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Unpacking Board-Level IT Competency

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Unpacking Board-Level IT Competency

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Abstract:

Boards of directors have an essential role in IT governance in organizations; however, many boards are falling short in this role. Many studies have attributed the lack of board IT governance to a competency gap. However, despite the importance of understanding this gap, there has been limited examination of what constitutes such competency. This paper unpacks the board IT competency construct by examining proxy and direct measures from the literature. Through a survey of 75 board directors in Sri Lanka, we found that while some proxy measures appear to be better measures of IT competency than other proxy measures, direct measures more accurately reflect board IT competency than proxy measures. To further assess the fitness of the proxy versus the direct measures we examined their relationship with board IT governance. We found that the direct measures are more strongly associated with board IT governance than the proxy measures. These findings expand the current understanding of how to measure board IT competency and provide support for its influence on board IT governance. Recommendations are given to researchers on how to measure board IT competency and to boards on how they can enhance their IT competency.

Keywords: Board of Directors, Board IT Competency, Board IT Experience, Board IT Expertise, IT Governance.

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1 Introduction

There is ongoing interest in how board level IT competency impacts IT governance (Peppard et al., 2023). The transformative impact of digital technologies, such as artificial intelligence (AI) (van Giffen & Ludwig, 2023) and the ever-increasing threat of cybersecurity incidents (EY, 2021a; Proudfoot et al., 2023), have increased the need for board-level attention to IT for the board to fulfill its duties of care and loyalty. However, research has repeatedly found that many boards are falling short in this role (Caluwe & De Haes, 2019), with less than 20% of boards taking up accountability for governing IT (Andriole, 2017; Bart & Turel, 2010; Nolan & McFarlan, 2005; O'Donnell, 2004; Valentine & Stewart, 2015). This shortfall can have real consequences for organizations, as board IT governance has significantly influenced organizational performance (Héroux & Fortin, 2018; Jewer & McKay, 2012; Weill et al., 2019). Furthermore, since average investments in IT consist of between 5% and 9% of overall corporate revenue and are increasing (Gartner, 2021), the negative impacts of lack of board IT governance will likely worsen as organizations increase their reliance on IT unless the current status quo changes. When boards are falling short in their governance of IT, significant issues such as IT risk management and the quality and focus of investment decisions are not often adequately considered (Andriole, 2009; Bart & Turel, 2010; Huff et al., 2006; Valentine et al., 2016). A global board risk survey from EY (2021b) found that just 9% of boards declared themselves extremely confident that the cybersecurity risks and mitigation measures presented to them can protect the organization from major cyber-attacks – down from 20% in the previous year.

Many studies have attributed the lack of board IT governance to a board IT competency gap (e.g., Caluwe, 2022; Hartmann & Carmenate, 2021; Proudfoot et al., 2023; PwC, 2012; Valentine, 2016). However, despite the importance of understanding this gap, the literature lacks an in-depth discussion of board IT competency, its measures, and its impact. There has been limited examination of what constitutes such competency at the board level. While IT skill frameworks such as SFIA 9 (Skills Framework for the Information Age), COBIT (Control Objectives for Information and Related Technologies), and ITIL (Information Technology Infrastructure Library) exist, these are management rather than board-focused. Using a mixed-method approach to triangulate research data, Valentine (2016) created a board-level IT competency set based on feedback from more than 400 directors, senior IT and non-IT executives, and industry practitioners (see also Valentine & Stewart, 2015; Valentine et al., 2016). Mohamad et al. (2014) also developed a board IT competency set; however, it should be acknowledged that it was based on a limited sample of 7 CIOs. These competency sets were developed to ensure board IT governance competencies were strategy-matching, were director-role focused from a compliance perspective, and to provide the means for boards to assess competencies for IT governance. For example, during an annual board review, to audit IT competency maturity for director recruitment, professional development, or succession planning (Valentine, 2016). Research on board-level IT competency sets is still in its early stages, and our study's findings can inform this work.

In empirical studies measuring board IT competency, aside from the studies by Jewer and McKay (2012) and Weill et al. (2019), which measured IT competency more directly, most research has relied on proxies to assess board IT competency despite the increasing focus on board IT governance. For example, proxies have been based on whether the directors had worked in IT and/or had education in IT (Bandodkar & Grover, 2022; Benaroch & Chernobai, 2017; Dissanayake et al., 2021; Haislip et al., 2020; Kambil & Lucas, 2002; van Peteghem et al., 2019; Vincent et al., 2019). The information supporting the proxy-based research has been based upon secondary data such as annual reports or other organization or industry filings. When the samples are large, proxies can provide an aggregate view of possible relationships, which can be valuable and inform subsequent research. Empirical research using various proxies to measure board IT competency and its influence on board IT governance, along with sometimes conflicting findings, inspired us to explore measurement issues in greater depth. The extent to which the proxy measures accurately reflected board IT competency in prior research was unclear, and thus, there was uncertainty around their relationship to outcomes such as board IT governance or firm performance. In addition, even if the proxy measures were practical to gauge the level of board IT competency to some degree, the aggregated proxy measures did not offer a specific roadmap for how a board can increase its IT competency. These gaps and issues were the primary motivation for this research.

This paper aims to deepen the understanding of the potential impact of board IT competency on IT governance by validating and extending previous research. It does so by comparing the effectiveness of direct measures to proxy measures. The following research questions guided our research:

RQ1: How do proxy measures compare to direct measures in assessing board IT competency?

RQ2: Which proxies are associated with board IT governance, and how do they compare to direct measures?

Together, the findings of the two research questions help us identify whether and how proxies can be used to measure board IT competency robustly. The first research question assesses board IT competency proxy variables used in the literature relative to direct measures, and the second research question compares the proxies' associations with the level of board IT governance compared to direct measures. The paper concludes that direct measures more accurately reflect board IT competency than proxy measures and are more highly associated with board IT governance than proxy measures. The use of the direct measure approach, coupled with proxies, addresses a number of concerns noted in the literature regarding the examination of board competence (Bandodkar & Grover, 2022; Dissanayake et al., 2021; Yoo & Kim, 2012). This research advances our understanding of how to assess board IT competency, paving the way for a deeper exploration of its impact. The validated direct measure of board IT competency offers practical potential for assessing competency levels, enabling boards to take targeted steps toward developing their capabilities.

We start by exploring and defining the constructs of board IT governance and IT competency and introduce our hypotheses to be tested: only with a valid direct measure of this construct will it be possible to find out what specific types of IT expertise and experience lead to board IT governance. Using a survey of 75 directors, we assess the level of board IT competency through multiple direct and proxy measures of board IT competency. We then examine the relationships between board IT competency measures and board IT governance, and compare the results of the direct measures to those of the proxy measures.

2 Background

The role of the board of directors is to control for the self-interest of executive management and protect stakeholder interests, provide advice and counsel to the CEO, act as a valuable competency resource, and facilitate access to resources for the firm (Johnson et al., 1996). Directors have an ethical and fiduciary duty to act honestly and in good faith with the best interests of the company in mind and to exercise a duty of care with diligence and skill that a reasonably prudent person would exercise in similar circumstances (Bayles, 1989; Valentine et al., 2016). Directors are responsible for executing these duties with appropriate levels of due diligence, which includes being sufficiently knowledgeable and informed about the business and its activities, as well as the environment in which it operates (LeBlanc & Gillies, 2005; Valentine & Stewart, 2015; Valentine et al., 2016). Given the impact of IT in organizations, board-level responsibilities extend to overseeing the organization's use of IT. In recent years, there have been increasing calls for more board-level engagement in IT governance (Caluwe & De Haes, 2019; Peppard et al., 2023; Proudfoot et al., 2023; van Giffen et al., 2023). Stakeholders have high expectations for boards to play a crucial role in IT governance and risk management, for example, by helping to shield the organization from cybersecurity incidents (Proudfoot et al., 2023) and to capitalize on IT investments, such as AI (van Giffen et al., 2023). Board IT governance is:

> *An integral part of corporate governance for which, as such, the board is accountable. It involves the definition and implementation of processes, structures, and relational mechanisms that enable both business and IT stakeholders to execute their responsibilities in support of business/IT alignment, and the creation and protection of IT business value (De Haes et al., 2020, p. 3).*

We define board IT governance as the extent to which the board is involved in evaluating, directing, and monitoring IT initiatives (Vincent et al., 2019).

