IT Effectiveness Efforts as Predictors of Organizational Outcomes: a Normative Model for Assessing IT Quality.

A thesis submitted to the University of Manchester for the degree of Doctorate of Business Administration (DBA) in the Faculty of Humanities, Manchester Business School.

January 2014

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Information Systems Discipline

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Acronyms

COBIT	Control Objectives for Business IT
IS	Information Systems
IEC	International Electrotechnical Commission
ISO	International Standards Organization
IT	Information Technology
ITIL	IT Infrastructure Library
PCA	Principle Component Analysis
PLS	Partial Least Squared
SAM	Strategic Alignment Model
SEM	Structured Equation Modelling
SME	Small to Medium Enterprise
MV	Manifest Variables
NGO	Non-Profit or Government Organization
LV	Latent Variables

The University of Manchester

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Abstract

Information technology (IT) is a key enabler of modern business practices, yet reliably effective IT systems remain a significant challenge for many organizations. The consequences when systems fail to behave as expected becomes ever-more problematic as IT dependence grows. Therefore, methods for assessing IT effectiveness and generating actionable recommendations for improvement are key drivers of success. For this reason, large organizations often adopt IT best practice frameworks such as COBIT, ITIL or ISO/IEC standards which can offer greater assurances of IT effectiveness. However smaller organizations are rarely able to adopt these frameworks due, in part, to resource constraints, and a preference to eschew authoritative practices in favour of informal guides to action. Consequently, a significant research gap is the lack of IT effectiveness approaches for organizations unable or unwilling to adopt formal IT best practice frameworks.

This thesis presents an alternative norms-based approach to IT effectiveness which some organizations might find more suitable. Norms are informal beliefs (e.g. 'using a complex password helps safeguard data') which motivate behaviours and can often be expressed using non-technical language. We review the literature to formulate a predictive model connecting norms to IT quality. Employing a scientific methodology defensible on philosophical grounds and accepted research practices, we distil a set of IT effectiveness norms from the COBIT 4.1 IT governance framework and adapt theories of motivation to justify our assertion that IT effectiveness norms can motivate actions.

Our work is signficant in its formulation of an alternative approach for assessing IT operations and improving organizational IT outcomes. Our survey instrument –validated in four studies, which include a non-profit and government organization, multiple small businesses, a large pharmaceutical company and a university –is a light-weight and reliable assessment tool. Our predictive model is able to explain 26% of observed variance, and can offer actionable and non-technical insights which can improve organizational outcomes.

A norms-based approach may bring many of the same IT effectiveness benefits offered by formal IT best practices into organizations, such as small businesses, which lack the resources for their implementation. This approach may also help bridge important communication gaps between IT professionals and others in the organization by providing a different, less technical perspective for framing, assessing, diagnosing, and communicating about IT processes.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Copyright Statement

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I am a business IT innovation consultant who specializes in improving organizational value chains through the integration of technology for more effective accomplishment of business goals. As an instructor of information systems at Oregon State, I also lecture and conduct research on the synthesis of IT in business practices. My experience with many organizations across a variety of industries provides a unique perspective on the application of technology in business that informs my research efforts. I am motivated by a desire to understand the mechanisms that contribute to better quality IT in organizations. I hope that my work will benefit academic research and practitioners by providing a new approach to achieving higher quality IT outcomes.

Journal Publications

Curry, M. Marshall, B., Kawalek, P. (2013). IT Artifact Bias- How Affordance Perceptions Influence IT Assessments (currently under review).

Marshall, B., Curry, M., Reitsma, R. (2011). Organizational Information Technology Norms and IT Quality. Communications of the IIMA, 11(4).

Conference Proceedings

Curry, M., Marshall, B., Kawalek, P. (2012) Disentangling IT Artifact Bias. December, 2012, Orlando, Florida, U.S.A.: 4th Annual Pre-ICIS Workshop on Accounting Information Systems.

Marshall, B., Curry, M. L., Reitsma, R. (2010). IT Governance Norms and IT Success. December 2010, Saint Louis, MO, U.S.A.: 2nd annual Pre-ICIS Workshop on Accounting Information Systems.

Acknowledgements

I am very grateful to those who have contributed to this work, and wish to personally thank a few.

- To my wife Michelle –without your love and encouragement this journey would not have been possible.

- To my advisor Peter Kawalek –your guidance was the light on my path; it is a privilege to work with you.

- To my colleague Byron Marshall –thank-you for showing me the ropes, being so generous with feedback, and always encouraging.

- To my colleague René Reitsma –I'll always be grateful for the opportunities you gave me, for supporting my goals, and being a good friend.

Chapter 1 Introduction

1.1 Introduction

This chapter will introduce the thesis by presenting, in broad terms, the major goals of our research effort and briefly describe the hypothesized relationship between IT effectiveness efforts and IT quality. We also describe the contributions that this work can have on approaches to better IT outcomes, especially for smaller businesses, and describe our personal motivation for this work then preview the thesis structure and our findings.

1.2 Use of Pronouns

There is only one author to this thesis, but the work benefits from collaboration with other researchers. Some have offered insight, guidance, encouragement and/or editorial feedback. Others have made explicit contributions to the work reported here. For instance, each of the studies presented in this thesis benefit from one or more co-researchers contributing suggestions to the design, collection, analyses, and reporting of work. Furthermore, the ideas used to develop theories and guide the work are derived from a larger corpus of academic research.

