep 4 - "What If" Queries</u>

Ask:

Did you consider other alternatives?

Might someone else in the same position have done it differently?

Could you have reasonable taken any other action?

Would you have made the same decisions at an earlier point in your career?

Would this incident have turned out differently if you, or someone with your level of skill/experience, had not been there? Would they have noticed Y? Would they have known to do X?

If the decision was not the best, what training, knowledge, or information could have helped?

What mistakes are likely at this point?

Did you acknowledge if your situation assessment or option selection were incorrect?

How might a novice have behaved differently?

If a key feature of the situation had been different, what difference would it have made in your decision?

What training, knowledge, or information might have helped?

Was <u>trust</u> important to making this decision?

Did the incident increase trust or breach trust?

Listen For:

Other possible courses of action, other potential interpretations, expert-novice differences, potential errors.

Follow-up on Decision

Ask:

What has happened since this decision was made?

Listen For:

Long-term outcome of decision.

Impact on other areas of governance?

Step 3: The board's general approach to IT Governance

Board IT Governance

Is the board regularly briefed on IT risks to which the enterprise is exposed?

Is IT a regular item on the agenda of the board and is it addressed in a structured manner?

Does the board have a clear view on the major IT investments from a risk and return perspective?

Does the board obtain regular progress reports on major IT projects?

Is the board getting independent assurance on the achievement of IT objectives and the containment of IT risks?

What does the whole board do versus a committee?

Is IT Strategy Communicated Separately or as part of the business strategy?

Is the board knowledgeable about the IT strategies in the organization?

IT Governance Effectiveness

How would you describe the overall effectiveness of the board's IT governance? (1-5)

Anything that could be done to improve IT governance?

How would you rate….? (1-5)

- The fit or alignment between your IT strategy and your organization's overall business strategy

Effectiveness of Corporate Governance

How would you rate the overall effectiveness of the board's corporate governance?

How would you rate the overall effectiveness of the board in shaping long-term strategy?

Board Experience, Education and Access to Information

Access to Information

To what degree does the board receives sufficient information to carry out its IT Governance responsibilities?

Board Experience and Education

Discuss each of these statements according to how much it describes the general knowledge level of the board.

- We are knowledgeable about IT.

- We are knowledgeable about the existing IT used in the business.

- We are knowledgeable about how competitors use IT to support business areas.

- Has the board received any training in IT Governance? If so, please describe the training. (Who initiated the training?)

Role of IT

How strongly would you agree or disagree that IT investments have created value for your company?

With regard to IT, how would you describe your company's philosophy? (Innovative or Conservative)

Thinking about your overall corporate strategy or vision, how important do you consider IT to be to the successful delivery of this strategy or vision?

How important do your consider IT to be to the successful operations of your organization?

Why is board IT Governance different for different companies?

IT Governance Mechanisms

Who is the key champion/sponsor for IT governance within your organization?

Does the CIO attend all board meetings?

Indicate whether the board currently has the following practices:

- Regular executive sessions for outside directors to discuss IT

- Portfolio management (including business cases, information economics, ROI, payback)

IT governance assurance and self-assessment

Corporate governance assessment

Discuss whether the following items describe the board:

- The board reviews IT budgets and plans on a regular basis

- Independent information channels provide useful information about company operations and management practices

- The board evaluates members of senior IT management

- The board evaluates the CIO

- The board members and IT management (including CIO) communicate between scheduled meetings

- The board influences IT on the meeting agenda

- The IT competency of overall board meets the strategic needs of the company and the board

- The recruitment and tenure policy includes consideration of IT competency

- There is IT leadership on the board

What sources of decision information does the board typically rely on as information sources in a board meeting?

Do you have an IT Strategy Committee at the level of board of directors?

Do you use the term ITG on the board? Are you familiar with that term?
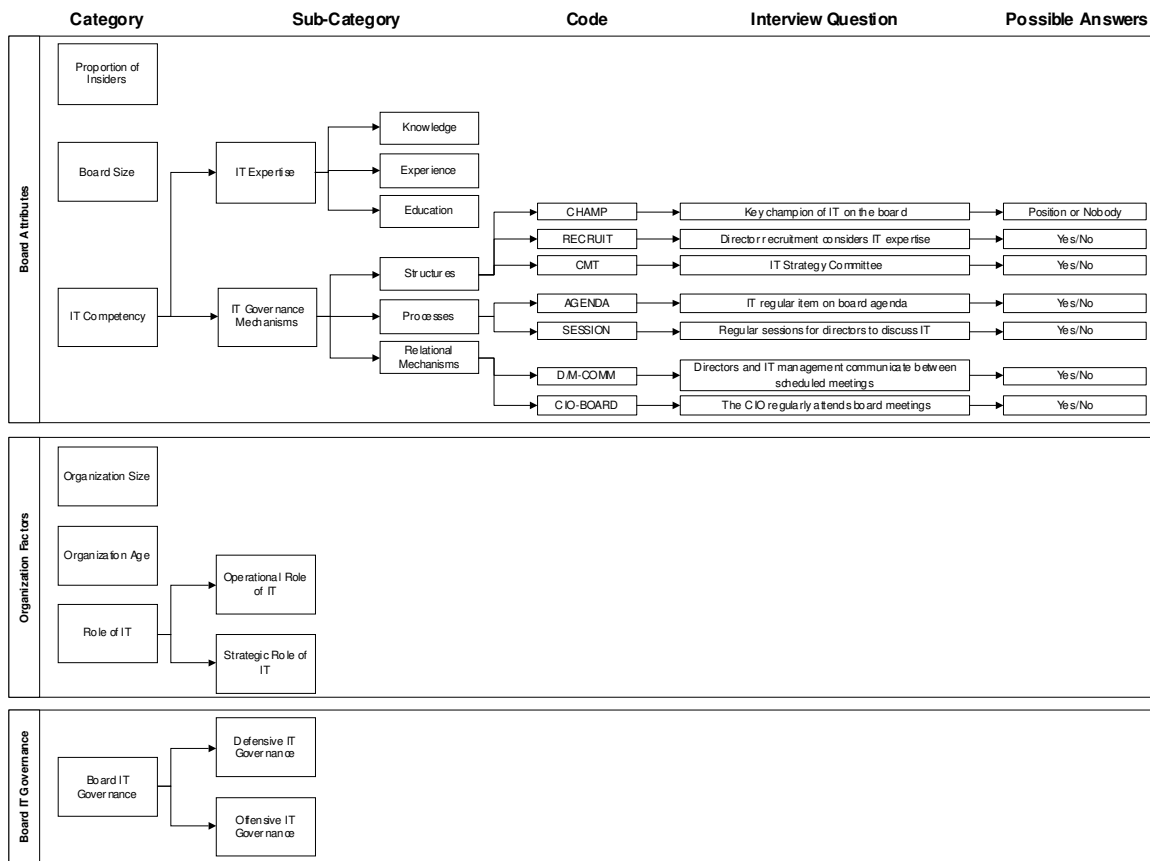
Appendix B
Interview Data Coding Methodology

The interviews were coded using the methodology described below and outlined in the figure on the following page. The figure includes the categories and sub-categories for all of the variables in the theoretical framework; however, for purposes of illustration, the codes, interview questions and possible answers are only shown for the IT Governance Mechanisms variable.

First, categories were developed for each variable, then, where necessary, sub-categories were developed. The sub-categories were developed for the latent (unmeasured) variables. Codes were developed for each sub-category and the interview data was coded and assigned to the categories. Next, the coded data for each respondent was organized according to the appropriate sub-category and category, and this data was used to assign an answer to each question used to measure the variables. Finally, each interview question was give a range of possible answers and those answers for all respondents are what are displayed in the tables in Appendix C.

This process is illustrated with the IT Governance Mechanisms variable in the figure on the following page. The sub-category IT Governance Mechanisms within the IT Competency latent variable is broken down into three sub-categories: structure, processes and relational mechanisms. Then codes were developed for each of these sub-categories. For example, three codes – CHAMP, RECRUIT, and CMT – were developed for the sub-category structures. The transcribed interview data was then coded using these codes. Finally, the coded data was assigned to the appropriate interview question (e.g. all of the data coded as CHAMP was organized as answers to the interview question "Key champion of IT on the board"), and one of the possible answers was assigned to the question for each director (e.g. the name of the position identified as the champion of IT or in the case where there was no champion, "nobody", was assigned as the answer).

Category	Sub-Category	Code	Interview Question	Possible Answers

Board Attributes
- Proportion of Insiders
- Board Size
- IT Competency

IT Expertise:
- Knowledge
- Experience
- Education

IT Governance Mechanisms:
- Structures
- Processes
- Relational Mechanisms

Code	Interview Question	Possible Answers
CHAMP	Key champion of IT on the board	Position or Nobody
RECRUIT	Director recruitment considers IT expertise	Yes/No
CMT	IT Strategy Committee	Yes/No
AGENDA	IT regular item on board agenda	Yes/No
SESSION	Regular sessions for directors to discuss IT	Yes/No
DM-COMM	Directors and IT management communicate between scheduled meetings	Yes/No
CIO-BOARD	The CIO regularly attends board meetings	Yes/No

Organization Factors
- Organization Size
- Organization Age
- Role of IT
  - Operational Role of IT
  - Strategic Role of IT

Board IT Governance
- Board IT Governance
  - Defensive IT Governance
  - Offensive IT Governance

Appendix C

Interview Data Analysis

Table 1 - Interviews – Offensive IT Governance

	Director									
	A	B	C	D	E	F	G	H	I	J
Offensive IT governance										
IT strategy is adequately communicated to the board	Yes	No No No No	No	No	Yes	No	Yes No No	Yes	Yes	Yes
Adequate business/IT strategic alignment	Yes	Yes No Yes Yes	Yes	Yes	Yes	Yes	Yes Yes No	Yes	Yes	Yes
Perform IT governance self-assessment	No	No No No No	No	No	No	No	No No No	No	No	No

Table 2 - Interviews – Overall Level of Offensive IT Governance

	Director									
	A	B	C	D	E	F	G	H	I	J
Overall level of offensive IT governance (L - Low, M – Medium, H – High)	H	M L M M	M	M	H	M	H M L	H	H	H
Coding Scheme: <u>Overall Offensive level of IT governance</u> – The first two questions in Table 1 were used to assess the overall level. The third question, "Perform IT governance self-assessment", was eliminated from the calculation because no boards performed such an assessment. An answer of "Yes" to both of the questions was assigned a level of High to the "overall level of offensive IT governance", an answer of "Yes" to one of the questions was assigned a Medium, and an answer of "No" to both questions was assigned a Low.										