A board's effectiveness relies on the boardroom dynamics—its capabilities, behaviors, and organizational practices. The individual and collective competencies and behaviors of directors foster effective corporate governance cultures, ultimately determining an organization's success or failure (LeBlanc & Gillies, 2005). Directors must be competent to analyze information from management, advisors, and suppliers. They should be able to evaluate this information critically and ask probing questions (Valentine et al., 2016). For example, digital technologies, such as AI, require capital-intensive investments that often pose novel legal, ethical, and reputational risks, and thus, "every director needs at least a foundational understanding of the technology to fulfill their duties" (van Giffen & Ludwig, 2023, p. 60). Checklists to guide board

decisions regarding digital technologies are available (e.g., cybersecurity (Rothrock et al., 2018)). While these can provide a minimum standard, boards need IT competency to critically review governance reports and proposals and fully address the intricate consequences and risk management dependencies that digital technologies can produce (Proudfoot et al., 2023). A lack of capabilities, including IT competency, can result in heightened business and technology risks, missed strategic opportunities, or an inability to integrate and capitalize on digital investments (Valentine et al., 2016).

2.1 Definition of Board IT Competency

It is important to understand the difference between expertise and competency. In general, expertise refers to increasing levels of performance beyond the average population's ability, with higher levels achieved after many years, often 10 or more, of deliberate practice, and reflects "extreme adaptations, accomplished through life-long effort" (Ericsson & Charness, 1994, p. 774). Individuals on a board will have varying degrees of expertise in IT, and the level of expertise may or may not be sufficient for competency: competency is the capacity to effectively and consistently utilize adequate expertise in a specific domain to meet director role compliance requirements and the task's objectives and performance criteria. Competence comprises "…complex ability constructs that are closely related to performance in real-life situations" (Hartig et al., 2008, p. v). Researchers have consistently theorized that competence is context specific because different contexts may require different abilities (Wang & Haggerty, 2011).

In the context of the IT competence of business managers, an area close to board directors, Bassellier et al. (2003) defined IT competence as "the set of IT-related knowledge and experience that a business manager possesses" (p. 317). This definition includes two dimensions of IT competence—knowledge and experience. Knowledge refers to "…specialized knowledge possessed by individuals: how well they understand fundamental IT concepts, how well informed they are about IT in their organization" (Bassellier et al., 2003, p. 320). While experience is a situated action (Orlikowski, 2002) referring to working on IT projects and managing IT in the organization—the activities they engage in deepen their knowledge. This experience is crucial for critical decision making. As Dewey (1933) noted, knowledge is insufficient for critical thinking, and prior experience is paramount if high-quality questions, inferences, and ideas arise. Dewey also noted that the ideas need to be validated, and this aligns with Bassellier et al.'s (2003) finding that while knowledge is a crucial part of business managers' IT competence, it is not sufficient to represent competence and must include the use and exploitation of such knowledge (i.e., applying and validating the ideas that arise). Similarly, Cohen and Levinthal's (1990) absorptive capacity construct refers "not only to the acquisition or assimilation of information by an organization but also to the organization's ability to exploit it" (p. 131). It is essential to capture the performance aspect of the knowledge. In this study, we applied the theory of competence in the context of board IT governance; we defined the board IT competency construct as the set of IT-related expertise and experience that a board's directors possess.

2.2 Influence of Board IT Competency

Prior literature on the influence of boards' IT competency on board IT governance has drawn from four main theoretical perspectives (see Table 1). *Agency theory* is the predominant theory in understanding the control role of the board and stipulates that the board should control for the self-interest of management (Benaroch & Chernobai, 2017; Buckby & Best, 2007; Mähring, 2006; Posthumus & Solms, 2008; Yayla & Hu, 2014). In IT governance, agency theory describes the board's oversight role of IT strategy, investment, and value creation, and in monitoring capital intense transformation projects to completion against what was planned. Another common theory used in this domain is the resource-based view of the firm and *resource dependency theory*. Rather than focusing on the control role of the board, it proposes that boards and directors are potentially valuable resources for IT governance (Benaroch & Chernobai, 2017; Héroux & Fortin, 2018; Turel & Bart, 2014; Valentine & Stewart, 2013). Resource dependency theory suggests that the board functions as a resource provision mechanism to help the organization make better decisions concerning IT. *Strategic choice theory* supports the idea that directors act as change agents between the focal firm and its environment. Therefore, a board with more IT competency would be more able to govern IT appropriately. Finally, according to *expertise theory*, board members with IT expertise provide additional value to IT decisions because their knowledge and experience enable them to make decisions in uncertain and complex environments.

Table 1. Theories of Board IT Governance

Theory applied	Role of the board in IT governance	Reference
Agency theory	A board with more IT expertise has a greater ability to oversee IT investments and institute control and monitoring mechanisms.	Bandodkar & Grover (2022); van Peteghem et al., (2019)
Resource dependency theory	A board with a high IT competency level is a resource that is valuable, rare, inimitable, and non-substitutable to help the organization make better IT decisions.	Bandodkar & Grover (2022); Dissanayake et al. (2021); van Peteghem et al., (2019)
Strategic choice theory	A board with a high IT competency level can act as a positive change agent and influence decision making in IT.	Jewer & McKay (2012); van Peteghem et al. (2019)
Expertise theory	A board with a high IT competency level can make appropriate responses to IT decisions.	Haislip et al. (2020); Valentine, 2016; Vincent et al. (2019)

These four theories all support the importance of board IT competency in influencing IT governance. They are based on the idea that the board is generally expected to provide expertise, advice, and counsel and that carrying out these functions effectively hinges on the board's level of IT competency. However, the analysis and application of this idea rely on the ability to define what IT competency is for the board of directors. This has been limited as the construct of board IT competency has not been sufficiently defined in the literature.

Furthermore, while the importance of board IT competency in improving board IT governance and/or firm performance has been argued in the literature, there has been limited empirical examination of these relationships. A 2019 review of the literature on board IT governance found only two papers empirically validating IT competency as an antecedent to board-level IT governance and/or firm performance (Caluwe & De Haes, 2019). Kambil and Lucas (2002) found that boards with more IT-experienced external members were associated with larger IT investments and the presence and role of a Chief Information Officer (CIO). Jewer and McKay (2012) found a positive relationship between board IT competency and IT governance and consequently firm performance. Our examination of the literature published since Caluwe and DeHaes' (2019) review revealed two further studies that supported the relationship between board IT competency and firm performance. Van Peteghem et al. (2019) measured board IT competency through a proxy of the percentage of directors with prior experience in an executive or board function in the IT sector or as a CIO or Chief Technology Officer (CTO), whereas Weill et al. (2019) followed a mixed methods approach (survey, interviews and machine learning of bios) to identify what makes a board digitally savvy. We also found one study that did not support this relationship (Dissanayake et al., 2021). Dissanayake et al. (2021) used a proxy for board IT competency through external datasets, as indicated by directors' prior experience serving on boards of other IT companies. They did not find a significant relationship with firm performance and suggested that this may be due to the rapidly changing nature of IT and that experience in older technologies may "dampen the advantages that experience with IT might provide" (p. 11).

Several other papers have reported varied results on the examination of the impact of board IT competency on different outcomes. For example, Vincent et al. (2019) did not find a significant relationship between board IT competency and a specific element of IT governance, maturity of risk management practices, when also considering the influence of the extent to which the board governs IT and the predisposition of management toward taking risks. However, they found that, taken alone, board IT competency had a significant positive relationship with the maturity of the board's risk management practices. They measured board IT competency through proxies by asking senior IT managers to indicate whether at least one director has worked directly in IT, whether at least one director has received formal training in IT, and whether at least one director has experience in the general management of IT.