Therefore, this thesis makes use of plural pronouns 'we' and 'our' despite the fact that in most cases 'I' or 'my' would be appropriate. Alternating between pronouns to reflect precision in distinguishing which parts were singularly the author's work would be confusing to the reader. Doing so would also be subject to interpretation and qualification. To improve readability we use plural pronouns to report this work.

1.3 Thesis Overview

The purpose of this research is to examine if norms guiding individual actions in an organization can be used to improve IT effectiveness. Many approaches to improve the quality of IT in organizations (IT quality) require technical expertise to adopt, assess, and interpret. These approaches are often modelled after well-known IT best practices, and once implemented, they establish normative patterns of behaviour, which over time may generate better IT quality. Rather than approaching IT quality from a technical 'top down' perspective, our work posits that using a 'bottom up' approach, which focuses on comparing observable IT effectiveness norms with those advocated by IT best practices, may be a new and useful approach to assessing and improving IT outcomes.

Therefore, the initial research question we seek to answer is as follows:

Initial Research Question: Can IT effectiveness norms be used to increase the quality of IT outcomes; if so, would some organizations find this a more suitable approach than adopting a formal IT best practice framework?

Because there are no known assessments of IT effectiveness norms, this thesis places major emphasis on formulating a predictive model based on theoretically derived constructs, which are validated in multiple studies. We hypothesize two drivers of IT quality: 1) routine IT processes which are meant to manage the IT function (IT effectiveness efforts); and, 2) the intellectual commitment of individuals to behave in a manner consistent with those efforts (IT effectiveness subscription). Put another way, while policies and procedures are necessary for managing IT operations, we submit that IT quality is higher when individuals are personally motivated to take actions consistent with the spirit of IT best practices. For example, although an organization may adopt a policy (an IT effectiveness effort) that requires complex passwords for IT system access, that policy is less effective when employees routinely write down their password and tape it to their desk (a normative behaviour inconsistent with the effort).

Our model for investigation theorizes two pathways for IT effectiveness norms to improve IT quality. The first path is a direct influence of IT effectiveness efforts on IT quality. The second path is the indirect influence of IT effectiveness efforts on IT effectiveness subscription, and subscription's influence on IT quality. While the first path assesses what practices are being used, the second assesses whether there is an individual subscription to the spirit of that practice. If either or both of these paths are shown to be significant, this evidence would support our claim that norms may be capable of delivering many of the benefits that adopting IT best practice frameworks, such as COBIT, offer.

Although it is difficult to quantify how IT quality benefits an organization (Brynjolfsson, 1993, Brynjolfsson and Hitt, 1998), most IT system users have some opinion about its contribution. This view may be based on their own personal experience using the system (individual satisfaction), feedback from colleagues and co-workers (satisfaction of others), or assessments of how well IT helps accomplish business goals (organizational success). Consequently, individual assessments of IT outcomes are frequently used as a dependent measure of IT quality (Delone and McLean, 2003), which we also adopt to test our hypotheses.

Our preliminary research model is depicted in Figure 1. We also present our hypotheses for this model.

H1: IT effectiveness efforts that are adopted by the organization can make a difference in IT quality.

H2: IT effectiveness efforts that are adopted by the organization can influence IT effectiveness subscription actions.

H3: IT effectiveness subscription actions can improve IT quality.

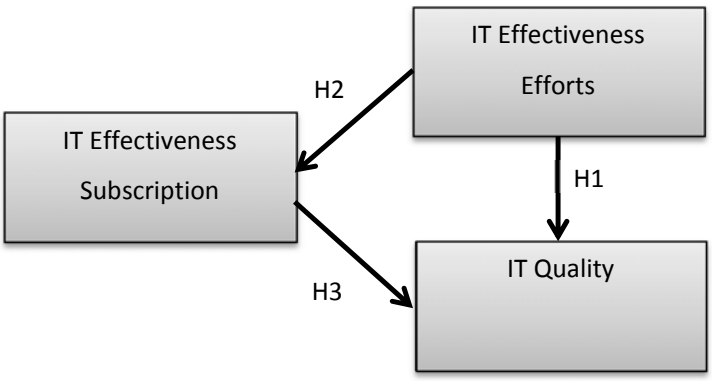


Figure 1. Research model to study the link between IT effectiveness and IT quality.

1.4 Contribution

We suggest that assessing intellectual commitment through normative behaviours could lead to important improvements in IT effectiveness efforts. A historical example helps to illustrate our point. In the early 20th century, most psychoanalytic practitioners and researchers believed patients could best be assisted by using mechanisms to reinforce desired behaviours, such as pain/pleasure stimuli and repetition (Brysbaert and Rastle, 2009). It seems that the current IT effectiveness approaches, which focus heavily on technical assessments of IT operations are very similar to the behavioural stimuli in our example. These assessment results are meant to drive corrective measures to improve IT. However, artefact focused and highly technical results may fail to consider the attitudes within the organization and may also be unsuitable for interpretation or action by non-IT individuals. Just as behaviourism gave way to modern cognitive psychology which incorporates a greater emphasis upon the intellectual capabilities of the mind, likewise, we suggest that there is a pressing need to understand how the cognitive construct of beliefs, desires, and values within the organization impact IT quality.