Table 3 - Interviews – Defensive IT Governance

	Director									
	A	B	C	D	E	F	G	H	I	J
Defensive IT governance										
Adequately briefed on IT risks	Yes	Yes Yes Yes Yes	Yes	No	Yes	Yes	Yes Yes No	Yes	Yes	No
Adequately briefed on IT projects	Yes	Yes No No Yes	Yes	Yes	Yes	Yes	Yes No No	Yes	Yes	No
Clear view of IT investments (risk and return)	Yes	Yes No No No	No	No	Yes	Don't know	Yes No No	Yes	Yes	Yes

Table 4 - Interviews – Overall Level of Defensive IT Governance

	Director									
	A	B	C	D	E	F	G	H	I	J
Overall level of defensive IT governance (L - Low, M – Medium, H – High)	H	H L L M	M	L	H	M	H L L	H	H	L
Coding Scheme: Overall Defensive level of IT governance – The questions in Table 3 were used to assess the overall level. An answer of "Yes" to all questions was assigned a level of High, an answer of "Yes" to two questions was assigned a Medium, and an answer of one "Yes" or no "Yeses" to the questions was assigned a Low.										

Table 5 - Interviews – Overall Level of IT Governance

	Director									
	A	B	C	D	E	F	G	H	I	J
Overall level of IT governance (L - Low, M – Medium, H – High)	H	M-H L M-L M	M	M-L	H	M	H M-L L	H	H	M
Coding Scheme: Overall level of IT governance – The questions in Table 2 and 4 were used to assess the overall level. An answer of "High" to both questions was assigned an overall level of High. An answer of "High" to one question and a "Medium" to the other question was assigned an overall level of Medium-High. An answer of "High" to one question and a "Low" to another question, or "Medium" to both questions was assigned a Medium overall. An answer of or a "Medium" to one question and a "Low" to another question was assigned a Medium-Low. An answer of "Low" to both questions was assigned a Low.										

Table 6 - Interviews – Overall Level of IT Governance Effectiveness

	A	B	C	D	E	F	G	H	I	J
Overall IT governance effectiveness (NE – Not Effective, E- Effective, VE – Very Effective)	VE	VE NE E E	E	E	VE	E	VE E NE	E	E	E

Table 7 - Interviews – Overall Level of Corporate Governance Effectiveness

	Director									
	A	B	C	D	E	F	G	H	I	J
Overall corporate governance effectiveness (NE – Not Effective, E- Effective, VE – Very Effective)	VE	VE E VE VE	VE	VE	VE	E	VE E E	VE	VE	E

Table 8 - Interviews – Proportion of Insiders and Board Size

	Director									
	A	B	C	D	E	F	G	H	I	J
Proportion of Insiders (Low <= 1/3 of total directors <= High)	Low	Low Low Low High	Low	High	Low	Low	Low Low Low	High	High	Low
Board Size (Small <= 8 directors <= Large)	Large	Small Large Small Large	Large	Small	Large	Large	Small Large Large	Large	Small	Large

Table 9 - Interviews – IT Expertise

	Director									
	A	B	C	D	E	F	G	H	I	J
IT Expertise										
Overall directors are knowledgeable of IT	Yes	Yes No Yes Yes	Yes	No	No	No	Yes No No	No	Yes	Yes
IT Leadership is present on the board	Yes	Yes No Yes Yes	Yes	No	No	No	Yes Yes Yes	No	Yes	Yes
Receive sufficient information on IT	Yes	Yes No Yes Yes	No	No	Yes	No	Yes No No	No	Yes	Yes
Training in IT governance	No	No No No	No	No	No	No	No No No	No	No	No

Table 10 - Interviews – Overall IT Expertise

	Director									
	A	B	C	D	E	F	G	H	I	J
Overall IT Expertise (L - Low, M – Medium, H – High)	H	H L H H	M	L	L	L	H L L	L	H	H
Coding Scheme: <u>Overall IT Expertise</u> – The questions in Table 9 were used to assess the overall level. The fourth question, "Training in IT governance", was eliminated because no boards any training. An answer of "Yes" to all questions was assigned a level of High, an answer of "Yes" to two questions was assigned a Medium, and an answer of one "Yes" or no "Yeses" to the questions was assigned a Low.										

Table 11 - Interviews – Presence of IT Governance Mechanisms

	Director									
	A	B	C	D	E	F	G	H	I	J
IT Governance Mechanisms										
Structures										
Key champion of IT on the board	CIO and board	CIO CIO CIO CIO	CIO	CIO	CEO, CTO	Nobody	Director Director Director	CTO	CEO, CIO	Everyone
Director recruitment considers IT expertise	No	No No No No	Yes	No	Yes	Yes	Yes No No	No	No	Yes
IT Strategy Committee	No	No	No	No	No	No	No	No	No	No
Processes										
IT regular item on board agenda	Yes	Yes No Yes Yes	Yes	No	Yes	No	Yes No No	Yes	No	Yes
Regular sessions for directors to discuss IT	Yes	Yes No Yes Yes	Yes	No	No	No	Yes No No	Yes	Yes	No
Relational Mechanisms										
Directors and IT management communicate between scheduled meetings	No	Yes Yes Yes Yes	Yes	No	Yes	Yes	Yes No No	No	Yes	No
The CIO regularly attends board meetings	Yes	Yes No No No	Yes	Yes	Yes	No	Yes No No	Yes	Yes	Yes

Table 12 - Interviews – Overall Presence of IT Governance Mechanisms

	Director									
	A	B	C	D	E	F	G	H	I	J
Overall use of IT governance mechanisms (L - Low, M – Medium, H – High)	M	H M M M	H	M	H	M	H L L	M	M	M
Coding Scheme: <u>Overall usage of IT Governance Mechanisms</u> – The questions in Table 11 were used to assess the overall level. If a "Key champion of IT on the board" was identified this was treated as a "Yes"; however, if nobody was identified this was a "No". The third question under Structure, "IT Strategy Committee", was eliminated from the calculation of "overall usage of IT governance mechanisms" because no boards had such a committee. An answer of "Yes" to at least five questions was assigned a level of High, an answer of "Yes" to two to four of the questions was assigned a level of Medium, and an answer of "Yes" to one or no questions was assigned a Low.										

Table 13 - Interviews – Overall IT Competency

	Director									
	A	B	C	D	E	F	G	H	I	J
Overall IT Competency	Medium-High	High Medium-Low High-Medium High-Medium	High-Medium	Medium-Low	Medium	Medium-Low	High Low Low	Medium-Low	High-Medium	High-Medium
Coding Scheme: <u>Overall level of IT Competency</u> – The questions in Table 10 and 12 were used to assess the overall level. An answer of "High" to both questions was assigned an overall level of High. An answer of "High" to one question and a "Medium" to the other question was assigned a High-Medium. An answer of "High" to one question and a "Low" to another question, or "Medium" to both questions was assigned a Medium overall. An answer of "Medium" to one question and a "Low" to another question was assigned a Medium-Low. An answer of "Low" to both questions was assigned a Low.										

Table 14 - Interviews – Self-assessed IT Competency Meets the Strategic Needs

	Director									
	A	B	C	D	E	F	G	H	I	J
IT Competency of overall board meets the strategic needs	Yes	Yes No Yes Yes	Yes	No	Yes	No	Yes No No	No	Yes	Yes

Table 15 - Interviews – Organization Size and Age

	Director									
	A	B	C	D	E	F	G	H	I	J
Organization Size (Small <= 500 <= Large)	Large	Small Large Large Large	Large	Large	Large	Large	Small Large Large	Small	Small	Small
Organization Age (New <= 10 years <= Old)	Old	New Old Old New	Old	Old	Old	Old	New Old Old	New	New	New

Table 16 - Interviews – Role of IT in the Organization

	Director									
	A	B	C	D	E	F	G	H	I	J
Operational reliance on IT										
How important do your consider IT to be to the successful operations of your organization? (L - Low, M – Medium, H – High)	H	H L L L	H	H	H	H	H H H	H	L	L
Strategic reliance on IT										
Thinking about your overall corporate strategy or vision, how important do you consider IT to be to the successful delivery of this strategy or vision? (L - Low, M – Medium, H – High)	H	H H H H	H	H	H	H	H L L	H	L	L

Table 17 - Interviews – Overall Role of IT in the Organization

	Director									
	A	B	C	D	E	F	G	H	I	J
Overall Role of IT in the Organization (L - Low, M – Medium, H – High)	H	H M M M	H	H	H	H	H M M	H	L	L
Coding Scheme: Overall role of IT in the organization – The questions in Table 16 were used to assess the overall level. An answer of "High" to both questions, or an answer of "High" to one question and a "Medium" to the other question was assigned an overall level of High. An answer of "High" to one question and a "Low" to another question, or "Medium" to both questions, or a "Medium" to one question and a "Low" to another question was assigned a Medium overall. An answer of "Low" to both questions was assigned a Low.										

Appendix D
Pre-Test Survey Re-Design

Extensive pre-testing of the survey was conducted with two corporate directors, two leading researchers in IT governance, and an expert in survey design. Similar pre-testing of surveys by a combination of researchers and intended survey participants was conducted by Raghunathan et al. (1999) – pre-test by two IS researchers and two IS executives – and by Premkumar and King (1992) – pre-test by three students, three faculty, and three executives.

During the pre-test participants were asked to respond to the survey questions and give feedback on any of the items and any other issues they wished to share. The pre-test revealed comments on the survey layout, wording of the questions, and length of the survey.

The comments from each successive pre-test were incorporated into the survey until the final version of the survey was created and an electronic survey (refer to Appendix E) was administered to the membership of the ICD.

First, interviews with the pre-test participants resulted in a redesign of the survey layout. For example, the questions that require identifying specific information on the organization, such as the industry, ownership structure, or number of employees were moved to the end of the survey. Additionally, instead of starting the survey with questions on the role of IT in the organization, which are more difficult and technical questions, some of the questions that were considered easier to answer were moved to the beginning of the survey. For example, the directors were first asked about their own experience and then their board's involvement in corporate governance. These questions were considered easier to answer by the participants in the pre-test because all directors would know about their own experiences (rather than their board's general level of experience which is asked in a later section). Also, the interviews conducted in phase one and the conversations with directors in the pre-test revealed that directors were likely to score their boards positively on the corporate governance questions. It was thought that answering positively to such questions would encourage directors to continue to complete the rest of the questions in the survey.

Second, the pre-test yielded rewording of some of the questions. For example, all references to company or business were changed to organization in order to have consistent wording throughout the survey. Also, some questions were reworded to reduce ambiguity, for example the wording "information channels" was changed to "information from management".

Third, the pre-test revealed that the survey was too long, sometimes tedious, and sometimes the questions were repetitive. To reduce the time to complete the survey to 15 minutes and to hopefully increase the response rate, some questions were eliminated from the survey and some possible categories of answers were reduced. One of the biggest changes was to eliminate a section of question on the board IT Strategy Committee. This was considered an acceptable way of reducing the number of questions because the interviews in phase one revealed that very few boards have such committees. Also, questions were eliminated throughout the survey if it was determined that the information was already being captured in another question, or if the pre-test participants indicated that they did not understand the question. For example, the following questions were deleted because their meaning was difficult to interpret and because the experience of directors is captured in other questions: "How many years have you served on boards of organizations that considered IT to be important to the successful delivery of the strategy or vision?", and; "How many years have you served on boards of organizations that considered IT to be important to successful operations?" Finally, some of the categories in the answers were reduced to simplify the questions, while still capturing the different answers. For example, number of years experience were reduced from five to four categories.

Appendix E

Survey Instrument

Board Oversight of Information Technology Activities

Information Technology Governance

Thank you for participating in this survey on board IT governance. In order to receive a report of this study's findings, please be sure to fill in your email address, or that of your assistant, at the end of this survey.