Conversely, using a proxy of whether the directors had served in an IT-related position of employment (e.g., CIO, CTO, Vice President of Information Technology, or IT consultant), Haislip et al. (2020) found support for the relationship between IT-expert Chief Executive Officers (CEOs) (members of boards) and timeliness of form 8-k filings (report of unscheduled material events or corporate change required by the SEC). Furthermore, Bandodkar and Grover (2022) found that appointing C-level information technology experts, such as CIOs and CTOs, on boards measured through proxies led to firm value creation under certain conditions. The diverse approaches to measuring board IT competency and the sometimes conflicting findings in these studies allude to the complexity of accurately capturing this construct and its influence. We posit that the lack of use of a well-defined construct to measure board IT competency has contributed to these varied results.

2.3 Measures of Board IT Competency

Board IT competency in empirical research can be measured i) directly by measuring levels of directors' IT knowledge and experience or ii) by using proxy measures, such as the number of directors with IT degrees or who have worked in IT. Direct measures are generally considered to provide an accurate reflection of the level of the construct under observation and, as such, represent 'gold standard' measures. However, direct measures, especially in the context of boards of directors, can be intrusive, time-consuming, and costly to use. This significantly limits their use in any context other than small studies, often making them an infeasible option.

Board research has, therefore, commonly relied on less costly and more readily available indirect sources of competency data, including review of annual reports or other industry fillings. However, despite their widespread use, the extent to which these proxy measures accurately reflect board competency is unclear. There are often discussions about the limitations of using proxies versus direct measures, and direct measures are often credited with deeper analysis (Bandodkar & Grover, 2022; Dissanayake et al., 2021; Yoo & Kim, 2012).

Our search of the literature found six studies in the AIS basket of 8 that measured board IT competency either through direct or proxy measures, and two studies, one from Communications of the Association of Information Systems (CAIS) and one from MIT Sloan Management Review (SMR), that were frequently cited in the literature (see Table 2).

Table 2. Research Studies that Measure Board IT Competency

Journal	Methodology	Reference
CAIS	Survey of 37 CEOs	Kambil and Lucas (2002)
JAIS[1]	Survey of 188 and 10 interviews of directors	Jewer and McKay (2012)
JAIS[1]	Reviewed 10K filings and annual reports for 334 C-level director appointments	Bandodkar and Grover (2022)
JIS[2]	Survey of 215 IT professionals	Vincent et al. (2019)
JIS[2]	Reviewed biographies of CEOs of 1500 firms	Haislip et al. (2020)
JSIS[3]	Reviewed BoardEx and Compustat for 2700 companies	Dissanayake et al. (2021)
MIS Quarterly	Reviewed SEC proxy filings for 110 operational IT failures	Benaroch and Chernobai (2017)
MIT SMR	Surveyed 81 board members, interviewed 14, used machine learning to analyze the bios of more than 40,000 directors	Weill et al. (2019)

Note: 1 Journal of the Association for Information Systems; 2 Journal of Information Systems; 3 Journal of Strategic Information Systems

As is common in board research, four of these eight studies reviewed external datasets to attain board IT competency information. These studies measured board IT competency through proxy measures—directors who worked in IT roles and/or who had formal training in IT—with varied measurement items. Of the other four studies, two used a survey (one of CEOs (Kambil & Lucas, 2002) and one of IT professionals (Vincent et al., 2019)), and two studies followed a mixed methodology, one employing a survey and interviews (Jewer & McKay, 2012) and the other using a survey, interviews, and machine learning of director bios (Weil et al., 2019). See Table 3 for the proxy versus direct measures used in the eight studies. As shown in the table, director experience included a range of measures from a general "worked in IT" measure to holding a management position in IT, prior experience serving on boards of other IT companies, or previous C-level experience. Director education was measured as having a technical degree or formal training (not necessarily a degree in the subject).

In addition to the use of director IT experience and education, Benaroch and Chernobai (2017) used two other proxies to measure board IT competency—CIO/CTO on the board and the number of board IT committees. Another study, Weill et al. (2019), did not use direct measures of board IT competency but rather used machine learning to analyze the biographies of directors. They found that IT competency was related to having directors who had been board members or senior executives in the IT industry, or directors who had worked in C-level positions such as CIO, CTO, Chief Operating Officer (COO), Chief Digital Officer (CDO), or Chief Marketing Officer (CMO).

Table 3. Measures of Board IT Competency

Element of Board IT Competency		Measurement Item	Reference
Proxy Measures	Director worked in IT	Director worked in IT role	Kambil & Lucas (2002)
		Worked directly in an IT role; experience in the general management of IT initiatives	Jewer & McKay (2012); Vincent et al. (2019)
		Held an IT management position in the past; previously worked in a public IT firm	Benaroch & Chernobai (2017)
		Prior experience serving on boards of other IT companies	Dissanayake et al. (2021)
		Previously served in an IT-related position of employment (e.g., CIO, CTO, Vice President of Information Technology, or IT consultant)	Haislip et al. (2020)
		Previous C-level information technology experience	Bandodkar & Grover (2022)
		Previously served in executive roles as CIO, CTO, COO, CDO or CMO; previously served as board member or senior executive in the IT industry	Weill et al. (2019)
		Previous executive or board role in the IT sector; executive position as CIO, COO, CEO in an IT firm	van Peteghem et al. (2019)
	Director education in IT	Technical degree	Kambil & Lucas (2002)
		Received formal training in IT	Jewer & McKay (2012); Vincent et al. (2019)
		Directors hold IT-related college degrees or certifications	Benaroch & Chernobai (2017)
		Academic degree in computer science, electrical engineering, or information systems	Haislip et al. (2020)
	CIO/CTO on the board	CIO/CTO on the board	Benaroch & Chernobai (2017)
	Board-level IT committees	Number of board IT committees	Benaroch & Chernobai (2017)
Direct Measures	Board's internal knowledge of IT	Knowledge about: IT polices in the organization; performance of IT; IT risks to which the organization is exposed; overall IT budget of the organization; overall IT strategy of the organization; IT resources in the organization, existing IT used in the organization; IT or business people to contact within the organization as sources of information about IT. The degree to which information from management about the organization's IT operations and management practices is sufficient	Jewer & McKay (2012)
	Board's external knowledge of IT	Extent of knowledge about: secondary sources of knowledge as a source of information about IT; applications in general; IT or business people to contact outside the organization as sources of information about IT; technology in general; systems development in general; directors to contact as sources of information about IT	Jewer & McKay (2012)
	Board-level IT governance mechanisms	IT is an item on the agenda of the board; the board encourages the inclusion of IT on the meeting agenda; the board works well with senior IT management; some board members and IT management communicate between scheduled meetings; the recruitment of board members includes consideration of IT expertise; the board gets independent assurance on the containment of IT risks; the board gets independent assurance on the achievement of IT objectives; there are regular sessions for outside directors to discuss IT	Jewer & McKay (2012)

Jewer and McKay (2012) developed direct measures of IT competency based on the IT expertise scales from Bassellier et al. (2003). They considered the presence of IT governance mechanisms on the board as a component of IT competency, suggesting that such mechanisms "increase the capacity of the board

to acquire, interpret, and disseminate information, thus increasing the ability of the board to govern IT" (p. 588). They treated the presence of IT governance mechanisms as one of the measures of IT competency along with IT expertise. They treated this as one construct in their analysis of the impact on board IT governance. In this paper, we build on these studies by comparing the fitness of a variety of proxy versus direct measures and examining their relationship to board IT governance.