Our work may be especially beneficial to organizations that have limited IT resources and expertise. Many corporations, financial institutions, and government organizations adopt formal IT best practice frameworks such as COBIT, ITIL, and ISO/IEC standards to comply with laws and

regulations (Damianides, 2005, Bulgurcu et al., 2010), and a dedicated staff of IT professionals is often necessary to accomplish these efforts. However, smaller organizations that are not under the same statutory requirements, often lack the resources and expertise to adopt these same practices (Huang et al., 2010, Devos, 2007, Tagliavini et al., 2001, DeLone, 1988). In these organizations, the end users must frequently accept some responsibilities for making IT systems function (Bayrak, 2013, Qiang et al., 2006, Lee et al., 2007).

IT best practice frameworks are very technical and may be difficult for non-IT individuals in a smaller organization to understand. Norms, however, have the advantage of being easily communicated using everyday terms. One example of a normative practice consistent with processes advocated by IT best practices, is taking steps to protect confidential data from unauthorized disclosure by requiring individuals to use complex passwords, which might be communicated as 'using a complex password helps safeguard data.'

If a norms-based approach can be shown to influence IT outcomes, this might prove useful in allowing management to informally assess IT operations. Any assessment results could lead to less technical and more easily understood recommendations for improvement. A norms-based approach may also help improve communication between IT professionals and non-IT users by offering an alternative formulation for discussing IT operations.

1.5 Motivation

Our motivation is partly based on personal experience and a desire to influence organizational IT success. As entrepreneurs, we have had the opportunity to work with over one hundred small to medium sized organizations. Our experience indicates that despite many similarities between organizational structure and IT services, there is tremendous variation in how effectively IT solutions accomplish their business goals. We recognize that the success of our work is linked to the success of our clients' businesses. Therefore, we set out to determine how IT success could be more consistently attained.

Our first naïve assumption was that technical expertise would predict IT success. After all, if IT systems are complex and technical, then effectively understanding those systems should facilitate more effective use. We realized this was false after encountering technically competent organizations that failed to accomplish their goals. For example, one business set out to revolutionize home mortgage loans by building a web-based application system in 1999. They created a detailed set of requirements and engaged us to develop their system. While the delivered solution met their requirements, it did not yield the desired result of generating more loans that could be processed cheaper and faster. Customers found the online loan application

daunting and confusing. The loan officers preferred to complete applications themselves in order to make sure the 'wrong' information was not disclosed, triggering an automatic denial. Finally, since online applications were new, lenders were unsure of how to rate the trustworthiness of these applications. Less than a year after launching the new online system, the business ran out of capital and closed its doors due, in part, to a failure in meeting loan forecasts.

The preceding example helped us realize the importance of aligning business goals and needs with IT capabilities. Therefore, we shifted the focus of our practice from IT services to becoming electronic business (eBusiness) consultants. Every engagement began with a detailed business analysis that informed any technical solutions delivered. This approach resulted in more client organizations realizing greater IT success, which helped our own work become more successful.

Over time, we made an effort to identify what activities could help ensure the IT success we wished for our clients. There were several activities we found to be beneficial:

- Conducting a cost-benefit analysis.
- Giving key employees training.
- Continually reassessing business goals.
- Taking steps to minimize risks.

However, we wondered if there might be other activities not considered that could benefit our clients. In 2008, we were introduced to the control objectives for business IT (COBIT) version 4.1 which is a well-regarded standard of IT best practices (IT Governance Institute, 2008, Ridley et al., 2004, Simonsson and Johnson, 2006). This version of COBIT distinguished itself from other similar efforts by focusing heavily on the business drivers of IT. We spent the next few years experimenting with adopting many practices advocated by COBIT into our business model.

Unfortunately, our experience showed COBIT was too technical for most small to medium sized organizations. We also learned through talking to larger organizations that primary responsibility for COBIT adoption fell to the chief information officer and the IT department. Therefore, it seemed to us that an approach to IT effectiveness tailored to the non-IT professionals in smaller organizations, which could allow them to enjoy many benefits COBIT offers larger organizations, was missing. To the best of our knowledge, no such approach yet exists, and this gap in the research and practitioner toolbox is what we have set out to address.

1.6 Thesis Organization

This thesis proceeds as follows: in chapter 2, we present a literature review of approaches to IT effectiveness and the characteristics of small businesses. We also review IT governance approaches, especially COBIT, in more detail. We identify a research gap in which a norms-based approach to IT effectiveness could address. We present a set of research questions, which, if answered, could validate our approach. Finally, we provide hypotheses to guide our work.

Chapter three is focused on research methodology. It begins by examining the scientific method in order to offer a philosophical justification of our positivist epistemology. We then conduct an analysis of information systems research to characterize the methods used in 80 papers published in 2010 by two leading journals. Finally, we present our own methodology for collecting empirical evidence, which we also critique.