PRIVACY NOTE

All of the data will be summarized and no individual will be identified from these summarized results. Furthermore, the web site is programmed to collect responses alone and will not collect any information that could potentially identify you (such as machine identifiers). Participation in this study is voluntary. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time by not submitting your responses. There are no known or anticipated risks from participating in this study. Because of the potentially sensitive nature of the study, every effort has been made to protect your anonymity. You will be invited to enter your email address or that of your assistant at the end of the survey if you would like to receive a report of the study's findings. Your email address will not be used to identify you, your board(s), or your organization(s). The data, with no personal identifiers, collected from the survey will be maintained on a computer database in a restricted access area of the university and on the researcher's computer. All data files will be password-protected and encrypted to ensure security and confidentiality of data. As well, the data will be electronically archived after completion of the study and maintained for five years and then erased. Only researchers associated with this project will have access.

This study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please feel free to contact Dr. Susan Sykes, Director, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or by email at ssykes@uwaterloo.ca .

If you require further information on this study or have any questions or suggestions please contact Jennifer Jewer directly at 519-590-8760 or jljewer@uwaterloo.ca. You can also email Jennifer's PhD supervisor, Dr. Kenneth McKay, at kmckay@ist.uwaterloo.ca.

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Please answer all questions in the survey for the largest organization (based on revenue) for which you serve on the board. The organization can be publicly traded, privately held, non-profit or government.

PART 1: YOUR EXPERIENCE

1.   What is your current title or status with this board? Please select all that apply.

☐ Board Chairman
☐ President
☐ CEO
☐ General Counsel
☐ Vice Chairman
☐ CFO
☐ CTO
☐ CIO
☐ Corporate Secretary
☐ Academic
☐ Consultant
☐ Outside director/Independent director
☐ Inside director
☐ Other: [   ]

2.   How many years have you served on this board?

○ Less than 2 years
○ More than 2 years

3.   How many years have you worked directly in an IT role within an organization or as a consultant or academic (e.g. in areas such as IT development, IT implementation, participation or leadership in new IT projects, management of IT projects)?

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○ None
○ Less than 2 years
○ 2 - 10 years
○ More than 10 years

4. **How many years experience do you have in the general management of IT within an organization or as a consultant or academic (e.g. in areas such as participation in the creation of an IT vision statement, IT strategy, IT policies, or IT budgets)?**

    ○ None
    ○ Less than 2 years
    ○ 2 - 10 years
    ○ More than 10 years

PART 2: BOARD INVOLVEMENT IN CORPORATE GOVERNANCE

We would like to reaffirm the anonymity of you, the board, and the organization. All of the data will be summarized and no individual, board or organization can be identified from these summarized results.

5.   Please rate the overall effectiveness of the board on the following items. Where 1 is "Very Ineffective" and 5 is "Very Effective".

	1	2	3	4	5	N/A
(i) Monitoring the organization's financial performance	○	○	○	○	○	○
(ii) Representing the interest of shareholders	○	○	○	○	○	○
(iii) Advising during major decisions such as mergers and acquisitions	○	○	○	○	○	○
(iv) Ensuring ethical behaviour within the organization	○	○	○	○	○	○
(v) Shaping long-term strategy	○	○	○	○	○	○
(vi) Identifying possible threats or opportunities critical to the future of the company	○	○	○	○	○	○
(vii) Planning for CEO succession	○	○	○	○	○	○
(viii) CEO performance evaluation process employed by the board	○	○	○	○	○	○

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PART 3: IT GOVERNANCE MECHANISMS USED BY THE BOARD

6.   **Indicate the degree to which the following items describe the board's relationship and communication with management. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".**

	1	2	3	4	N/A
(i) Some board members and IT management (including CIO) communicate between scheduled meetings	○	○	○	○	○
(ii) The board works well with senior IT management	○	○	○	○	○
(iii) The board works well with senior business management	○	○	○	○	○
(iv) The CIO participates in board meetings	○	○	○	○	○
(v) The CIO participates in Audit Committee meetings	○	○	○	○	○
(vi) Information from management about the organization's IT operations and management practices is sufficient	○	○	○	○	○

7.   **Indicate the degree to which the following items describe the board's processes. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".**

	1	2	3	4	N/A
(i) IT is an item on the agenda of the board	○	○	○	○	○
(ii) IT is an item on the agenda of the Audit Committee	○	○	○	○	○
(iii) The board encourages the inclusion of IT on the meeting agenda	○	○	○	○	○
(iv) If necessary, the board members					

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voice opinions that conflict with the CIO's view	○	○	○	○	○
(v) The board gets independent assurance on the achievement of IT objectives	○	○	○	○	○
(vi) The board gets independent assurance on the containment of IT risks	○	○	○	○	○
(vii) There are regular sessions for outside directors to discuss IT	○	○	○	○	○

8. **Indicate the degree to which the following items describe the board/management structure. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".**

	1	2	3	4	N/A
(i) The recruitment of board members includes consideration of IT expertise	○	○	○	○	○
(ii) The IT expertise of the overall board meets the needs of the company and the board	○	○	○	○	○
(iii) The CIO reports to the CEO and/or COO	○	○	○	○	○

9. **Who is the key champion/sponsor for ensuring that IT is well managed within your organization?**

  ○ CEO—Chief Executive Officer
  ○ CIO—Chief Information Officer
  ○ CFO—Chief Financial Officer
  ○ Compliance/audit
  ○ Nobody
  ○ Other: ⬚

10. **Is the board-level IT expertise concentrated (i.e. 1-2 directors lead IT discussions) or distributed (i.e. all directors participate equally in IT related discussions)?**

  ○ Concentrated
  ○ Distributed
  ○ Don't Know

11. **Do you have an IT Strategy Committee at the level of board of directors?**

- ○ Yes
- ○ No
- ○ Don't Know

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PART 4: ROLE OF IT IN THE ORGANIZATION

12. **With regard to IT, how would you describe your organization's philosophy? Please select all that apply.**

   ☐ Innovative (uses IT as a competitive weapon)
   ☐ Functional (invests in leading technologies)
   ☐ Conservative (relies on proven, mature technologies)
   ☐ Don't know

13. **Please indicate the degree to which the organization relies on the following. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".**

	1	2	3	4	5
(i) Cost-effective, uninterrupted, secure, smoothly operating IT	○	○	○	○	○
(ii) IT for its competitive edge through systems that provide new value-added services and products or high responsiveness to customers	○	○	○	○	○

14. **Please indicate the extent to which you agree or disagree with the following statements as they relate to the existing IT in the organization. Where 1 is "Disagree Strongly" and 5 is "Agree Strongly".**

	1	2	3	4	5
(i) IT is vital to our organization	○	○	○	○	○
(ii) IT breakdown for extended periods will affect organizational activities severely	○	○	○	○	○
(iii) The organization relies heavily on IT for efficient operation	○	○	○	○	○
(iv) IT breakdown will critically affect one or more of our functional departments	○	○	○	○	○

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	1	2	3	4	5
(v) IT breakdown will affect our database access	○	○	○	○	○
(vi) IT breakdown will affect overall coordination within our organization	○	○	○	○	○

15.   **Please indicate the significance of the following items as components of your portfolio of planned IT projects. Where 1 is "Very Unimportant" and 5 is "Very Important".**

	1	2	3	4	5
(i) Projects involving application of new technologies	○	○	○	○	○
(ii) Projects focusing on routine maintenance to meet evolving business needs, new regulatory or legal requirements	○	○	○	○	○
(iii) Projects focusing on existing systems enhancements	○	○	○	○	○
(iv) Projects whose primary benefit is providing new decision support information to top management	○	○	○	○	○
(v) Projects whose primary benefit is providing new decision support information to middle and lower levels of management	○	○	○	○	○
(vi) Projects which will allow the organization to develop and offer new products or services for sale	○	○	○	○	○
(vii) Projects which enable development of new administrative control and planning processes	○	○	○	○	○
(viii) Projects which offer significant tangible benefits through improved operational efficiencies	○	○	○	○	○
(ix) Projects which appear to offer new ways for the organization to compete	○	○	○	○	○

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PART 5: BOARD INVOLVEMENT IN IT GOVERNANCE

16. **Please rate the overall effectiveness of the board on the following: Where 1 is "Very Ineffective" and 5 is "Very Effective".**

	1	2	3	4	5	N/A
(i) IT governance	○	○	○	○	○	○
(ii) Oversight of long-term IT strategy	○	○	○	○	○	○
(iii) Oversight of the current IT operations of the organization	○	○	○	○	○	○

17. **Indicate the degree to which the board monitors the following issues or activities. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".**

	1	2	3	4	N/A
(i) Business/IT alignment	○	○	○	○	○
(ii) IT performance	○	○	○	○	○
(iii) IT cost management	○	○	○	○	○
(iv) Distributed IT strategies to ensure IT strategies are consistent and integrated	○	○	○	○	○

18. **Indicate the degree to which the board monitors the following issues or activities. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".**

	1	2	3	4	N/A
(i) Contribution from IT to a competitive advantage	○	○	○	○	○
(ii) IT risks to which the organization is exposed	○	○	○	○	○

(iii) Compliance with IT to laws,

regulations, industry standards and contractual commitments	○	○	○	○	○
(iv) Compliance with the agreed organizational risk profile of IT	○	○	○	○	○
(v) Stakeholders' satisfaction with IT (e.g. measured through a survey and/or number of complaints)	○	○	○	○	○
(vi) Organization's progress or performance toward better IT governance	○	○	○	○	○
(vii) Workforce planning and investment to ensure recruitment and retention of skilled IT staff	○	○	○	○	○
(viii) IT project governance/management methodologies	○	○	○	○	○
(ix) Training and development to ensure the needs are fully identified and addressed for all staff	○	○	○	○	○

19. Indicate the degree to which the board is involved in the following activities. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".