3 Hypotheses to be Tested

Given the exploratory nature of our study, we have developed general hypotheses to test our research questions. To examine how proxy measures compare to direct measures in assessing board IT competency (RQ1), we started by assessing the correlations of the proxy measures with each other, and the correlations among the direct measures. Whereas direct measures capture the same construct and are designed to quantify the actual phenomenon, leading to stronger internal consistency and correlations, proxy measures serve as indirect indicators, meaning they may not consistently measure the same underlying construct. Each of the proxy measures may reflect a different dimension of IT competency. For example, the number of directors with IT work experience (proxy for IT competency) captures practical, applied experience in IT-related roles, which may be operational (e.g., IT project management or software development) or strategic (e.g., IT leadership, digital transformation), therefore, experience does not always translate into governance expertise. The number of directors with IT education (another proxy) reflects formal, academic knowledge of IT, which may be theoretical rather than practical. Also, IT education varies significantly—some directors may have technical degrees, while others may have broader IT-related business degrees. Unlike direct measures, proxies can be affected by contextual factors that are unrelated to the construct of interest. For example, some corporate governance regulations require firms to have a CIO/CTO on the board (another proxy); however, these mandates do not necessarily reflect actual board-level competency. For example, in the banking sector, regulatory bodies often require cybersecurity expertise at the board level, leading companies to appoint a CIO/CTO even if they do not actively participate in IT governance discussions. Furthermore, proxy measures introduce measurement noise and bias, leading to weak or inconsistent correlations (Alkhazali & Zoubi, 2005). Therefore, if different proxy measures capture non-overlapping aspects, they may show weak correlations with each other. A board member with a degree in IT may have theoretical knowledge but lack governance experience, while a CIO/CTO on the board may have strategic IT oversight but not formal education in IT. These two proxies measure different aspects of IT competency, leading to low correlations between them. The lack of a direct one-to-one relationship introduces random measurement noise, weakening the correlation between different proxy measures.

In contrast, direct measures, when developed through a rigorous theoretical framework and validated using psychometric techniques such as exploratory factor analysis (EFA), are expected to show strong internal consistency and convergent validity. Convergent validity ensures that items designed to measure the same construct are highly correlated, while discriminant validity ensures that they are distinct from unrelated constructs. Because valid direct indicators of board IT competency should measure the same underlying phenomenon, they are expected to exhibit significant correlations with one another. Therefore based on psychometrics and measurement theory that supports the idea that valid, direct indicators of a construct should correlate well with each other, we propose the following hypotheses:

Hypothesis 1: Proxy measures are not expected to show significant correlations with one another.

Hypothesis 2: Direct measures are expected to show significant correlations with one another.

As proxy measures of board-level IT competency possess several limitations in terms of their reliability and validity, we use the direct measures of board IT competency to determine the precision and accuracy and to validate the proxy measures (RQ1). We thus hypothesize that:

Hypothesis 3: Proxy measures are not expected to show significant correlations with direct measures.

Next, to further explore the fitness of the proxy versus the direct measures of board IT competency, we examined the proxy measures' association with board IT governance compared to the direct measures (RQ2). Prior literature suggests that IT competency in boards influences their intentions to govern the IT of their organizations. This is supported by theories such as agency theory, resource dependency theory,

strategic choice theory, and expertise theory. However, these effects may be misestimated if competency is measured using proxies rather than direct indicators. Proxy measures, which may capture only surface-level credentials rather than actual IT governance capabilities, could lead to inconsistent results across studies.

While there has been support for the relationship between board IT competency and IT governance in prior studies (Jewer & McKay, 2012; van Peteghem et al., 2019; Weill et al., 2019), as we discussed, conflicting findings have also been found (Dissanayake et al., 2021; Vincent et al., 2019). We attribute some of these varied results to the use of proxy versus well-defined direct measures of board IT competency.

Proxy measures may exhibit weaker associations with board IT governance because they are indirect indicators that may not accurately capture governance-relevant IT competency. As discussed previously, unlike direct measures, proxy measures are often influenced by contextual factors such as regulatory mandates, industry norms, and firm-specific governance structures. This measurement noise can weaken their predictive power in explaining IT governance behaviors and decisions. Thus, we propose:

Hypothesis 4: Proxy measures will exhibit weaker associations with board IT governance compared to direct measures.

4 Materials and Methods

We designed a survey incorporating both direct and proxy measures of board IT competency, along with measures of board IT governance, to assess how well proxies compare to direct measures in capturing board IT competency and their association with board IT governance. The survey included a variety of questions across different domains, but for this study, we focused specifically on the direct and proxy measures of board IT competency and IT governance. Additionally, we included five questions exploring directors' perceptions of IT expertise, IT governance, and their related impact to provide further contextual insights.

4.1 Survey Administration

We developed the survey with representatives from EY Sri Lanka, EY Global Delivery Services, and the Sri Lanka Institute of Directors (SLID). SLID used the survey to identify the state of board IT governance in Sri Lanka. We pretested the survey with academics, survey design professionals, and directors and redesigned the survey to address the comments of the pre-test participants. The survey was distributed nationally to directors by SLID and by the Sri Lankan Ministry of Finance, the Government of Sri Lanka, the Colombo Stock Exchange, The Ceylon Chamber of Commerce, and the National Chamber of Commerce of Sri Lanka. The survey was built with Qualtrics and distributed electronically by EY Global Delivery Services. The intention was to reach as many directors in Sri Lanka as possible, so a recruitment email was sent to directors to participate in the survey, reminders were sent out, and web and social media outlets were used to share the link to the survey. This was a long survey requiring, on average, 15 to 20 minutes to complete, and for this study, we are using a subset of the questions from the survey. In total, 100 responses were received. Of the 100 responses, 24 were omitted because they contained less than half of the answers to the survey questions; this left us with 76 responses for our analysis. One additional response was deleted because there was an outliner on the variable "number of directors on the board."

4.2 Sample Profile

Since directors often serve on more than one board, they were asked to respond to the survey for the board of the largest organization they served. No one industry dominated our responses. A mix of various types of companies from different industries made up 24% of our sample, followed by banking companies (14%), food/beverages and tobacco (9%), and insurance (8%). The rest of the industries each accounted for 3 to 5% of the respondents. In terms of the ownership of the companies, government/state-owned enterprises and publicly traded companies each made up 33% of our sample, followed by privately held (15%), family-owned businesses (12%), and others (6%). In terms of firm size, 34% were small firms (<=500 employees), 50% were mid-sized (500-5000), and 16% were large (5,000+). The respondents appeared qualified to answer the survey questions—34% were independent directors, followed by board chairman (12%), CEO (12%), inside director (10%), and advisory board member (9%). 69% had served on the board for which they answered the survey for over 2 years. Overall, the characteristics of

respondents in our sample profile show that the data were obtained from a reasonably heterogeneous group, except for the gender disparity (84% male), and provides reasonable confidence in the data obtained from the survey. The gender disparity in our sample represents the disparity in the number of women directors on boards in Sri Lanka (Nananyakkara & Rodrigo, 2022).

4.3 Measures

We measured the four broad categories of proxy measures and three categories of direct measures identified from the previous research on board IT competency (shown in Table 3). The proxy measures comprised (1) the work experience, measured through the number who worked in an IT role and the number who worked in the general management of IT, (2) the number of directors with formal training in IT, (3) the existence of a CIO/CTO role on the board, and (4) the existence of a board-level IT committee (see Table 4).

Measures for the direct IT competency constructs—IT expertise and IT governance mechanisms—and board IT governance were adapted from Jewer and McKay (2012). This study utilized a survey of directors to evaluate their level of IT competency. Items were added to reflect the current context (see Tables 5 and 6). IT expertise captures the knowledge dimension of board IT competency and includes knowledge of IT in the organization (i.e., IT used in the organization or the IT budget), knowledge of sources of IT expertise (i.e., technical experts inside or outside the organization to contact), and knowledge of IT in general (i.e., IT applications and systems development). IT governance mechanisms capture the experience dimension with the intent that the mechanisms provide evidence of putting the knowledge into action. Mechanisms include actions to work with others (i.e., work with senior IT management, CIO participates in board meetings) and internal activities (i.e., regularly including IT on the agenda of the board, board members voice opinions that conflict with the CIO's view). IT governance mechanisms are evidence of activities that directors perform to apply their IT knowledge in the governance of IT in the organization. Finally, the board IT governance construct measured the extent to which the board is involved in evaluating, directing, and monitoring IT initiatives (Vincent et al., 2019) in the organization (i.e., compliance with IT to laws, regulations, industry standards, and contractual commitments, stakeholder satisfaction with IT, and contribution from IT to a competitive advantage).