Chapter four begins with a philosophical justification of how norms can drive IT effectiveness. We use the Humean and cognitive theories of motivation to argue that IT effectiveness norms can have both a direct and indirect effect on IT quality. Next, we present a study that makes a first attempt to identify a set of norms for assessing the quality of proposed IT solutions. We evaluate 115 written proposals made by business students and demonstrate that many of these norms were significant in improving the proposals' quality.

Chapter five presents a series of four studies conducted to test if IT effectiveness improves IT quality through our two hypothesized paths: one direct and the other indirect. We also present refinements to our instrument and contrast the results between studies. The NAA study was conducted with 120 respondents from non-profit and government organizations (NGO) and demonstrates that IT effectiveness has a direct influence on IT quality. It also identifies that one of our IT effectiveness effort constructs was not able to assess business and IT alignment as we expected.

The AFBP study was conducted with 120 respondents from small family businesses and offers support for both a direct and indirect path between IT effectiveness and IT quality. Ten semi-structured interviews are used to offer additional support that items are assessing the constructs we expect. These interviews also provide theoretical insight that suggests assessing business and IT alignment from a process perspective is more appropriate than the business approach we attempted in the NAA study.

While the preceding two studies examined many responses from many organizations, the PHARMA study was conducted with 46 respondents from a European pharmaceutical company. This study offers support that IT effectiveness efforts are a valid predictor of IT quality within a

single organization. This study also tests new process focused business and IT alignment items and offers initial support for this approach.

Finally, the BIS study was conducted with 72 business students in an information systems class. We test several new items for each of the theoretical constructs, and analyse the results to develop a second order predictive model of interaction. In this final model, which explains 26% of observed variation, both the direct and indirect paths between IT effectiveness and IT quality are statistically significant and have nearly equal effect contributions.

Chapter six presents a synthesis of all four studies by discussing the implications of this work in light of our research goals. We also discuss the contributions of our work, their limitations, and future steps, which could help our work to become a more widely adopted approach to IT quality.

1.7 Conclusion

We have presented an introduction of this thesis, which includes a rationale for the use of plural pronouns, an overview of the hypothesized relationships, and a discussion of the contributions that this work can offer. We also discuss our personal motivation, and preview the thesis and the results it presents.

Chapter 2 Literature Review

2.1 Introduction

In this chapter we explore the meaning of key terms such as IT effectiveness and IT quality and also review approaches to IT effectiveness which form the theoretical foundation of our own model. These approaches are critically evaluated and a research gap is identified. We then present a set of research questions, which motivate our work, and conclude by introducing our initial model and hypotheses.

2.2 IT and IS

It is helpful to begin by clarify the meaning of the terms IT and IS in an organizational context. Nevo and Wade (2010) define *information technology* (IT) as machines that process, store and disseminate information. Leonardi and Barley (2008) expand the scope of "technology" to also include people and processes (Leonardi and Barley, 2008). Kroenke (2011) defines *information systems* (IS) as the interaction between people, processes, data, and technology. Thus the term IT encompasses devices, people and processes used to store information, while IS refers to the interaction between people and IT.

While there is considerable overlap, Benyon-Davies (2013, 2011, 2010, 2009a, 2009b) argues that distinctions between the terms IT and IS lies largely in the role they play in representing information. Drawing upon natural language theory he contends that information is stored as 'signs' –essentially, anything that conveys meaning because of an agreed upon convention of representation (Beynon-Davies, 2009a), and IT is responsible for storing information signs. The advantage of his conceptualization is its ability to transcend our historical conceptualization of technology. For example, Benyon-Davies suggests the Inka Indians (circa 1200-1572 AD) were employing IT to record census data in the form of knots in a 'khipu' tapestry that represented people, places and things (Beynon-Davies, 2010).

By contrast, IS are systems which use signs to mediate communication with people. Put another way, IS is responsible for transmitting information between people for the purpose of human decision making (Beynon-Davies, 2010). Thus, in the Inka Indian example, the transfer of knotted khipus to a centralized location where the signs they stored could be processed, is a historically transcending example of IS (Beynon-Davies, 2010).

While we have taken care to distinguish between the meanings of IT and IS, these distinctions can often be difficult to discern. Our experience suggests that outside of the field of IS, many people are confused by the term 'IS' (for examples, see Firth et al., 2008) and are more comfortable using

the term 'IT' to describe both the technology which stores and process information and the systems which transmit that information for human use.

Therefore, for this thesis our working definition of IT includes the technology, machines, and people which store, process and transmit information for human use. We anticipate this use will be less confusing to the reader than alternating between IT and IS, despite the fact that in some instances our definition may not be consistent with those found in other research.

The term 'IS' also applies to an academic discipline, which this research falls within. Therefore, we will use the term for discussions related the IS field. For example, in section 3.3 we review a series of journal publications to identify common research trends in the field of IS research.

2.3 IT Processes and IT Quality

We define *IT processes* as a collection of structured activities or tasks intended to manage the IT assets within an organization for the accomplishment of business goals and strategy. Many organizations may have a dedicated staff of *IT professionals* –employees with training or experience, who accept responsibility for IT processes. However smaller organizations which are more resource-constrained often have difficulty committing time, money, and effort to IT management (Huang et al., 2010, Devos, 2007, Tagliavini et al., 2001, DeLone, 1988) and consequently transfer some responsibility to end users (Qiang et al., 2006, Bayrak, 2013, Lee et al., 2007). We refer to this group as *IT administrators* –employees who are not IT professionals, yet have some responsibility for IT processes.