	1	2	3	4	N/A
(i) Shapes the business/IT strategic alignment	○	○	○	○	○
(ii) Advises during major IT decisions	○	○	○	○	○
(iii) Identifies possible IT threats and opportunities critical to the future of the organization	○	○	○	○	○
(iv) Monitors that IT delivers against the strategy through clear expectations and measurement	○	○	○	○	○
(v) Performs IT governance assurance and self-assessment	○	○	○	○	○

20. Please indicate the extent to which you agree or disagree with the following statements. Where 1 is "Disagree Strongly" and 5 is "Agree Strongly". IT management (including the CIO)...:

	1	2	3	4	5
(i) Is competent (e.g. is able to reach set goals)	○	○	○	○	○
(ii) Has integrity (e.g. bases its relationship with stakeholders, including the board, on mutual respect)	○	○	○	○	○

(iii) Is transparent (e.g. the board is told when things are going wrong) ○ ○ ○ ○ ○

(iv) Is reliable (e.g. is consistent in its communication and actions) ○ ○ ○ ○ ○

PART 6: IT AND ORGANIZATIONAL PERFORMANCE

21. **Please rate your organization's level of growth. Where 1 is "Very Low" and 5 is "Very High".**

	1	2	3	4	5	N/A
(i) The sales growth position relative to our principal competitor is	○	○	○	○	○	○
(ii) My satisfaction with sales growth rate is	○	○	○	○	○	○
(iii) The market share gains relative to our principal competitors are	○	○	○	○	○	○

22. **Please rate your organization's level of profitability. Where 1 is "Very Low" and 5 is "Very High".**

	1	2	3	4	5	N/A
(i) The return on corporate investment position relative to our principal competition is	○	○	○	○	○	○
(ii) My satisfaction with the return on corporate investment is	○	○	○	○	○	○
(iii) My satisfaction with return on sales is	○	○	○	○	○	○
(iv) The net profit position relative to our principal competitor is	○	○	○	○	○	○
(v) The financial liquidity position relative to our principal competitor is	○	○	○	○	○	○

23. **Please assess the extent to which IT has contributed to the following seven areas of organizational performance. Where 1 is "Contribution is minimal" and 5 is "IT has contributed to a very great extent".**

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	1	2	3	4	5	N/A
(i) Return on Investment (ROI)	○	○	○	○	○	○
(ii) Sales Revenue Increase	○	○	○	○	○	○
(iii) Market Share Increase	○	○	○	○	○	○
(iv) Cost Savings	○	○	○	○	○	○
(v) Operating Efficiency	○	○	○	○	○	○
(vi) Process Improvement	○	○	○	○	○	○
(vii) Customer Satisfaction	○	○	○	○	○	○

24. **How strongly would you agree or disagree that IT investments have created value for your organization?**

○ Disagree strongly
○ Disagree slightly
○ Neither agree nor disagree
○ Agree slightly
○ Agree strongly
○ Don't know

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PART 7: GENERAL INFORMATION AND IT EXPERTISE

The questions on this page are about the characteristics of the board.

25.   How many directors are on the board?

26.   How many outside directors are on the board? (Outside directors are those members of the board who are not employed as part of the organization's management team, their subordinates, relatives, or managers of the organization's subsidiaries. Also these directors are not members of the organization's immediate past management team.)

27.   Is the CEO the Chairman of the board?

      ○ Yes
      ○ No

28.   Is this a board of a subsidiary organization?

      ○ Yes
      ○ No

Board Oversight of Information Technology Activities

Information Technology Governance

The questions on this page are about the IT experiences of ALL the directors on the board.

29. How many directors have worked directly in an IT role within an organization or as a consultant or academic (e.g. in areas such as IT development, IT implementation, participation or leadership in new IT projects, management of IT projects)?

   ○ None
   ○ 1 director
   ○ 2 – 5 directors
   ○ More than 5 directors
   ○ Don't Know

30. How many directors have experience in the general management of IT within an organization or as a consultant or academic (e.g. in areas such as participation in the creation of an IT vision statement, IT strategy, IT policies, or IT budgets)?

   ○ None
   ○ 1 director
   ○ 2 – 5 directors
   ○ More than 5 directors
   ○ Don't Know

31. How would you describe the overall IT experience level of the directors on this board?

   ○ Very Low
   ○ Low
   ○ Intermediate
   ○ High
   ○ Very High
   ○ Don't Know

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The page has questions about the IT knowledge of ALL directors on the board.

32. Please indicate the extent to which the board members are knowledgeable about different aspects of IT in general. Where 1 is "Not Knowledgeable at All" and 5 is "Very Knowledgeable".

	1	2	3	4	5
(i) Technology in general (i.e. personal computer, client-server, LAN, imagery technology, multimedia technology)	○	○	○	○	○
(ii) Applications in general (i.e. internet, electronic data interchange, e-commerce, Groupware)	○	○	○	○	○
(iii) Systems development in general (i.e. traditional systems development life cycle, end-use computing, prototyping, outsourcing, project management practices)	○	○	○	○	○

33. Please indicate the extent to which the board members are knowledgeable about different aspects of IT used in the organization. Where 1 is "Not Knowledgeable at All" and 5 is "Very Knowledgeable".

	1	2	3	4	5
(i) Existing IT used in the organization	○	○	○	○	○
(ii) The overall IT budget of the organization	○	○	○	○	○
(iii) The overall IT strategy/vision of the organization	○	○	○	○	○
(iv) IT policies in the organization	○	○	○	○	○
(v) The performance of IT	○	○	○	○	○
(vi) The IT risks to which the organization is exposed	○	○	○	○	○
(vii) The IT resources (people, systems, financials) in the organization	○	○	○	○	○

34. **Please indicate the extent to which the board members are knowledgeable about different sources of IT information. Where 1 is "Not Knowledgeable at All" and 5 is "Very Knowledgeable".**

	1	2	3	4	5
(i) IT or business people to contact within the organization as sources of information about IT	○	○	○	○	○
(ii) IT or business people to contact outside of the organization as sources of information about IT	○	○	○	○	○
(iii) Secondary sources of knowledge as source of information about IT	○	○	○	○	○
(iv) Other directors to contact as sources of information about IT	○	○	○	○	○

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Board Oversight of Information Technology Activities

Information Technology Governance

The questions on this page are about the education of ALL the directors on the board.

35. **How many directors have received formal training in IT (i.e. certificates, diplomas, undergraduate or graduate degrees)?**

    ○ None
    ○ 1 director
    ○ 2 – 5 directors
    ○ More than 5 directors
    ○ Don't Know

36. **Has the board received any training in IT Governance?**

    ○ Yes
    ○ No

37. **If the board has received training in IT Governance, please describe the training.**

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PART 8: ORGANIZATION INFORMATION

38. **Please indicate which of the following best describes your organization's industry:**

   ○ Advanced technology
   ○ Healthcare product/Pharmaceuticals
   ○ Aerospace/Defense
   ○ Apparel, textiles
   ○ Automotive
   ○ Bank and Savings institutions
   ○ Other financial institutions
   ○ Construction services and building materials
   ○ Chemicals
   ○ Consumer products
   ○ Electronics/Electrical equipment
   ○ Energy/Utilities
   ○ Entertainment/Hospitality
   ○ E-commerce
   ○ Forest and Paper products
   ○ Healthcare provider/Managed care
   ○ Industrial/Agricultural equipment
   ○ Insurance
   ○ Metals and Metal products
   ○ Other manufacturing
   ○ Professional services
   ○ Other service company
   ○ Publishing
   ○ Retail
   ○ Rubber and plastics
   ○ Scientific equipment
   ○ Transportation/Distribution/Packaging
   ○ Other: [_____]

39. **Please check the box that best describes your organization:**

   ○ Publicly traded
   ○ Privately held
   ○ Non-profit

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○ Government

40. **Approximately how many employees does the organization have?**

   ○ Less than 50
   ○ 51 - 100
   ○ 101 - 500
   ○ 501 - 1000
   ○ 1001 - 5000
   ○ 5001 - 10000
   ○ More than 10000

41. **Approximately when was the organization founded?**

   ○ Less than 5 years ago
   ○ 5-10 years ago
   ○ 11-20 years ago
   ○ 21- 30 years ago
   ○ 31-40 years ago
   ○ More than 40 years ago

42. **Approximately how long ago did the organization last experience a major reorganization (i.e. merger, acquisition, etc.)?**

   ○ Less than 5 years ago
   ○ 5-10 years ago
   ○ 11-20 years ago
   ○ 21- 30 years ago
   ○ 31-40 years ago
   ○ More than 40 years ago
   ○ Not Applicable

43. **Approximately how long has the CEO been in this position?**

   ○ Less than 2 years
   ○ 2-5 years
   ○ 6-10 years
   ○ More than 10 years
   ○ Not Applicable

44. **Approximately how long has the CIO (or equivalent head of IT) been in this position?**

   ○ Less than 2 years
   ○ 2-5 years

○ 6-10 years
○ More than 10 years
○ Not Applicable

PART 9: CONCLUDING SURVEY

45.   Are there any other issues or comments that you would like to note in relation to any of the
        questions asked?

46.   OPTIONAL: Please enter your email address, or the email of your assistant, in order to receive a
        detailed report of the findings from this study:

Thank you for completing this survey.

**If you require further information on this study or have any questions or suggestions please contact
me directly at 519-590-8760 or jljewer@uwaterloo.ca. You can also email my PhD supervisor, Dr.
Kenneth McKay, at kmckay@ist.uwaterloo.ca. Thank you for participating in this study. Sincerely,
Jennifer Jewer**

Submit Survey

Appendix F

Identification of Influential Outlier

Examination of the regression diagnostics revealed the response had high leverage and distance. Finally, high influence of the response was revealed through performing the regression with and without the response. It was revealed that the significance of six of the regression coefficients changed.

Equality of variance - The plot of residuals by predicted values (ZPRED and ZRESID) indicates that that case 86 is an outlier.

Scatterplot
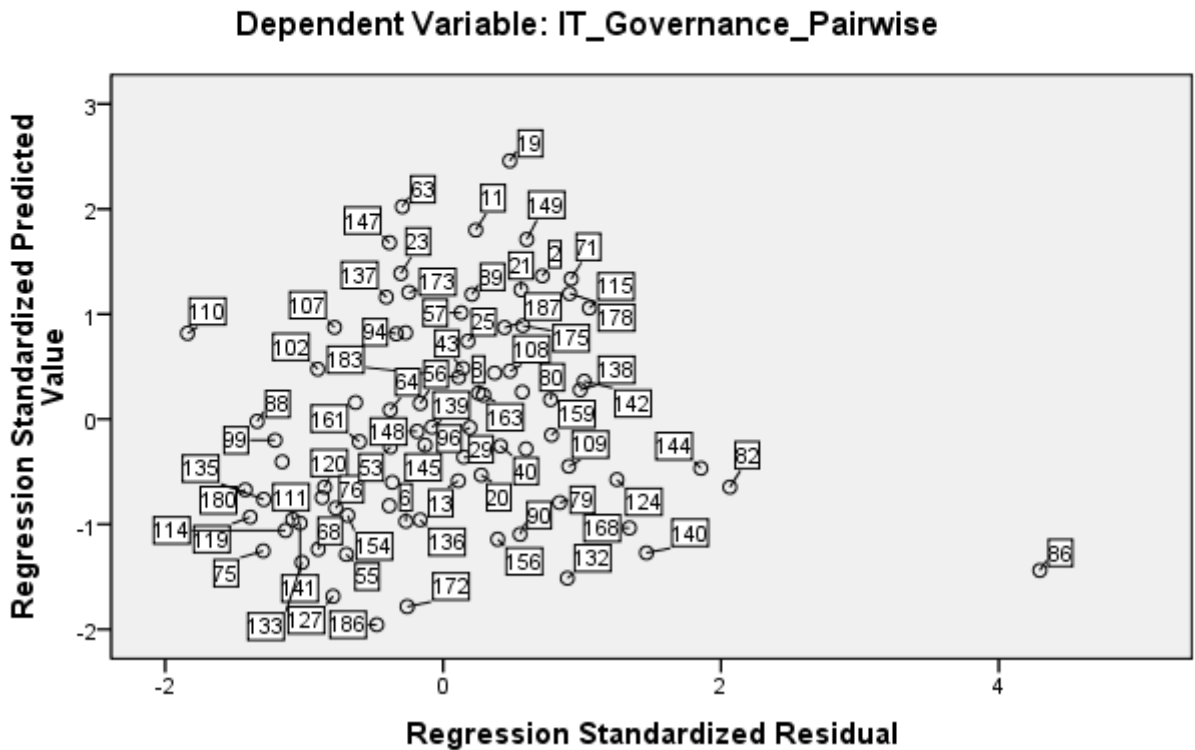
Dependent Variable: IT_Governance_Pairwise