Respondents were instructed to answer the questions based on their perception of the IT competence and governance of the board. These direct items were measured using a 5-point scale ranging from "strongly disagree" to "strongly agree".

5 Analysis

We started by analyzing the proxy and then the direct measures of board IT competency. We then examined the relationship between board-level IT competency and board IT governance. Table 4 presents the descriptive statistics of the proxy variables in the study.

Table 4. Frequency and Percentage of Proxy Variables

Number of directors	**with formal IT training**	**who worked in an IT role**	**who worked in general IT management**
None	11 (18%)	23 (38%)	17 (29%)
1 to 2	24 (38%)	32 (53%)	35 (59%)
3 to 5	7 (11%)	4 (7%)	5 (9%)
6 or more	2 (3%)	1 (2%)	2 (3%)
Don't know	19 (30%)	0 (0%)	0 (0%)
Is the CIO a member of the board?	Yes	5 (7%)	
	No	69 (92%)	
	Don't know	1 (1%)	
Do you have an IT Strategy or Steering Committee at the level of the Board of Directors?	Yes, a permanent committee	6 (8%)	
	Yes, on an as-needed basis	27 (36%)	
	No	38 51%)	
	Don't know	4 (5%)	

The number of directors with formal IT training, who worked in an IT role, and who worked in general IT management were transformed through a MinMax transformation because the scales of these variables

were different from the scales of the direct measures. Since only five (5/75, 7%) of the respondents indicated that the CIO is a member of the board, this variable was removed from the correlation analysis. The number of boards with an IT strategy committee was transformed into a dichotomous variable (Yes/No).

To analyze the direct measures of board IT competency, first, a procedure combining the pairwise deletion method and imputation by a maximum likelihood method was used to handle any missing data (Enders, 2001). Next, we performed confirmatory factor analysis (CFA) to extract the latent variable for each competency construct. Tables 5 and 6 provide the measurement items for the direct measures of board IT competency and IT governance with their means, standard deviations, and factor loadings.

We followed an iterative process for each construct to ensure a good model fit. CFA models were considered acceptable with: RMSEA ≤ 0.10, SRMR ≤ 0.08, CFI ≥ 0.90, and TLI ≥ 0.90 (see Table 7). Additionally, the chi-square/df ratio ≤ 3 rule was used. To meet the requirements of thresholds, items with low factor loadings (< 0.5) were removed from the analysis, and covariance between error terms was created when their covariance was high. CFA extracted three factors for the direct IT expertise of the board measures, two factors for the board IT governance mechanisms, and one factor for the overall board IT governance construct.

Table 5. Operationalization of IV Direct Measures with Mean, Standard Deviation, and Factor Loadings

Construct	Mean (std dev)	Factor loading
Board IT expertise [a]		
Knowledge of IT in the organization		
Existing IT used in the organization	3.22 (0.83)	0.750
The overall IT budget of the organization	3.44 (0.9)	0.755
The overall IT strategy of the organization	3.18 (0.99)	0.773
Key IT policies in the organization	3.14 (0.94)	0.764
The performance of key IT initiatives	3.02 (0.96)	0.763
The IT risk to which the organization is exposed	3.04 (0.97)	0.785
The key IT resources and assets (people, data, users, systems, financials) in the organization	3.25 (0.84)	0.744
Digital technologies in general (i.e., data analytics, virtual reality, AI, machine learning, IoT, cloud)	2.22 (0.85)	0.701
Information from management about the organization's IT operations and management practices is sufficient [b]	2.56 (1.54)	0.653
Knowledge of sources of IT expertise		
Technical experts or knowledgeable business people to contact within the organization as sources of important information about IT	2.82 (1.06)	0.716
Implementation of digital initiatives in a business/organizational context (i.e., integrated data lakes/centers, agile development, digital marketing, digital service delivery, digital transformation)	2.36 (0.95)	0.697
Technical experts or knowledgeable business people to contact outside the organization as sources of important information about IT	2.54 (0.92)	0.874
Secondary sources of knowledge as sources of important information about IT	2.52 (0.95)	0.856
Other directors to contact for sources of important information about IT	2.7 (0.98)	0.750
Knowledge of IT in general		
IT in general (i.e., personal computer, client/server, LAN, imagery technology, multimedia)	3.07 (0.79)	0.794
IT Applications in general (i.e., Internet, electronic data interchange, e-commerce, groupware)	3.01 (0.77)	0.855
IT Systems development in general (i.e., traditional systems development lifecycle, end-use computing, prototyping, outsourcing, project management practices)	2.48 (0.85)	0.755
IT governance mechanisms [c]		
IT governance mechanisms - work with others		
Some board members and IT management (including CIO) communicate between scheduled meetings	2.81 (1.64)	0.794
The board works well with senior IT management	2.91 (1.52)	0.811
The CIO participates in board meetings*	2.78 (1.69)	0.795
The CIO participates in Audit Committee meetings*	2.67 (1.72)	0.802
IT governance mechanisms – internal activities		
The board works well with senior business management	3.62 (1.29)	0.521
IT is regularly an item on the agenda of the Board	2.47 (1.78)	0.909
IT is an item on the agenda of the Audit Committee*	2.53 (1.77)	0.860

The board encourages the inclusion of IT on the meeting agenda	2.61 (1.8)	0.909
If necessary, the board members voice opinions that conflict with the CIO's view*	2.73 (1.62)	0.652
The board gets independent assurance on the achievement of IT objectives	2.28 (1.72)	0.832
The board gets independent assurance on the containment of IT risk	2.52 (1.73)	0.832
There are regular sessions for outside directors to discuss IT	1.93 (1.7)	0.815
The recruitment of board members includes consideration of IT expertise	1.84 (1.59)	0.562

Notes:
[a] Please indicate the extent to which 3 or more members of the board are knowledgeable about different aspects of IT used in the organization.
[b] Indicate the degree to which the following items describe the board's relationship and communication with management.
[c] Indicate the degree to which the following items describe the board's relationship and communication with management, structures and processes.
* Indicates a newly added measurement item.

Table 6. Operationalization of DV Direct Measure with Mean, Standard Deviation, and Factor Loadings

Construct	Mean (std dev)	Factor loading
Board IT governance [a]		
Contribution from IT to a competitive advantage	2.75 (1.6)	0.715
IT risks to which the organization is exposed	3.08 (1.49)	0.734
Compliance with IT to laws, regulations, industry standards and contractual commitments	2.83 (1.57)	0.803
Compliance with the agreed organizational risk profile of IT	2.62 (1.8)	0.779
Stakeholders' satisfaction with IT (e.g., measured through survey or and or number of complaints)	2.17 (1.55)	0.821
Organization's progress or performance towards better IT governance	2.73 (1.59)	0.906
Workforce planning and investment to ensure recruitment and retention of skilled IT staff	2.37 (1.55)	0.855
IT project governance/management methodologies	2.48 (1.54)	0.916
Training and development to ensure the needs are fully identified and addressed for all staff	2.41 (1.52)	0.840
Data Privacy and compliance with best practices and regulations*	2.69 (1.53)	0.806
Organization's IT procurement process and policies*	3.0 (1.57)	0.748
Shapes the business/IT strategic alignment	2.75 (1.61)	0.675
Advises during major IT decisions	3.09 (1.48)	0.694
Identifies possible IT threats and opportunities critical to the future of the organization	2.75 (1.39)	0.713
Monitors that IT delivers against the strategy through clear expectations and measurement	2.67 (1.55)	0.755
Performs IT governance assurance and self-assessment	2.32 (1.57)	0.859
Actively engages management on strategic issues of digital transformation*	2.58 (1.59)	0.777
Actively engages with management and independent external advisors on cyber-security risk management issues from a business resilience and value-at-risk perspective*	2.52 (1.57)	0.901

Notes:
[a] Indicate the degree to which the board monitors/is involved in the following issues or activities.
* Indicates a newly added measurement item.