We define *IT effectiveness* as approaches to assess the IT contribution and improve its contribution to business goals and strategy. Therefore, we conceptualize IT effectiveness as a key contributor to user satisfaction with IT in organizations. Our research attempts to predict how these IT effectiveness efforts impact employee satisfaction with the quality of IT outcomes. However, other factors also impact IT effectiveness as we discuss in the next section.

2.4 Productivity as a Measure of IT Quality

One measure of IT quality is the impact IT investments have on organizational productivity. In 1987, Steven Roach, the chief economist at Morgan Stanley, noted economy-wide measures of productivity for the decade of 1970 had not risen despite steadily growing expenditures on IT (Roach, 1991). Dubbed the *productivity paradox*, Roach's observation was signficant because it challenged a widely accepted belief that IT added value to business.

Brynjolfsson (1993) and Brynjolfsson and Hitt (1998) identified three criticisms of Roach's assertion. First, a world-wide shortage of oil significantly contributed to the productivity decline.

Second, Moore's law (Schaller, 1997), an observation that computing power doubles every eighteen to twenty-four months, was not factored into productivity calculations. Thus, the economic impact of IT purchases early in the decade was incorrectly factored in later purchases. Third, productivity calculations are ratios of measured output-to-input and since information is largely intangible, older methods did not accurately measure value (Brynjolfsson, 1993, Brynjolfsson and Hitt, 1998).

Unfortunately, even when calculations are adjusted to correct for the noted problems, there still were no measureable benefits for IT investments during the decade of the 1970s. However, after approximately 1990, Brynjolfsson and Hitt (2000) note that investments in IT have consistently generated measurable financial benefits which continue to increase each year.

Most economists agree (Brynjolfsson and Brown, 2005, Stiroh, 2001, Brynjolfsson and Hitt, 1998, Brynjolfsson and Hitt, 2000) IT investments are currently the single greatest driver of organizational productivity. Stiroh (2001) has demonstrated a link between productivity gains and IT investments for the decade of 1990, while Brynjolfsson and Brown's (2005) study suggests companies with higher IT investments to industry average are more productive. However to generate productivity gains, IT investments must also be accompanied by IT effectiveness efforts. For example, Brynjolfsson and Brown (2005) describe seven pillars of productivity which they identified in highly successful 'digital organizations' that we briefly summarize:

1. Convert analogue processes to digital ones
2. Share digital information across the organization
3. Empower employees to make decisions using the information
4. Use merit based incentives to motivate employees
5. Invest in a corporate culture which links goals to activities
6. Recruit the right people who will fit into the culture
7. Invest in training employees to give them additional skills

In the above list it is interesting to note that, only point one is primarily IT focused. The other six points emphasize adapting organizational processes in order to achieve IT effectiveness. Similarly, we believe approaches to IT effectiveness should also be less IT-centric and more organizationally focused.

2.5 The Role of Organizational Culture on IT Quality

Organizational culture has been defined as a complex set of values, beliefs and assumptions that guide the way an organization conducts its business (Deal and Kennedy, 2008). Organizational culture contains information on behaviour patterns which help form normative behaviours (Rosch, 1999). For our purposes, we describe culture as a set of established practices intended to help companies be successful

Barney (1986) maintains that a firms culture can, in some cases, help create value for the organization. When these conditions exist, he recommends managers try to better understand the organizational culture and how it is impacting competitive value, and then take steps to strengthen them (Barney, 1986). Porter and Millar (1985) have also maintained that when organizational culture is focused towards practices which enhance the strategic role of IT then companies are likely to be successful. Using a model of five organizational success drivers, they describe how IT has the ability to help and to harm business models across all five dimensions.

2.6 IT Effectiveness Measures in Smaller Organizations

One goal of our research is to develop a model suitable to assess both small and large organizations. In this section we examine key aspects of the small to medium enterprise (SME).

2.6.1 SME Characteristics

It is difficult to define what constitutes an SME. The European Commission (2003) classifies SMEs based on the number of employees (between 10 to 250) and revenues (between €2 million and €50 million in annual turnover). By contrast, the United States Small Business Agency (SBA) defines a small business as an independently owned and operated, for-profit entity, that is not dominant in its field. Additionally, the SBA has guidelines by industry to classify small businesses based on employee size or revenue (U.S. Small Business Administration, 2011). According to the SBA, most small businesses employ fewer than 500 employees (although some industries may have 1500) or annual receipts less than $7 million (yet some industries may have receipts up to $35.5 million).

For our study, we define *very small organizations* as having 1-9 employees; *small organizations* as those with 100-249 employees, and *small to medium organizations* as between 250-999 employees.