Normality of Residuals – Review of the histogram of the standardized residuals again revealed that there was an outlier in the dataset.
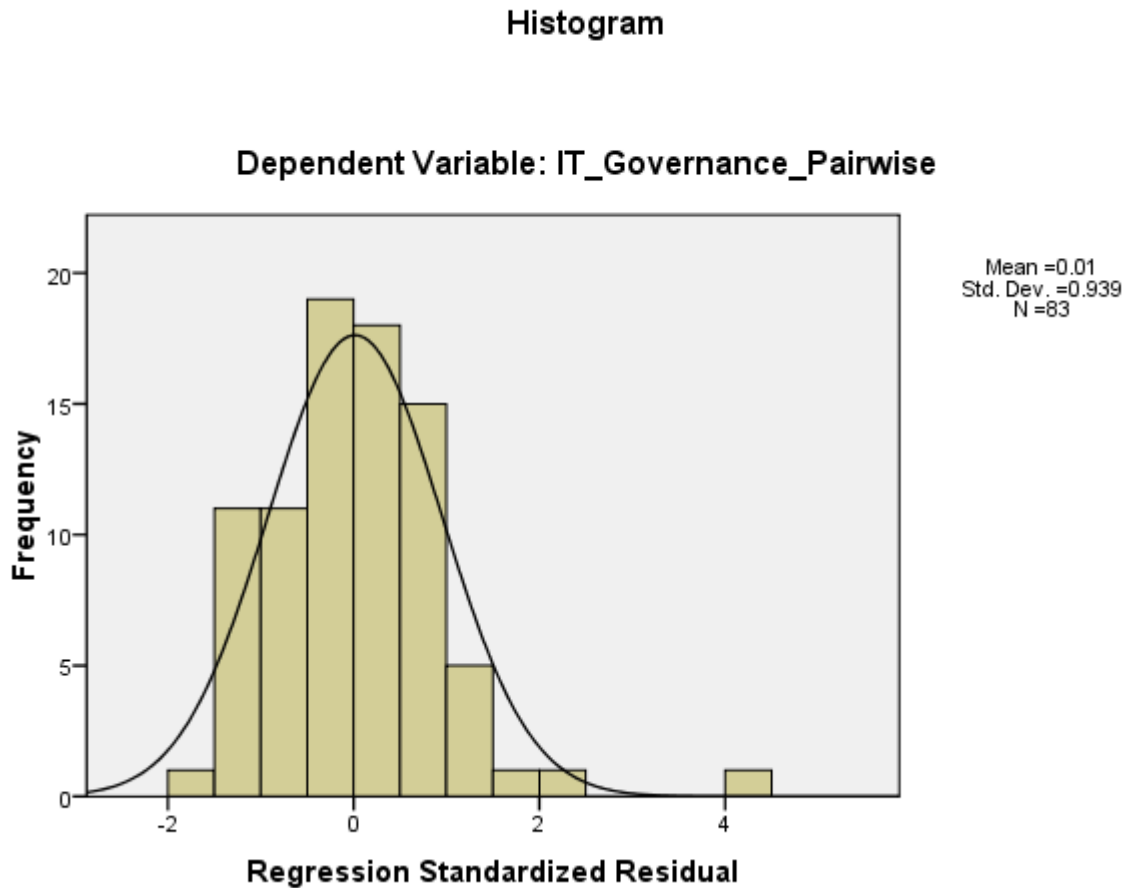
Histogram

Dependent Variable: IT_Governance_Pairwise

Mean =0.01
Std. Dev. =0.939
N =83

Data Problems – Examination of the standardized versions of residuals – the standardized residuals, the studentized residuals – to see if there were any values with absolute value greater than 2, thus indicating distance, revealed that case 86 had a standardized residual of 4.29 and a studentized residual of 4.79.

Examination of the data for case 86 showed that it appeared reasonable and that it did not appear to be coded incorrectly. No problems with data entry were identified so the analysis continued to determine if the outlier was influential and thus, if removed, would change the regression results.

Comparison of the multiple regression of organization factors and board attributes on board IT governance involvement results with and without case 86 revealed that removal of the case changed the significance of six of the regression coefficients. Therefore it was concluded that case 86 was an influential outlier and it was deleted from the dataset.

Variables	Regression Results With Case 86	Regression Results Without Case 86	Change in Significance?
Intercept	.373 (.451)	.498 (.412)	
Organization Size - Small[a]	-.214 (.244)	-.286 (.223)	
Organization Size – Medium[a]	-.313 (.224)	-.408+ (.205)	Change
Organization Size -Large[a]	-.075 (.228)	-.091 (.208)	
Organization Age – 20 years or less[b]	.135 (.150)	.167 (.137)	
Operational Reliance on IT	-.030 (.086)	-.002 (.079)	
Strategic Reliance on IT – Factor 1 – Managerial Support	.212** (.076)	.170* (.070)	Change
Strategic Reliance on IT – Factor 2 - Differentiation	.069 (.081)	-.003 (.076)	
Strategic Reliance on IT – Factor 3 - Enhancement	.100 (.078)	.042 (.072)	
Proportion of Insiders	-.439* (.211)	-.573** (.194)	Change
Board Size	-.597 (.403)	-.785* (.369)	Change
IT Expertise Factor 1 – Internal Knowledge	.372*** (.104)	.435*** (.095)	
IT Expertise Factor 2 – External Knowledge	.163** (.072)	.210** (.065)	
IT Expertise Factor 3 – Experience and Training	.202* (.079)	.218** (.072)	Change
IT Governance Mechanisms Factor 1 – Internal Activities	.135 (.108)	.146 (.098)	
IT Governance Mechanisms Factor 2 – External Activities	.185* (.081)	.185** (.074)	Change
F Value	9.863***	13.049***	
Model R-Square	.611***	.678***	
Adjusted R-Square	.549***	.626***	

Coefficients listed are unstandardized betas. Standard errors are in parenthesis.
*+ $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$*
[a] Dummy variable for organization size with "small" composed of those organizations with less than or equal to 100 employees, "medium" composed of those with 101-500 employees, "large" composed of those with 501-5000 employees, and the contrast group is those with 5001 or greater employees.
[b] Dummy variable for organization age with 0 = formed more than 20 years ago, 1 = formed 20 years ago or less.

Equality of variance - The plot of residuals by predicted values (ZPRED and ZRESID) indicates that there are no longer any outliers in the dataset.

Scatterplot
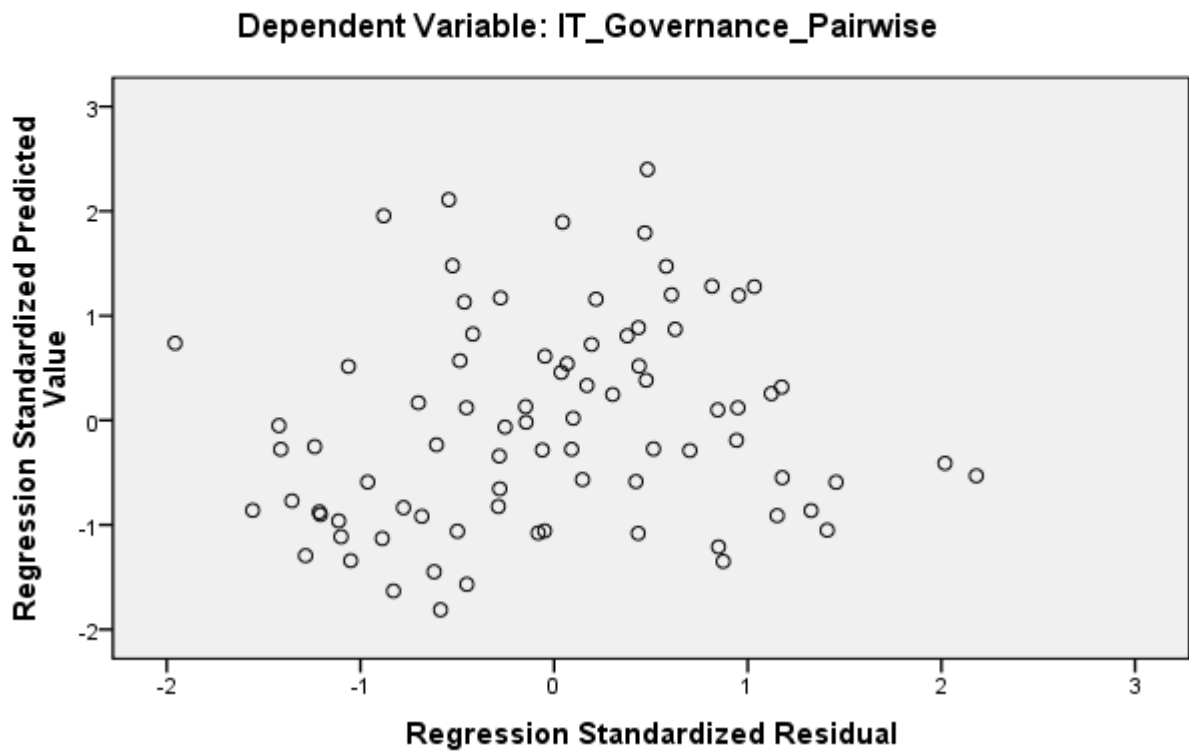
Dependent Variable: IT_Governance_Pairwise

Normality of Residuals – Review of the histogram of the standardized residuals again revealed that there are no longer any outliers in the dataset.