Table 7. Model fit for CFA

	Board-IT expertise	Board-IT governance mechanisms	Board-IT governance
CFI	0.925	0.946	0.934
TLI	0.910	0.929	0.921
RMSEA	0.088	0.098	0.097
SRMR	0.067	0.045	0.054
Cronbach's Alpha	0.944	0.945	0.970
Chi-square/ degrees of freedom	176.268/113	99.925/59	216.377/129

We performed correlation analysis to examine the relationships between the variables. This allowed us to assess whether there was a relationship between direct measures of board IT competency and proxy measures, and between proxy measures and board IT governance. It was not possible to perform a

regression analysis to examine whether the direct measures were more highly associated with board IT governance or firm performance due to multicollinearity (i.e., the nature of proxy measures is that they should be highly correlated with the direct measures). The difference in strength between the two correlations was tested using the cocor package described by Diedenhofen and Musch (2015). Descriptive statistics were used to summarize the directors' perceptions of IT expertise, IT governance, and their related impact based on the five questions that were used to provide additional contextual insights.

6 Results

Table 8 summarizes the support for the hypotheses in this study. Overall, we found support or partial support for all of our hypotheses.

Table 8. Summary of Support

Research question	Hypothesis	Result
RQ1: How do proxy measures compare to direct measures in assessing board IT competency?	H1: Proxy measures are not expected to show significant correlations with one another.	Partially supported
	H2: Direct measures are expected to show significant correlations with one another.	Supported
	H3: Proxy measures are not expected to show significant correlations with direct measures.	Partially supported
RQ2: Which proxies are associated with board IT governance, and how do they compare to direct measures?	H4: Proxy measures will exhibit weaker associations with board IT governance compared to direct measures.	Supported

To investigate our first research question, how do proxy measures compare to direct measures in assessing board IT competency, we performed a correlation analysis and the results are shown in Table 9. All of the correlations are positive. Only one of the proxy measures, the number of directors who worked in the general management of IT, was significantly correlated with another proxy measure, the number of directors who worked in an IT role, providing partial support for Hypothesis 1. The direct measures of board IT competency—the IT expertise and IT governance mechanisms factors—were significantly correlated, supporting Hypothesis 2. Furthermore, the results provided partial support for Hypothesis 3. Some proxy measures for board IT competency were significantly associated with some direct measures, but none were correlated with all of the direct measures.

Table 9. Correlations Among Variables

		Proxy Measures				Direct Measures				
		Formal	Worked IT (1)	WorkedMgmt (2)	Cmt. (3)	Know Org (4)	Know Sources (5)	Know Gen (6)	ITG mech1 (7)	ITG mech2 (8)
Proxy Measures	1	0.087								
	2	0.096	0.524**							
	3	0.171	0.119	0.036						
Direct Measures	4	0.112	0.238*	0.258*	0.188					
	5	0.237*	0.228*	0.293*	0.201	0.866**				
	6	0.257*	0.175	0.222	0.078	0.841**	0.868**			
	7	0.187	0.266*	0.220	0.408**	0.611**	0.553**	0.531**		
	8	0.153	0.183	0.183	0.380**	0.635**	0.560**	0.546**	0.872**	
	ITG	0.134	0.382**	0.371**	0.286*	0.667**	0.674**	0.604**	0.742**	0.693**

Note: Legend: Formal = # directors w/formal IT training, WorkedIT = # directors worked in IT role, WorkedMgmt = # directors worked in general IT management, Cmt = Board has IT strategy committee, KnowOrg = Knowledge of IT in the organization, KnowSources = Knowledge of sources of IT expertise, KnowGen = Knowledge of IT in general, ITGmech1 = IT governance mechanisms - work with others, ITGmech2 = IT governance mechanisms – internal activities, ITG = Board IT governance
* Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed)

Regarding our second research question, we found that, overall, the proxy measures showed weaker associations with board IT governance than the direct measures, thus supporting Hypothesis 4. This is a very satisfactory result, especially considering that this study aimed to assess whether proxies can be used to measure board IT competency robustly. The fact that the direct measures are more strongly associated with board IT governance than the proxy measures lends further support to the fitness of the direct over the proxy measures. Three of the four proxy measures—the number of directors who worked in an IT role, the number of directors who worked in general IT management, and the number of directors who have an IT strategy committee—were significantly correlated with board IT governance. However, the proxy measure of the number of directors with formal IT training was not significantly correlated with board IT governance.

We used tests of significance between the correlations of proxy versus direct measures with board IT governance to determine if the proxy measures were as strongly associated with board IT governance as direct measures (see Table 10).

Table 10. Comparison of Statistical Significance of the Correlation of the Proxy Versus Direct Measures with Board IT Governance

Correlation with Overall Board IT Governance—Proxy versus Direct	Dunn and Clark's z (1969)*	Williams' t (1959)	Significant difference?
# with formal training vs. knowledge of IT in the org	z = -4.1658, p-value = 0.0000	t = -4.3563, df = 72, p-value = 0.0000	Yes
# with formal training vs. knowledge of sources of IT expertise	z = -4.5652, p-value = 0.0000	t = -4.8604, df = 72, p-value = 0.0000	Yes
# with formal training vs. knowledge of IT in general	z = -3.8322, p-value = 0.0001	t = -4.0155, df = 72, p-value = 0.0001	Yes
# with formal training vs. IT governance mechanism – work with others	z = -5.3003, p-value = 0.0000	t = -5.7138, df = 72, p-value = 0.0000	Yes
# with formal training vs. IT governance mechanism – internal activities	z = -4.5642, p-value = 0.0000	t = -4.8241, df = 72, p-value = 0.0000	Yes
# directors worked in IT role vs. knowledge of IT in the org	z = -2.5635, p-value = 0.0104	t = -2.6060, df = 72, p-value = 0.0111	Yes
# directors worked in IT role vs. knowledge of sources of IT expertise	z = -2.6280, p-value = 0.0086	t = -2.6728, df = 72, p-value = 0.0093	Yes
# directors worked in IT role vs. knowledge of IT in general	z = -1.8384, p-value = 0.0660	t = -1.8551, df = 72, p-value = 0.0677	No
# directors worked in IT role vs. IT governance mechanism – work with others	z = -3.5427, p-value = 0.0004	t = -3.6461, df = 72, p-value = 0.0005	Yes
# directors worked in IT role vs. IT governance mechanism – internal activities	z = -2.7820, p-value = 0.0054	t = -2.8312, df = 72, p-value = 0.0060	Yes
# directors worked in general IT management vs. knowledge of IT in the org	z = -2.6809, p-value = 0.0073	t = -2.7307, df = 72, p-value = 0.0079	Yes
# directors worked in general IT management vs. knowledge of sources of IT expertise	z = -2.8191, p-value = 0.0048	t = -2.8787, df = 72, p-value = 0.0053	Yes
# directors worked in general IT management vs. knowledge of IT in general	z = -1.9705, p-value = 0.0488 (null hypothesis rejected)	t = -1.9915, df = 72, p-value = 0.0502 (null hypothesis retained)	No
# directors worked in general IT management vs. IT governance mechanism – work with others	z = -3.5430, p-value = 0.0004	t = -3.6410, df = 72, p-value = 0.0005	Yes
# directors worked in general IT management vs. IT governance mechanism – internal activities	z = -2.8662, p-value = 0.0042	t = -2.9202, df = 72, p-value = 0.0047	Yes
Board has IT strategy cmt. vs. knowledge of IT in the org	z = -3.2194, p-value = 0.0013	t = -3.3036, df = 72, p-value = 0.0015	Yes
Board has IT strategy cmt. vs. knowledge of sources of IT expertise	z = -3.3216, p-value = 0.0009	t = -3.4148, df = 72, p-value = 0.0011	Yes
Board has IT strategy cmt. vs.	z = -2.4228,	t = -2.4576, df = 72, p-	Yes

knowledge of IT in general	p-value = 0.0154	value = 0.0164	
Board has IT strategy cmt. vs. IT governance mechanism – work with others	z = -4.7785, p-value = 0.0000	t = -5.1267, df = 72, p-value = 0.0000	Yes
Board has IT strategy cmt. vs. IT governance mechanism – internal activities	z = -3.9778, p-value = 0.0001	t = -4.1757, df = 72, p-value = 0.0001	Yes
**Note*: *The cocor software calculates the comparison of two correlations using multiple tests, for simplicity, we show the results of two of the tests in this table.*			

Each row indicates whether the correlation between the direct measure and board IT governance had a statistically significant difference from the correlation between the proxy measure and board IT governance. We found that the differences between the correlations were statistically significant and higher for the direct measures than for the proxy measures for all but the "IT expertise in general" factor. That direct measure's correlation with board IT governance did not have a statistically significant difference as compared to the proxy measures of the number of directors who worked in an IT role and the number who worked in IT management. This makes sense as this direct measure is of the general knowledge of IT, applications, and system development.