Two distinctive characteristics of SMEs frequently noted in the literature are less formal management structures (Huang et al., 2010, Costello et al., 2007) and access to fewer resources than larger organizations (Albayrak et al., 2009, Brown et al., 1998). At around 100 employees or less, SMEs tend to be flat organizations where one primary leader (such as the owner) directs the

staff with little or no help. Andersen et al (2001) noted, however, as the size of an organization grows, it becomes more hierarchical. One key advantage to the small and informal management structure is an ability to be highly flexible and innovative (Costello et al., 2007, Ramdani and Kawalek, 2008). A drawback of this management style is the lack of strategic planning (Andersen et al., 2001, Knight, 2001, Gabrielsson, 2005). Smaller and relatively young firms also tend to have more flexible organizational cultures than older and larger firms (Barney, 1986).

As we noted in section 2.3, because smaller organizations are more resource-constrained and often lack a staff of dedicated IT professionals, they frequently transfer some responsibility for IT administration to end users (Qiang et al., 2006, Bayrak, 2013, Lee et al., 2007).

2.6.2 SME Measures of Success

Another distinctive characteristic of SMEs is the use of a wide variety of measures for success. This is important as we consider developing an IT effectiveness model because well accepted measures of IT quality used in larger organizations, may not be applicable to SMEs.

Both financial and non-financial measures of success are frequently discussed in the SME literature. For example, Walker and Brown (2004) mention autonomy, job satisfaction, and the ability to balance work and family responsibilities as common measures of success. Trondsen's (1997) literature review of small business success factors notes "personal satisfaction such as being their own boss, independence, and realizing creativity and innovative potential" are often cited.

2.6.3 IT and the SME

While IT systems greatly benefit the modern SME, their impact is often hindered by inconsistency, unpredictability, and a lack of long-term benefits (Parker, 2007, Levy and Powell, 1998, Benbasat et al., 1987). SMEs are often able to realize benefits from IT sooner than larger organizations, in part, because they are so flexible and innovative, as a ten-year review by Hoffman et al. (1998) confirms. For example, Parker and Castleman (2007) reviewed 120 journal articles on SME e-business studies noting how innovative IT enabled SMEs to be more competitive using Internet markets.

One way to classify SME IT usage is in terms of intensity and complexity. IT intensity refers to the proportion of business processes that rely on IT, while IT complexity considers the sophistication of machines and business processes (Banker et al., 2010). SMEs with high degrees of IT intensity and complexity can realize greater benefits, but they also face more risks when those systems fail. An over reliance on complex IT solutions, such as those used in large organizations, can have negative consequences, as Hoffman et al. (1998) illustrate by citing cases of SME failures

attributed to IT. Consequently, SMEs may favour lower intensity and less complex IT solutions, such as off-the-shelf software and outsourced IT services (Devos et al.).

2.6.4 SME Conclusions

While there are many variations in what constitutes an SME, we can make several important generalizations supported by the literature:

- There is a profusion of variation in the composition of SMEs.
- SMEs are informally managed and resource-constrained.
- They are highly innovative and flexible, yet rarely perform strategic planning.
- IT makes great contributions to SMEs, but also presents challenges.

We will refer back to these points later, especially in our AFBP study of IT effectiveness in small family businesses.

2.7 Models of IT Effectiveness

Choosing an IT effectiveness approach is important to assess the IT contribution and make improvements. Although considerable research effort has gone into predicting IT effectiveness (Galbraith et al., 2006) we critically analyse the suitability of several approaches for predicting IT quality. Our intent here is not to provide an exhaustive list of all available models, but instead to narrowly focus on those which offer constructs that can benefit our research goals.

One approach suggests measuring the predictors known to impact IT effectiveness and then focusing corrective actions to improve these measures. Two examples we discuss are the strategic alignment model (Henderson and Venkatraman, 1993) and the DeLone and McLean success model (DeLone, 1988). An alternative approach adopted by larger organizations is to follow the collective wisdom compiled in formal IT best practices. We also review the Control Objectives for Business IT (COBIT), a widely cited and authoritative framework used as a strategy for planning, managing, and improving business IT (IT Governance Institute, 2007); and the normative behaviours that adopting this framework may promote in organizations.

2.7.1 Strategic Alignment

Making IT resources and capabilities align with the strategic business goals has been a topic of serious concern by IT executives for over two decades (Luftman et al., 2005). Referred to as *strategic alignment* in the research literature, it is a widely studied area (see for example: Cragg et al., 2007, De Haes and Van Grembergen, 2008a, De Haes and Van Grembergen, 2008b, Bergeron et al., 2004, Jouirou and Kalika, 2004, Chan, 2002, Reich and Benbasat, 2000, Chan et al., 1997,

Henderson and Venkatraman, 1993). Many case studies have demonstrated that when organizations take steps to plan their business strategy it enables IT professionals to make better tactical decisions about the acquisition and implementation of IT to meet those goals. Consequently, organizations which have measurable levels of strategic alignment are more successful than those which have not.

2.7.1.1 Assessing Alignment: The Strategic Alignment Model

How can organizations assess whether they are achieving strategic alignment? Partially to answer this question, Henderson and Venkatraman (1993) developed the strategic alignment model (SAM). SAM applied the importance of business strategy to IT effectiveness through relationships between the business and IT goals (called strategic fit) and current business needs and IT capabilities (called functional alignment) as depicted in Figure 2. The ability of SAM to predict IT value has been empirically demonstrated repeatedly in large organizations (for summaries, see Chan and Reich, 2007) as well as in smaller ones (see examples in Bergeron et al., 2004, Cragg et al., 2007, Jouirou and Kalika, 2004).