Histogram
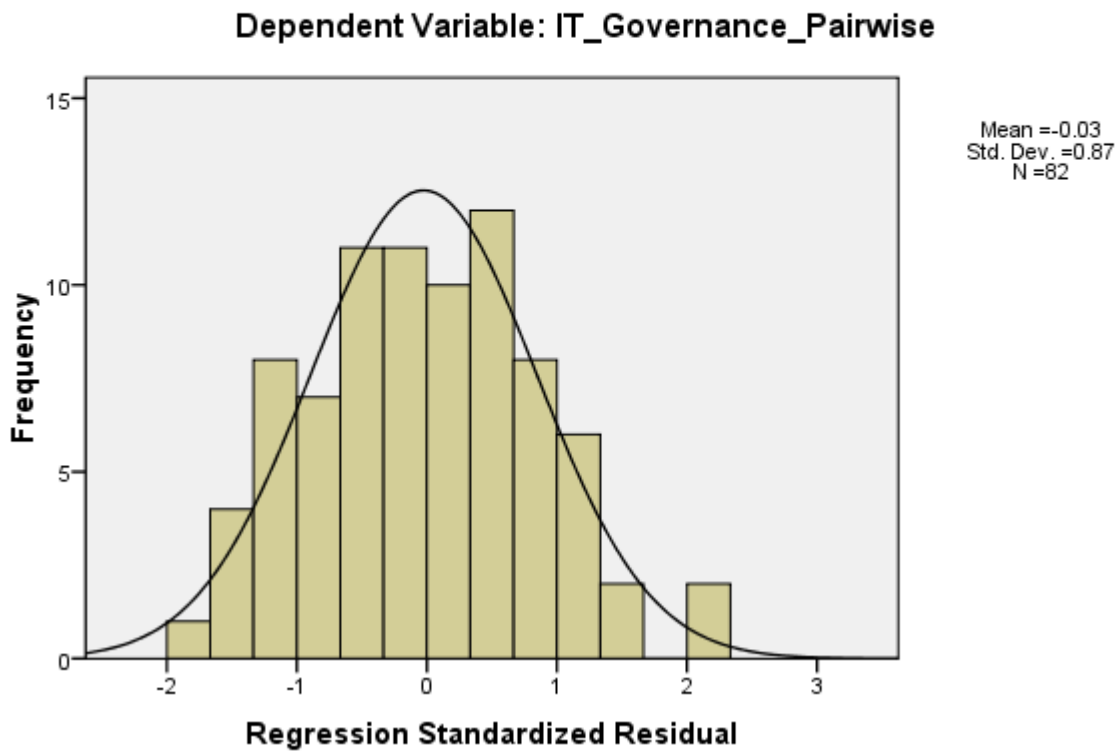
Dependent Variable: IT_Governance_Pairwise

Mean =-0.03
Std. Dev. =0.87
N =82

Data Problems – Examination of the standardized versions of residuals – the standardized residuals, the studentized residuals – to see if there were any values with absolute value greater than 2, thus indicating distance, revealed that two cases had values slightly higher than 2. Since these values were only slightly larger than the rule of thumb they were ignored.

Appendix G

EFA of Overall Board IT Governance

Survey Findings - Factor Analysis - Overall Board IT Governance Involvement

Analysis 1: Level of Overall Involvement in IT Governance
Maximum Likelihood Solution (One Factor Extracted)

	Factor 1 **Overall IT Governance**
Eigenvalue:	**8.058**
Variance Explained:	**57.554%**
Cronbach's Alpha:	**0.943**
IT project governance/management methodologies [a]	0.827
Training and development to ensure the needs are fully identified and addressed for all staff [a]	0.806
Compliance with the agreed organizational risk profile of IT[a]	0.804
Workforce planning and investment to ensure recruitment and retention of skilled IT staff [a]	0.796
Monitors that IT delivers against the strategy through clear expectations and measurement [b]	0.787
Performs IT governance assurance and self-assessment [b]	0.779
Organization's progress or performance toward better IT governance [a]	0.772
Compliance with IT to laws, regulations, industry standards and contractual commitments [a]	0.764
Identifies possible IT threats and opportunities critical to the future of the organization [b]	0.756
Shapes the business/IT strategic alignment [b]	0.740
Stakeholders' satisfaction with IT (e.g. measured through a survey and/or number of complaints) [a]	0.706
Contribution from IT to a competitive advantage [a]	0.703
Advises during major IT decisions [b]	0.702
IT risks to which the organization is exposed [a]	0.656

[a] *Indicate the extent to which the board monitors the following issues or activities. (Scale 1: Not at all - 4: To a large extent, N/A)*

[b] *Indicate the extent to which the board is involved in the following activities. (Scale 1: Not at all - 4: To a large extent, N/A)*

Appendix H
Iterations for EFA of IT Expertise

Initial Model (E1 - 19)

Factor loadings for item E19 was very low (0.255). Further analysis also revealed that 85.1% of the respondents indicated that their board did not receive any training in IT governance. Therefore this item was dropped from the next iteration.

Iteration 1 (E1 - 18)

The resulting 18 item model had satisfactory factor loadings; therefore no further modification was done.

IT Expertise Items:

		Scale
E1	The extent to which the board members are knowledgeable about IT policies in the organization	A
E2	The extent to which the board members are knowledgeable about the performance of IT	A
E3	The extent to which the board members are knowledgeable about the IT risks to which the organization is exposed	A
E4	The extent to which the board members are knowledgeable about the overall IT budget of the organization	A
E5	The extent to which the board members are knowledgeable about the overall IT strategy/vision of the organization	A
E6	The extent to which the board members are knowledgeable about the IT resources (people, systems, financials) in the organization	A
E7	The extent to which the board members are knowledgeable about existing IT used in the organization	A
E8	The extent to which the board members are knowledgeable about IT or business people to contact within the organization as sources of information about IT	A
E9	Indicate the degree to which information from management about the organization's IT operations and management practices is sufficient	A
E10	The extent to which the board members are knowledgeable about secondary sources of knowledge as source of information about IT	A
E11	The extent to which the board members are knowledgeable about applications in general (i.e. internet, electronic data interchange, e-commerce, Groupware)	A
E12	The extent to which the board members are knowledgeable about IT or business people to contact outside of the organization as sources of information about IT	A
E13	The extent to which the board members are knowledgeable about technology in general (i.e. personal computer, client-server, LAN, imagery technology, multimedia technology)	A
E14	The extent to which the board members are knowledgeable about systems development in general (i.e. traditional systems development life cycle, end-use computing, prototyping, outsourcing, project management practices)	A
E15	The extent to which the board members are knowledgeable about other directors to contact as sources of information about IT	A
E16	How many directors have worked directly in an IT role within an organization or as a consultant or academic (e.g. in areas such as IT development, IT implementation, participation or leadership in new IT projects, management of IT projects)?	B
E17	How many directors have received formal training in IT (i.e. certificates, diplomas, undergraduate or graduate degrees)?	B
E18	How many directors have experience in the general management of IT within an organization or as a consultant or academic (e.g. in areas such as participation in the creation of an IT vision statement, IT strategy, IT policies, or IT budgets)?	B
E19	Has the board received any training in IT Governance?	C
Scale: A: 1: Not Knowledgeable - 5: Very Knowledgeable B: None, 1 director, 2-5 directors, more than 5 directors, don't know C: Yes or No		

Appendix I

Iterations for EFA of IT Governance Mechanisms

Initial Model (RM1 – 5, P1 – 7, S1 – 5)

Before performing the EFA, a couple of actions were taken to ensure that all items should be included in the analysis.

Firstly, items with a large number of "not applicable" responses were removed from the EFA. Cross-tabulations with items RM4 (15.3% not applicable), RM5 (15.5%), P4 (17.1%) and S3 (16.5%) and the question "How long has the CIO been in the position" (Survey question 44) revealed that those organizations that did not have a CIO answered "not applicable" on the aforementioned items. Therefore, it was determined that since questions which specifically asked about the CIO had a large number of "not applicable" responses they were removed from the EFA.

Secondly, examination of items S4 and S5 revealed that 96.3% have a champion of IT and that 91.4% do not have an IT Strategy Committee. Therefore, it was determined that inclusion of these items in the EFA would not be beneficial to the analysis.

Iteration 1 (RM1 – 3, P1, P2, P3, P5, P6, P7, S1, S2, S4, S5)

EFA on the items revealed that factor loadings for item S2 was very low (0.367). Therefore this item was dropped from the next iteration.

Iteration 2 (RM1 – 3, P1, P2, P3, P5, P6, P7, S1, S4, S5)

EFA on the items revealed that factor loadings for item P2 was at a moderate to low level and was equal for factor 1 and factor 2 (0.509 and 0.510). Therefore, it was determined that this item did not load strongly on either factor, and this item was dropped from the next iteration.

Iteration 3 (RM1 – 3, P1, P3, P5, P6, P7, S1, S4, S5)

EFA on the items revealed that item RM3 loaded strongly on factor 3 (0.923) by itself (no other items loaded on factor 3). Examination of this item revealed that the responses to this item were highly

skewed to the right with the almost all of the responses (96.3%) falling in the 3 (to some extent) and 4 (to a large extent) response categories. Therefore, it was determined that inclusion of this item in the EFA would not be beneficial to the analysis and it was dropped from the next iteration.

Iteration 4 (RM1, RM2, P1, P3, P5, P6, P7, S1, S4, S5)

The resulting 8 item model had satisfactory factor loadings; therefore no further modification was done.

IT Governance Mechanisms Items:

RM1 – 5, P1 – 7, S1 – 5

Relational Mechanisms - Indicate the degree to which the following items describe the board's relationship and communication with management. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".	
RM1	Some board members and IT management (including CIO) communicate between scheduled meetings
RM2	The board works well with senior IT management
RM3	The board works well with senior business management
RM4	The CIO participates in board meetings
RM5	The CIO participates in Audit Committee meetings
Processes - Indicate the degree to which the following items describe the board's processes. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".	
P1	IT is an item on the agenda of the board
P2	IT is an item on the agenda of the Audit Committee
P3	The board encourages the inclusion of IT on the meeting agenda
P4	If necessary, the board members voice opinions that conflict with the CIO's view
P5	The board gets independent assurance on the achievement of IT objectives
P6	The board gets independent assurance on the containment of IT risks
P7	There are regular sessions for outside directors to discuss IT
Structures - Indicate the degree to which the following items describe the board/management structure. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent".	
S1	The recruitment of board members includes consideration of IT expertise
S2	The IT expertise of the overall board meets the needs of the company and the board
S3	The CIO reports to the CEO and/or COO
S4	There is a key champion/sponsor for ensuring that IT is well managed within my organization (Yes/No)
S5	We have an IT Strategy Committee at the level of board of directors (Yes/No)

Appendix J

EFA of Role of IT

Survey Findings - Factor Analysis - Role of IT in the Organization

Analysis 1: Operational Reliance on IT in the Organization **Maximum Likelihood Solution (One Factor Extracted)**			
	Factor 1		
Eigenvalue:	**4.258**		
Variance Explained:	**70.973%**		
Cronbach's Alpha:	**0.917**		
Please indicate the extent to which you agree or disagree with the following statements as they relate to the existing IT in the organization. Where 1 is "Disagree Strongly" and 5 is "Agree Strongly":			
IT breakdown will critically affect one or more of our functional departments	0.890		
Organization relies heavily on IT for efficient operation	0.875		
IT is vital to our organization	0.864		
IT breakdown for extended periods will affect organizational activities severely	0.863		
IT breakdown will affect our database access	0.796		
IT breakdown will affect overall coordination within our organization	0.758		

Analysis 2: Strategic Reliance on IT in the Organization **Maximum Likelihood Solution / Varimax Rotation**			
	Factor 1 **Managerial Support**	**Factor 2** **Differentiation**	**Factor 3** **Enhancement**
Eigenvalue:	**4.227**	**1.24**	**1.033**
Variance Explained:	**46.965%**	**13.782%**	**11.482%**
Cronbach's Alpha:	**0.841**	**0.785**	**0.692**
Please indicate the significance of the following items as components of your portfolio of planned IT projects. Where 1 is "Very Unimportant" and 5 is "Very Important":			
Projects whose primary benefit is providing new decision support information to top management	0.850	0.175	0.165
Projects whose primary benefit is providing new decision support information to middle and lower levels of management	0.837	0.149	0.055
Projects which enable development of new administrative control and planning processes	0.728	0.221	0.248
Projects which offer significant tangible benefits through improved operational efficiencies	0.601	0.328	0.450
Projects which will allow the organization to develop and offer new products or services for sale	0.113	0.915	0.058
Projects which appear to offer new ways for the organization to compete	0.235	0.861	0.112
Projects involving application of new technologies	0.312	0.576	0.291
Projects focusing on routine maintenance to meet evolving business needs, new regulatory or legal requirements	0.069	0.154	0.861
Projects focusing on existing systems enhancements	0.307	0.083	0.798