Finally, Table 11 presents the results of the five survey questions that explore the directors' perceptions of IT expertise, IT governance, and their related impact.

Table 11. Perceptions of Board IT Expertise and Governance

	1 N (%)	**2 N (%)**	**3 N (%)**	**4 N (%)**	**5 N (%)**	**N/A N (%)**
Indicate the degree to which your board has been challenged by IT decisions and situations due to issues in the following areas:[a]						
Lack of board IT competencies (n=72)	16 (22)	17 (24)	29 (40)	10 (14)	N/A	N/A
Lack of board IT governance (n=72)	16 (22)	18 (25)	31 (43)	7 (10)	N/A	N/A
Please rate the overall effectiveness of the board on the following:[b]						
IT governance (n=74)	7 (9)	11 (15)	17 (23)	28 (38)	11 (15)	0 (0)
Indicate the degree to which the following items describe the board/management structure.[c]						
The IT expertise of the overall board meets the needs of the company and the board (n=73)	*15 (21)*	*16 (22)*	*31 (42)*	*10 (14)*	*N/A*	*1 (1)*
Has the board received any training/ briefings about best practices in IT governance?[d] (n=62)	*7 (11)*	*45 (73)*	*10 (16)*	*N/A*	*N/A*	*N/A*

a: Not at all (1), not really (2), to some extent (3), to a large extent (4)
b: Very ineffective (1), ineffective (2), neither effective nor ineffective (3), effective (4), very effective (5)
c: Not at all (1), not really (2), to some extent (3), to a large extent (4)
d: Don't know (1), no (2), yes (3)

7 Discussion

Directors are responsible for fulfilling their ethical and fiduciary duties with due diligence, which requires sufficient knowledge to make informed decisions (Bayles, 1989; LeBlanc & Gillies, 2005). While it is widely recognized that IT competency at the board level enhances IT success by promoting more engaged governance (Caluwe & De Haes, 2019), there remains a lack of clarity about what constitutes board IT competency (Valentine et al., 2016) and how accurately proxy measures capture this construct. Moreover, despite the common belief that an IT-competent board is better equipped to govern IT, empirical evidence supporting this relationship is limited, and findings in the literature have been somewhat contradictory (Dissanayake et al., 2021; Vincent et al., 2019). The lack of understanding of what constitutes direct board IT competency measures combined with the use of different proxies to measure board IT competency has contributed to these discrepancies.

Our study finds that direct measures reflect board IT competency more accurately than proxy measures. Whereas all direct measures were correlated with each other, only some proxy measures were associated with each other, and only some proxies were correlated with other direct measures. Therefore, no one

proxy measure emerged to be as accurate as the direct measures of board IT competency. Furthermore, we found that the direct measures of board IT competency were more strongly associated with board IT governance than the proxy measures. Thus, this research enhances our understanding of how to measure board IT competency, enabling further investigation into its impact.

The results of our survey support other studies that have found a board-IT competency gap (e.g., Hartmann & Carmenate, 2021; PwC, 2012). The questions relating to the directors' perception of IT expertise and governance provide additional insights (Table 11). Just over half of the survey respondents indicated that their board had been challenged by IT decisions and situations, at least to some extent, due to a lack of board IT competencies (39/72, 54%) and board IT governance (38/72, 53%). Only 53% (39/74) rated their board's overall effectiveness in IT governance as either effective or very effective. This raises concerns about the level of IT governance provided. Additionally, just over half of the respondents (41/73, 56%) indicated that the IT expertise of the overall board at least to some extent meets the needs of the company and the board, with an alarming 21% (15/73) indicating that the board's IT expertise does not meet the needs at all. Furthermore, only 16% (10/62) of the participants indicated that their board had received any training about best practices in IT governance.

Given these findings, we now discuss this study's research contributions. Following Corley and Gioia's (2011) guidance on making a meaningful contribution, this study combines original insight with practical usefulness for researchers and directors. It offers empirical, theoretical, and practical insights by advancing understanding of how best to measure board IT competency, providing valuable knowledge for academic and professional audiences.

7.1 Empirical and Theoretical Implications

This study's findings have empirical and theoretical implications, deepening the understanding of the relationship between board IT competency and effective IT governance. The empirical methodology used to investigate board IT competency is critical and reveals a potential bias when proxies are used. Specifically, the direct measures appear to be better than the proxy measures and are more highly associated with board IT governance than proxy measures. This provides support for the validity of direct versus proxy measures. Such empirical contributions have far-reaching theoretical implications, likely stimulating future research (Ågerfalk, 2014). This study has the potential to extend IS theory and practical thinking around board IT competency and its influence. We recommend that future research prioritize direct measures of board IT competency. Although capturing direct measures is more challenging, the benefits justify the effort. Perhaps more efficient and effective ways of capturing the direct measures can be developed in the future. However, suppose the research aims to assess the influence of board IT competency on outcomes on a large scale, where direct measures are impractical. In that case, our findings suggest that using proxies that measure the number of directors who have worked in IT roles and/or general IT management rather than the number of directors with formal IT training may be a viable alternative. These work-related proxy measures were significantly correlated, with direct IT competency measures—knowledge of IT in the organization and knowledge of sources of IT expertise—and with board IT governance, albeit not as strongly as the direct measures.

The theoretical implications arise from extending and validating a subset of the knowledge we have about the potential causality relationships between board IT competency and IT governance and addressing a recognized shortage of research in this topic area (Bandodkar & Grover, 2022; Turel & Bart, 2014; van Peteghem et al., 2019, Wang & Haggerty, 2011). By examining IT competency in the context of the board of directors, we contribute to the research in this way. We provide validation for Jewer and McKay's (2012) board IT competency construct, which was conceptualized as including IT expertise and IT governance mechanisms. Supported by resource-dependency theory, a board IT competency measure needs the capabilities provided by the IT governance mechanisms in addition to IT expertise. The IT governance mechanisms enable the board to execute their governance responsibilities more effectively. Again, recognizing that direct measures are not always feasible as it can be difficult to reach directors directly if future studies use proxies for board IT competency, we recommend that in addition to measures of director IT expertise, they also include proxy measures of IT governance mechanisms. The governance mechanisms are the manifestation of the board's expertise and contribute to the organizational knowledge and culture in encouraging and supporting better practices. This is an important factor in considering the persistence and sustainability of board contributions.

7.2 Practical Implications

Practically speaking, companies have begun appointing technology experts to the board, creating board-level technology committees to help oversee IT-related issues, developing their board's existing IT competencies, and advocating for the recruitment of directors with IT expertise or experience (Higgs et al., 2016; Proudfoot et al., 2023; van Giffen & Ludwig, 2023; Weill et al., 2019). As awareness of the need for board IT competency increases, a deeper understanding of these competencies will enable boards to improve how they fulfill their governance responsibilities by allowing them to adopt forward-thinking and dynamic approaches to IT governance (Adie et al., 2024). This research provides concrete measures of how to assess board IT competencies and reinforces their importance in influencing board IT governance.