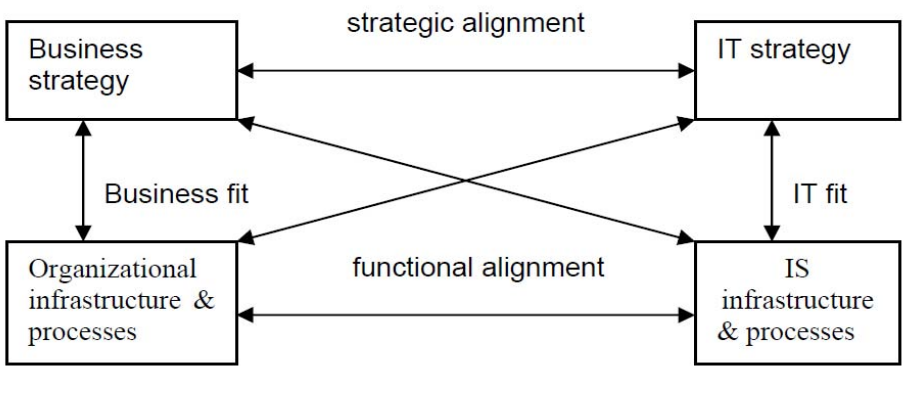


Figure 2. Major components of Henderson and Venkatraman (1993) Strategic Alignment Model (Cragg et al., 2007)

One significant contribution of SAM was to make clear the shared role that both business leaders and IT professionals have in IT results. Today, it is well recognized that senior management and IT staff collaboration is critical to the success of IT initiatives (Jarvenpaa and Ives, 1991).

Thus, one explanation for the productivity paradox (described above) is that prior to 1990, IT effectiveness was primarily the responsibility of the IT staff with less active participation by management. As organizations began to recognize the value of IT towards accomplishing goals and strategy, business practices resulted in greater strategic alignment (Henderson and

Venkatraman, 1993, Venkatraman, 1989a) and measurable productivity (Brynjolfsson and Hitt, 2000, Brynjolfsson and Hitt, 1998).

While SAM is an important contribution, a hindrance to its wider adoption as a measure for evaluating IT effectiveness may stem from the fact that its results emphasize IT, instead of the value people give IT through business processes. Thus, any corrective actions noted through the application of SAM would require in-depth IT knowledge and training to rectify. Organizations, which are resource-constrained or do not have a dedicated IT staff, might experience difficulty interpreting SAM based assessments to improve IT quality.

2.7.1.2 Strategic Alignment and Small Businesses

It is important to note that smaller organizations which do not perform strategic planning might encounter difficulties adopting SAM. In such organizations, applying SAM would require either significant changes to business practices or a modification to the model. For example, Cragg et al. (2007) used a modified SAM which omitted the strategy constructs, to evaluate IT alignment of business processes in the SME.

2.7.1.3 Strategic Alignment as an On-Going Process

SAM is intended to assess levels of strategic alignment, but others (for a review, see Chan and Reich, 2007, Benbya and McKelvey, 2006, Baets, 1996) have argued that alignment is an on-going process which must be re-evaluated often. For example, Benbya and McKelvey (2006) develop an alignment model where IT strategy "coevolves" with the business strategy. Similarly, Burn (1997) proposed a cyclical model of alignment where IT alternates between leading and lagging business strategy (and vice versa), which must continually be balanced –an exercise the authors compare to "walking a tight rope."

Strategic alignment continues to be a subject of interest for both researchers and practitioners. While the classic adoption of SAM was intended to assess levels of coordination in planning between IT and business, newer process oriented interpretations envision alignment as a journey.

2.7.2 DeLone and McLean IT Success Model

In contrast to the organizational focus of strategic alignment, DeLone and McLean proposed a more people-focused approach to IT effectiveness by developing a model which synthesizes communications and information theory to measure IT success (Delone and McLean, 2003, DeLone and McLean, 1992). The DeLone and McLean success model is an important contribution that facilitates positivist IT research by providing a dependent variable to quantify IT success (DeLone and McLean, 1992).

The model uses six categories to group IT success: system quality, information quality, use, user satisfaction, individual impact, and organizational impact (see Figure 2). An updated version of the model, applying the findings of marketing research, adds service quality as a third quality dimension (Leyland et al., 1995).