Appendix K

EFA of Financial Performance

Survey Findings - Factor Analysis - Financial Performance

Analysis 1: Financial Growth	
Maximum Likelihood Solution (One Factor Extracted)	
	Factor 1
	Growth
Eigenvalue:	**2.493**
Variance Explained:	**83.104%**
Cronbach's Alpha:	**0.897**
Please rate your organization's level of growth. Where 1 is "Very Low" and 5 is "Very High".	
The market share gains relative to our principal competitors are	0.921
My satisfaction with sales growth rate is	0.908
The sales growth position relative to our principal competitor is	0.905
Analysis 2: Financial Profit	
Maximum Likelihood Solution / (One Factor Extracted)	
	Factor 1
	Profit
Eigenvalue:	**3.733**
Variance Explained:	**74.666%**
Cronbach's Alpha:	**0.910**
Please rate your organization's level of profitability. Where 1 is "Very Low" and 5 is "Very High".	
My satisfaction with the return on corporate investment is	0.930
The net profit position relative to our principal competitor is	0.897
The return on corporate investment position relative to our principal competition is	0.875
My satisfaction with return on sales is	0.870
The financial liquidity position relative to our principal competitor is	0.735

Appendix L

EFA of Operational performance

Survey Findings - Factor Analysis - Operational performance

	Factor 1 - External Performance	Factor 2 - Internal Performance
Analysis 1: Operational performance		
Maximum Likelihood Solution / Varimax Rotation		
Eigenvalue:	4.389	1.101
Variance Explained:	62.705%	15.735%
Cronbach's Alpha:	0.882	0.880
Please assess the extent to which IT has contributed to the following seven areas of organizational performance. Where 1 is "Contribution is minimal" and 5 is "IT has contributed to a very great extent".		
Sales Revenue Increase	.943	.172
Market Share Increase	.917	.244
Customer Satisfaction	.676	.488
Return on Investment (ROI)	.655	.355
Process Improvement	.225	.892
Operating Efficiency	.244	.883
Cost Savings	.353	.783

Appendix M

Descriptives for Variables Contained in Factors

Board Involvement in IT Governance

Defensive IT Governance

Indicate the degree to which the board monitors the following issues or activities. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent."

	Mean (Standard Deviation)	1	2	3	4	N/A	Missing	Total
IT project governance/management methodologies	2.19 (1.040)	50	54	61	17	3	3	188
Workforce planning and investment to ensure recruitment and retention of skilled IT staff	2.7 (1.015)	51	53	66	13	3	2	188
Training and development to ensure the needs are fully identified and addressed for all staff	2.14 (1.001)	51	57	62	12	3	3	188
Compliance with the agreed organizational risk profile of IT	2.42 (1.138)	34	42	77	27	6	2	188
Organization's progress or performance toward better IT governance	2.28 (1.038)	44	50	69	18	3	4	188
Compliance with IT to laws, regulations, industry standards and contractual commitments	2.45 (1.167)	37	44	64	36	5	2	188
Stakeholders' satisfaction with IT (e.g. measured through a survey and/or number of complaints)	2.05 (1.136)	52	56	55	15	8	2	188
IT risks to which the organization is exposed	2.88 (1.017)	15	33	82	53	3	2	188
Contribution from IT to a competitive advantage	2.19 (1.274)	44	45	60	26	11	2	188

<u>Offensive IT Governance</u>

Indicate the degree to which the board is involved in the following activities. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent", and 4 is "To a large extent."

	Mean (Standard Deviation)	1	2	3	4	N/A	Missing	Total
Monitors that IT delivers against the strategy through clear expectations and measurement	2.23 (1.040)	45	63	55	21	3	1	188
Identifies possible IT threats and opportunities critical to the future of the organization	2.25 (1.002)	42	61	65	16	3	1	188
Advises during major IT decisions	2.49 (1.170)	40	40	63	40	4	1	188
Shapes the business/IT strategic alignment	2.22 (1.068)	47	55	62	19	4	1	188
Performs IT governance assurance and self-assessment	2.01 (1.029)	61	61	48	13	4	1	188

IT Competency of Board

<u>IT Expertise</u>

Factor 1 – Internal Knowledge Factor
Please indicate the extent to which the board members are knowledgeable about ….
Where 1 is "Not Knowledgeable at All" and 5 is "Very knowledgeable".

	Mean (Standard Deviation)	1	2	3	4	5	Missing	Total
IT policies in the organization	2.46 (1.031)	37	62	58	27	4	0	188
The performance of IT	2.76 (1.015)	23	49	74	35	7	0	188
The IT risks to which the organization is exposed	2.96 (1.106)	21	43	58	53	12	1	188
The overall IT budget of the organization	2.98 (1.075)	16	51	50	60	10	1	188
The overall IT strategy/vision of the organization	2.82 (1.128)	26	49	58	43	12	0	188
The IT resources (people, systems, financials) in the organization	2.83 (1.049)	22	43	79	31	12	1	188
Existing IT used in the organization	2.89 (0.959)	13	50	77	40	8	0	188
IT or business people to contact within the organization as sources of information about IT	3.20 (1.145)	17	32	59	55	24	1	188

IT Expertise Continued

Factor 1 – Internal Knowledge Factor Continued

	Mean (Standard Deviation)	1 - Not at all	2 – Not really	3 – To some extent	4- To a large extent	N/A	Missing	Total
Indicate the degree to which information from management about the organization's IT operations and management practices is sufficient	2.6 (1.027)	19	55	77	33	4		188

Factor 2 – External Knowledge Factor

Please indicate the extent to which the board members are knowledgeable about ….
Where 1 is "Not Knowledgeable at All" and 5 is "Very knowledgeable".

	Mean (Standard Deviation)	1	2	3	4	5	Missing	Total
Secondary sources of knowledge as source of information about IT	2.48 (0.993)	30	70	58	23	5	2	188
Applications in general (i.e. internet, electronic data interchange, e-commerce, Groupware)	2.97 (0.933)	7	53	76	42	10	0	188
IT or business people to contact outside of the organization as sources of information about IT	2.55 (1.011)	28	65	64	23	7	1	188
Technology in general (i.e. personal computer, client-server, LAN, imagery technology, multimedia technology)	3.04 (0.930)	7	47	74	51	9	0	188
Systems development in general (i.e. traditional systems development life cycle, end-use computing, prototyping, outsourcing, project management practices)	2.59 (1.002)	24	72	55	32	5	0	188
Other directors to contact as sources of information about IT	2.83 (1.159)	25	53	52	41	15	2	188

IT Expertise Continued

Factor 3 – Experience and Training Factor

	None	1	2-5	More than 5	Don't Know	Missing	Total
How many directors have worked directly in an IT role within an organization or as a consultant or academic (e.g. in areas such as IT development, IT implementation, participation or leadership in new IT projects, management of IT projects)?	64	55	54	4	11		188
How many directors have received formal training in IT (i.e. certificates, diplomas, undergraduate or graduate degrees)?	78	43	34	7	26		188
How many directors have experience in the general management of IT within an organization or as a consultant or academic (e.g. in areas such as participation in the creation of an IT vision statement, IT strategy, IT policies, or IT budgets)?	41	49	81	5	11		188

IT Governance Mechanisms

Factor 1 – Internal Activities Factor

Indicate the extent to which the following items describe the board's activities. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent" and 4 is "To a large extent".

	Mean (Standard Deviation)	1	2	3	4	N/A	Missing	Total
IT is an item on the agenda of the board	2.29 (1.157)	48	53	49	33	4	1	188
The board encourages the inclusion of IT on the meeting agenda	2.33 (1.221)	47	43	56	35	6	1	188
The board works well with senior IT management	2.41 (1.331)	16	44	81	30	16	1	188
Some board members and IT management (including CIO) communicate between scheduled meetings	2.25 (1.182)	34	62	58	25	9	0	188
The recruitment of board members includes consideration of IT expertise	2.12 (1.215)	56	45	55	24	8	0	188

<u>IT Governance Mechanisms Continued</u>

Factor 2 – External Activities Factor

Indicate the extent to which the following items describe the board's activities. Where 1 is "Not at all", 2 is "Not really", 3 is "To some extent" and 4 is "To a large extent".

	Mean (Standard Deviation)	1	2	3	4	N/A	Missing	Total
The board gets independent assurance on the containment of IT risks	1.87 (1.263)	66	53	32	23	12	2	188
The board gets independent assurance on the achievement of IT objectives	2.06 (1.249)	56	48	49	24	10	1	188
There are regular sessions for outside directors to discuss IT	1.69 (1.182)	84	51	23	18	11	1	188

Role of IT

<u>Operational Reliance on IT</u>

Please indicate the extent to which you agree or disagree with the following statements as they relate to the existing IT in the organization. Where 1 is "Disagree Strongly" and 5 is "Agree Strongly".

	Mean (Standard Deviation)	1	2	3	4	5	Missing	Total
IT breakdown will critically affect one or more of our functional departments	4.27 (0.947)	3	10	17	61	96	1	188
The organization relies heavily on IT for efficient operation	4.24 (0.906)	3	6	23	66	90	0	188
IT is vital to our organization	4.37 (0.964)	5	5	20	43	115	0	188
IT breakdown for extended periods will affect organizational activities severely	4.39 (0.966)	5	6	17	43	117	0	188
IT breakdown will affect our database access	4.30 (0.894)	2	7	22	59	98	0	188
IT breakdown will affect overall coordination within our organization	3.99 (0.913)	0	13	40	71	64	0	188

Strategic Reliance on IT

Factor 1 – Managerial Support Factor

Please indicate the significance of the following items as components of your portfolio of planned IT projects. Where 1 is "Very Unimportant" and 5 is "Very Important".

	Mean (Standard Deviation)	1	2	3	4	5	Missing	Total
Projects whose primary benefit is providing new decision support information to top management	3.26 (1.041)	8	38	60	60	21	1	187
Projects whose primary benefit is providing new decision support information to middle and lower levels of management	3.20 (1.030)	12	32	66	62	16	0	188
Projects which enable development of new administrative control and planning processes	3.41 (0.958)	5	28	60	75	20	0	188
Projects which offer significant tangible benefits through improved operational efficiencies	3.66 (1.039)	7	16	53	69	43	0	188

Factor 2 – Differentiation Factor

Please indicate the significance of the following items as components of your portfolio of planned IT projects. Where 1 is "Very Unimportant" and 5 is "Very Important".