Professional bodies and institutions could use the validated direct board IT competency construct measure to examine the state of practice of board IT competency, such as measuring board IT competency across industries or between countries. These findings, identifying specific competency gaps, could then be used to develop training programs or other efforts, such as promoting the need for board IT competencies. Individual boards could then consider reviewing IT competency maps, such as the one developed by Valentine (2016), as part of their annual competency assessment. A regular board capability analysis could help ensure that the capability profile matches the organization's strategic and operational context (LeBlanc & Gillies, 2005; Valentine, 2016). Competency-building activities, such as training or focused recruitment efforts, could then be initiated (Benaroch & Chernobai, 2017). Other activities could include "digital tourism," where board members visit other organizations to learn from their experiences or they could visit non-competing companies that have made significant progress in IT governance in similar industries (Weil et al., 2019). Overall, improving the understanding of board IT competency could lead to improved IT-competent boards through a better understanding of IT competency needs and, therefore, more effective use of board IT competency audits and planning for professional development needs, recruitment, and succession planning.

The direct measure of board IT competency gives a clear picture that not only does there need to be knowledge of IT in general, but there also needs to be knowledge of IT used in the organization, and knowledge of sources available to contact to access information about IT (e.g., the general areas of domain knowledge needed for developing skill and expertise in decision making (McKay et al., 2015)). Therefore, in addition to efforts to enhance the direct IT knowledge on boards, such as through recruiting directors with IT knowledge and general experience, boards need to put mechanisms in place to expose directors to the IT used in the organization, and the related policies and risks. Boards also would benefit from identifying key sources of IT expertise within and outside of the organization for directors to contact when needed. IT expertise is not enough; IT-competent boards also have IT governance mechanisms to enable them to oversee IT. These mechanisms require the board to actively design its governance structures, processes, and relational mechanisms (Peterson, 2004) to support the provision of governance of IT. For example, ensuring that the CIO participates in board meetings, regularly including IT on the board's agenda, or holding regular sessions for outside directors to discuss IT. Active learning and a deep level of comprehension are essential for board development of the necessary skills and expertise for IT governance.

7.3 Future Research

The area of board IT competency presents exciting avenues for future research. One contribution to the field would be to reconcile the board IT competency direct measure used in this study with other board IT governance capability clusters and competency sets grounded in standards, such as ISO 38500, and expressed as behaviors (e.g., Adie et al., 2024; SFIA 9; Valentine, 2016). Since this study focused on assessing the fitness of the proxy versus the direct measures by examining their relationships with board IT governance, we intentionally selected direct measures of board IT competency that were distinct from board IT governance behavioral measures. Therefore, we did not include behavioral descriptions from SFIA 9 for governance at Level 7 or Valentine's (2016) board IT competency measures because some of them overlapped with IT governance behaviors and may have conflated our results. For example, Valentine's (2016) measure of the ability to "lead and govern information and technology risk" overlaps with the IT governance measure assessing the degree to which the board monitors the IT risks to which the organization is exposed, and its ability to assess the compliance with the agreed organizational risk profile of IT. Future research should explore how these two approaches—Jewer and McKay's (2012) emphasis on underlying expertise and governance mechanisms, and Valentine's (2016) focus on

behavioral descriptions of board IT governance—complement each other. Both perspectives offer unique insights into board IT competency.

Additionally, Valentine's (2016) framework includes a mix of C-level executives and directors, providing insights into how senior executives outside of the boardroom perceive essential competencies. In contrast, Jewer and McKay's (2012) measure focuses exclusively on board directors' perceptions of IT competence. Aligning these perspectives could yield a consolidated competency framework—incorporating directors' self-assessed IT competencies, executives' views on required competencies, and the necessary expertise, knowledge, and behaviors for effective IT governance.

Furthermore, we define board IT competency broadly as a set of IT-related expertise and experience, and IT governance mechanisms. However, specific types of IT competence, such as expertise in emerging technologies (e.g., AI (van Giffen & Ludwig, 2023)) or critical issues (e.g., cybersecurity (Proudfoot et al., 2023)), may be more relevant for certain organizations. Future work could also refine this concept to incorporate cognitive elements beyond technical knowledge, such as understanding IT's strategic value and business implications, as Valentine (2016) suggested, rather than just knowing about IT itself. This could shed light on how regularly boards might need to assess strategy-matching board-level IT governance capability and competency requirements and adjust (i.e., recruit or develop) for any identified gaps (Valentine, 2016). Therefore, future research is needed to refine the concept of board IT competency for these various needs and expand capability analysis's efficacy as a mechanism of IT governance.

Additionally, boards require a strategy-matching blend of competencies to fulfill their responsibilities effectively (LeBlanc & Gillies, 2005; Valentine, 2016). While IT competencies are essential across industries, their specific type and level vary depending on organizational strategy, structure, industry, and location (Peppard et al., 2023). Future research could investigate these contingencies and how they impact the IT competencies boards require. This study's validated direct measure of board IT competency serves as a foundation for empirical research exploring these industry-specific contingencies.

There is also a need to examine how boards can actively develop their competency levels (Proudfoot et al., 2023; van Giffen & Ludwig, 2023). Without a clear articulation of board-level IT governance competencies and regular capability and competency analysis, recruitment and development efforts remain inconsistent and less aligned with organizational strategy. Beyond adding IT-competent directors, research suggests alternative strategies for enhancing board IT competency, such as learning from other organizations through site visits and case studies, dedicated time for IT governance discussions, focusing on threats and opportunities (Weill et al., 2019), or mentorship programs and board training in IT governance. However, these methods have received limited empirical attention, and further research is needed to assess their effectiveness in cultivating IT-competent boards.

Future research could also examine the role of specific IT governance mechanisms in shaping a board's ability to govern IT effectively. While this study validates board IT competency as comprising both expertise and IT governance mechanisms (Jewer & McKay, 2012), a qualitative exploration of governance mechanisms—including when and how they should be used individually or in combination—could provide valuable insights for boards seeking to optimize their oversight.

Finally, our study primarily assessed the fitness of proxy versus direct measures through their relationship with board IT governance. However, prior research suggests that board IT competency can influence other critical outcomes, such as firm performance (Turel et al., 2017), substantive versus signal value of IT competency (Bandodkar & Grover, 2022), or security breaches and risk management (Higgs et al., 2016). Future research should explore the full range of outcomes associated with IT-competent boards, further refining IT governance competency's role in corporate success.

7.4 Limitations

This study faces several limitations. Our participants are from one country, the limited sample size restricts our analysis, and the survey uses self-reports. Given the exploratory nature of our study, we recognize these limitations. However, our sample demographics are representative of the Sri Lankan industries and ownership types. Our sample meets the size requirements for CFA of our direct measures when considering the number of factors and indicators, as well as their factor loadings (Wolf et al., 2013). Also, our sample of 75 directors is similar to academic surveys of board directors and top management (Andriole (2009) 50 CIOs and CTOs; Bart and Turel (2010) 94 directors; Heroux and Fortin (2018) 66 executives; Turel et al. (2017) 98 directors and 104 directors). Future research that involves the replication of this survey in different settings would help with any possible cultural bias in the sample set and address

the sample size issue. Self-reports inherently carry the risk of bias, as respondents may overestimate or underestimate their board's IT competency due to perception gaps, social desirability, or lack of complete awareness. Directors may not always have an accurate or objective view of the board's IT knowledge and governance capabilities. However, in this study using objective measures was not feasible, as such data is not readily available, and obtaining a matched sample of directors and management was not possible. Given these limitations, we recommend that future research incorporate both direct and proxy measures to mitigate potential biases. By triangulating these approaches, researchers can identify inconsistencies, validate findings more robustly, and develop a more comprehensive understanding of board IT competency.

8 Conclusions

Board-level IT governance is increasingly recognized as a critical component of a board's fiduciary and ethical responsibilities, as well as an opportunity to create strategic value for organizations. However, effectively fulfilling these responsibilities requires a deeper understanding of board IT competency and how it can be assessed and aligned with governance standards depending on the board's unique strategic requirements. By unpacking board IT competencies measured via proxy versus direct measures, this study contributes to a fuller understanding of the nature of board IT competency and its influence. Only with such measures and examination will it be possible to get a true sense of the level of board IT competency.

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