	Mean (Standard Deviation)	1	2	3	4	5	Missing	Total
Projects which will allow the organization to develop and offer new products or services for sale	3.16 (1.368)	31	31	40	48	38	0	188
Projects which appear to offer new ways for the organization to compete	3.29 (1.292)	22	30	47	48	40	1	188
Projects involving application of new technologies	3.40 (1.098)	12	21	67	55	33	0	188

Factor 3 – Enhancement Factor

Please indicate the significance of the following items as components of your portfolio of planned IT projects. Where 1 is "Very Unimportant" and 5 is "Very Important".

	Mean (Standard Deviation)	1	2	3	4	5	Missing	Total
Projects focusing on routine maintenance to meet evolving business needs, new regulatory or legal requirements	3.70 (0.969)	6	14	47	85	36	0	188
Projects focusing on existing systems enhancements	3.68 (0.876)	3	12	57	85	30	1	187

Financial Performance

Profitability

Please rate your organization's level of profitability. Where 1 is "Very Low" and 5 is "Very High".

	Mean (Standard Deviation)	1	2	3	4	5	N/A	Missing	Total
The return on corporate investment position relative to our principal competition is	3.38 (1.327)	2	12	28	48	15	5	0	110
My satisfaction with the return on corporate investment is	3.20 (1.255)	5	21	27	43	11	3	0	110
My satisfaction with return on sales is	3.04 (1.483)	6	17	32	35	13	7	0	110
The net profit position relative to our principal competitor is	3.26 (1.493)	3	11	35	33	20	7	1	110
The financial liquidity position relative to our principal competitor is	3.51 (1.525)	5	13	23	29	35	5	0	110

Growth

Please rate your organization's level of growth. Where 1 is "Very Low" and 5 is "Very High".

	Mean (Standard Deviation)	1	2	3	4	5	N/A	Missing	Total
The sales growth position relative to our principal competitor is	3.46 (1.444)	4	3	36	36	25	6	0	110
My satisfaction with sales growth rate is	3.26 (1.482)	6	11	31	36	20	6	0	110
The market share gains relative to our principal competitors are	3.33 (1.460)	5	9	31	39	20	6	0	110

Operational performance

Factor 1 - External Performance Metrics

Please assess the extent to which IT has contributed to the following seven areas of organizational performance. Where 1 is "Contribution is minimal" and 5 is "IT has contributed to a very great extent".

	Mean (Standard Deviation)	1	2	3	4	5	N/A	Missing	Total
Sales Revenue Increase	2.65 (1.529)	16	15	40	21	10	8	0	110
Market Share Increase	2.66 (1.540)	15	20	31	27	9	8	0	110
Customer Satisfaction	2.98 (1.622)	10	7	38	29	16	9	0	110
Return on Investment (ROI)	2.85 (1.363)	13	16	37	33	6	5	0	110

Factor 2 - Internal Performance Metrics

Please assess the extent to which IT has contributed to the following seven areas of organizational performance. Where 1 is "Contribution is minimal" and 5 is "IT has contributed to a very great extent".

	Mean (Standard Deviation)	1	2	3	4	5	N/A	Missing	Total
Process Improvement	3.37 (1.248)	4	14	30	43	16	3	0	110
Operating Efficiency	3.47 (1163)	3	7	34	49	14	3	0	110
Cost Savings	3.12 (1.254)	5	15	42	34	10	4	0	110

Appendix N
Analysis of Descriptive and Bivariate Statistics

Board IT governance: Board IT governance is the self-reported level of involvement in offensive and defensive board-level IT governance activities. The survey respondents reported their board's involvement in offensive IT governance using a 5-item scale (scored from 1 to 4). The mean ranged from 2.01 to 2.49 for the items indicating a moderate level of involvement in offensive activities. The boards' involvement in defensive IT governance was measured using a 9-item scale (scored from 1 to 4), and the mean was also at a moderate level (ranging from 2.05 to 2.88) with the highest value greater than the measures for offensive IT governance. Board IT governance demonstrated bivariate correlation with all of the dependent variables except for proportion of insiders and number of directors.

Board Attributes: Mean board size is 10.3 directors, with the smallest board having 3 members and the largest board having 25 members. Bivariate correlations indicate that board size is related to the proportion of insiders, and the IT expertise experience and training factor (factor 3).

The mean proportion of insiders on the board was 24%, with the proportion of insiders ranging from 0%, no insiders on the board (38 boards), to 100%, all board members were insiders (7 boards). Proportion of insiders is correlated with the number of directors and the IT governance mechanisms internal activities factor (factor 1).

The IT expertise construct is composed of 3 factors. The first factor, internal knowledge, is composed of a 9-item measure and a 1-item measure. The mean per-item score of the nine-item internal knowledge measure ranged from 2.46 to 3.20 on a 1 to 5 scale indicating boards' moderate level of knowledge of IT internal to the organization. The 1-item internal knowledge measure (scored from 1 to 4) showed that the majority of the boards (59%) rated themselves a 3 or 4, indicating that they receive sufficient information from management about the organization's IT operations and management practices. 30% rated themselves a 2, and 10% rated themselves as not receiving sufficient information from management at all. The second IT expertise factor, external knowledge, is composed of a 6-item measure with means ranging from 2.48 to 3.04 on a 1 to 5 scale. The third IT expertise factor, experience and training, is composed of a 3-item measure that indicates the number of directors who have IT experience and training (scored from none, 1 director, 2-5 directors, and greater than 5 directors). 60% of the boards have 1-5 directors who have worked directly in an IT role

within an organization and 34% have no directors with such experience. Similarly, 70% of the boards have 1-5 directors who have received formal training in IT and 22% have no directors with such training. Finally, 41% of the boards have 1-5 directors with experience in the general management of IT and 42% with no such experience.

The IT governance mechanism construct is composed of 2 factors. The first factor, internal activities, is composed of a 5-item measure (scored from 1 to 4) with means ranging from 2.12 to 2.41. This indicates a moderate level of use of processes and relational mechanisms inside the boardroom that involve the consideration of IT. The second factor, external activities, is composed of a 3-item measure (scored from 1 to 4) with means ranging from 1.69 to 2.06. This indicates a low to moderate level of involvement in processes that occur outside of the boardroom.

All the IT expertise and IT governance mechanisms factors are correlated with the board involvement in IT governance factor, indicating that these constructs appear to be important in understanding board involvement in IT governance. Additionally, the IT expertise internal knowledge factor is correlated with all the IT governance mechanisms factors, the IT expertise external knowledge factor is correlated with the IT governance mechanism external activities factors, and the IT expertise experience and training factor is correlated with the number of directors and the IT governance mechanism internal activities factor.

Organization Factors: Organizations included in the survey tended to have 101 – 500 employees (32.4%), less than 50 employees (19.7%), or 1001 – 5000 (19.7%). Furthermore, organizations tended to have been founded more than 40 years ago (32.1%), or 11 – 20 years ago (22.8%).

The survey respondents indicated their organization's role of IT on two dimensions – operational and strategic reliance. The respondents reported their perceptions of the operational reliance on IT with a construct measured using a 6-item scale (scored from 1 to 5). The mean for the items ranged from 3.99 to 4.39 indicated a moderate to strong operational reliance on IT. The respondents reported their perceptions of the strategic reliance on IT in the organization with a construct measured using 3 scales. The first scale, the managerial support factor, was a 4-item scale (scored from 1 to 5) and the mean scores ranged from 3.2 to 3.66. The second scale, the differentiation factor, was a 3-item scale (scored from 1 to 5) and the mean scores ranged from 3.16 to 3.4. Finally, the third scale, the enhancement factor, was a 2-item scale (scored from 1 to 5) and the mean scores were 3.68 and 3.70. These results indicate that organizations had a slightly higher operational versus strategic reliance on IT in the organization. Bivariate statistics indicate that the operational reliance on IT factor is related

to all of the strategic reliance on IT factors. In addition, it is important to note that the strategic reliance on IT factors are all correlated with the offensive and defensive IT governance factors; however, the operational reliance on IT factor is correlated with the offensive IT governance factor but not with the defensive IT governance factor.

    <u>Financial Performance:</u> Financial performance is the self-reported level of growth and profit relative to the respondent's principal competitor. Growth is reported using a 3-item scale (scored from 1 to 5) the mean ranged from 3.26 to 3.46 indicating a moderate to high level of growth. Profit was measured using a 5-item scale (scored from 1 to 5), and the mean was also at a moderate to high level (ranging from 3.04 to 3.51). Financial performance demonstrated bivariate correlation with the defensive IT governance factor and the strategic reliance on IT managerial support factor (factor 1).

    <u>Operational performance:</u> Operational performance is the self-reported level of performance along two dimensions – external performance and internal performance. The external performance metric is reported using a 4-item scale (scored from 1 to 5) with the mean ranging from 2.65 to 2.98 indicating a moderate level of external performance. The internal performance metric is reported using a 3-item scale (scored from 1 to 5). The mean ranged from 3.12 to 3.47 indicating a moderate to high level of internal performance.

Appendix O

Supplemental Analysis – Proportion of Insiders and IT Governance

Supplemental Analysis 1 – Effects of Proportion of Insiders on Type of IT Governance

	Defensive IT Governance	Offensive IT Governance
Variables		
Intercept		
Proportion of Insiders	-.442+ (.252)	-.475* (.238)
F Value	3.088+	4.001*
Model R-Square	.025+	.029*
Adjusted R-Square	.017+	.021*
Coefficients listed are unstandardized betas. Standard errors are in parenthesis.		
*+ p < .1, * p < .05, ** p < .01, *** p < .001*		

Supplemental Analysis 2 – Effects of Proportion of Insiders and Level of Comfort in IT Management on Board IT Governance

	Level of Comfort - Transparency	Level of Comfort - Competency	Level of Comfort - Integrity	Level of Comfort - Reliability
Variables				
Intercept	-.469 (.318)	-.666 (.426)	-.744+ (.397)	-.531 (.350)
High Level of Transparency[a]	.396 (.402)			
High Level of Competency[b]		.624 (.516)		
High Level of Integrity[c]			.737 (.473)	
High Level of Reliability[d]				.508 (.431)
Proportion of Insiders	-.155 (.407)	-.422 (.584)	-.472 (.575)	-.177 (.480)
Proportion of Insiders and High Level of Transparency Interaction	**-.362 (.555)**			
Proportion of Insiders and High Level of Competency Interaction		**-.001 (.742)**		
Proportion of Insiders and High Level of Integrity Interaction			**.220 (.692)**	
Proportion of Insiders and High Level of Reliability Interaction				**-.243 (.609)**
F Value	5.754***	5.458**	4.440**	6.041***
Model R-Square	.127***	.121**	.101**	.132***
Adjusted R-Square	.105***	.099**	.078**	.110***

Coefficients listed are unstandardized betas. Standard errors are in parenthesis.
*+ p < .1, * p < .05, ** p < .01, *** p < .001*
[a] *Dummy variable for level of transparency of IT management, composed of those responses with transparency rated 4 or 5 on a five point scale.*
[b] *Dummy variable for level of competency of IT management, composed of those responses with competency rated 4 or 5 on a five point scale.*
[c] *Dummy variable for level of integrity of IT management, composed of those responses with integrity rated 4 or 5 on a five point scale.*
[d] *Dummy variable for level of reliability of IT management, composed of those responses with reliability rated 4 or 5 on a five point scale.*

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