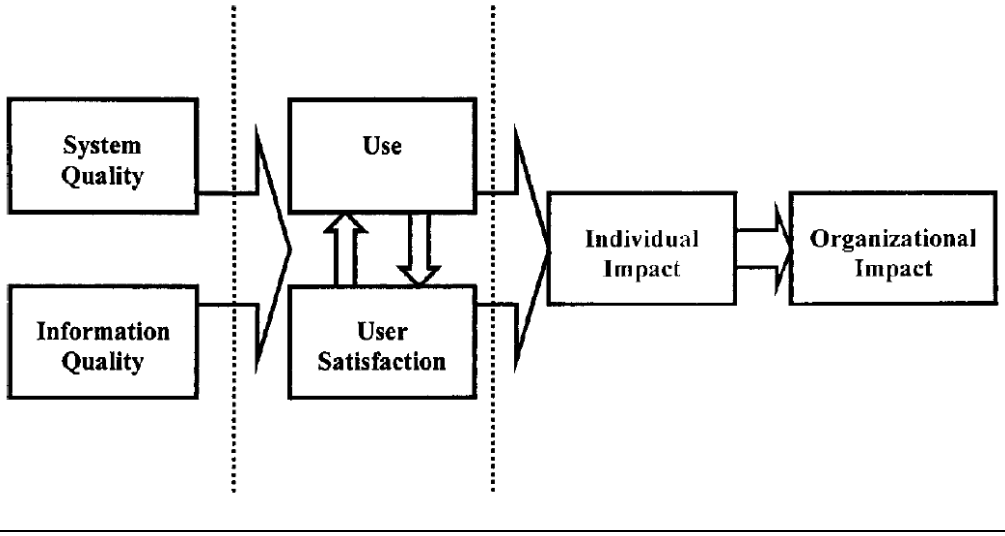


Figure 3. Success Model (DeLone and McLean, 1992)

The DeLone and McLean (1992) model has been widely used in IT research since it was first proposed, and many researchers have validated its constructs as statistically significant predictors of IT success. A summary of 16 confirmatory studies is found in the reflective paper written by DeLone and McLean ten years after their original publication (Delone and McLean, 2003). The model has also been extended by other researchers (for example, see Ballantine et al., 1996, and Leyland et al., 1995) to create richer IT success predictors.

While the DeLone and McLean model is an important contribution, Seddon et al. (1998) criticized its insufficiency since assessments of IT success vary, based on a stakeholder's perspective. For example, one individual's perspective of IT success might be different from a sub-group's perspective (e.g., marketing). These IT success perspectives, in turn, might be different from the perspective of the entire organization, or outside the organization—such as customers, suppliers, or the general public.

Although DeLone and McLean (2003) respond to this criticism that adding stakeholder perspective is an unnecessary complication of their model (Delone and McLean, 2003), we suggest a variety in perspectives may be necessary, especially when considering SME IT quality. We have already noted that SMEs often have different measures of success than larger organizations. Therefore, a

wider consideration of perspectives towards IT could help to make IT effectiveness applicable to more organizations, such as SMEs.

Costello et al.(2007) also argue that the margin for many organizations does not provide the luxury to use the generalized approach that DeLone and McLean's (2003) models use. Costello et al. advocate experimentation by modifying and combining frameworks to develop tailored measures of IT success for the SME (Costello et al., 2007). A revised model to assess SME electronic markets was proposed by Gengatharen and Standing (2003), while DeLone (1988) also proposed a version of the model to measure success factors in SME computer adoption.

2.7.3 Defining IT Quality

The DeLone and McLean (1992, 2003) model offers a key dependent variable for our attempt to predict how IT effectiveness efforts impact employee satisfaction with IT quality. Their work establishes user satisfaction with both IT and the IT contribution to organizational outcomes as a suitable proxy. Adopting their work, we define *IT quality* as the ability of IT to make effective organizational impact while also satisfying the users of those IT systems.

2.7.4 IT Governance Frameworks

While SAM and DeLone and McLean's models focus on a set of key predictors for IT effectiveness, an alternative approach is the adoption of IT best-practices advocated by IT governance frameworks. IT governance efforts are efforts that "reduce risk and ensure investments in IT resources add value" (Hall, 2011). The control objectives for business IT (COBIT) is one of the most widely adopted frameworks (IT Governance Institute, 2008, Ridley et al., 2004, Simonsson and Johnson, 2006) and is often cited as authoritative in IT governance literature (IT Governance Institute, 2008, IT Governance Institute, 2007, Grembergen et al., 2003).

Other frameworks include the Information Technology Infrastructure Library (ITIL), developed by the UK government (Cartlidge et al., 2007), and ISO/IEC standards (e.g. ISO/IEC 20000, ISO/IEC 38500 and ISO/IEC 27002) developed by the International Organization for Standardization (2005). Related commercial frameworks have also been developed by Microsoft, Hewlett Packard, and the International Business Machines Corporation (IBM), among others. Sallé (2004) provides a comprehensive review of many IT governance frameworks, while the IT Governance Institute (2008) presents an in-depth classification of how these frameworks support one another.

Despite substantial variation in their approaches, these frameworks have been shown to contribute to improved outcomes such as cost savings, productivity improvements, and better organizational efficiency (Bergeron et al., 2004, Haes and Grembergen, 2008, Henderson and Venkatraman, 1993, Reich and Benbasat, 2000). Consequently, IT governance frameworks such as

COBIT (IT Governance Institute, 2008, IT Governance Institute, 2007, Tuttle and Vandervelde, 2007, Ridley et al., 2004, Grembergen et al., 2003) and ITIL (Dugmore and Taylor, 2008, IT Governance Institute, 2008, Duffy and Denison, 2008, Cartlidge et al., 2007, Cater-Steel et al., 2006) are a highly significant practitioner-focused contribution to IT effectiveness.

IT governance frameworks are collections of IT best practices intended to improve IT reliability and predictability. They are widely adopted in public companies, banking, and government agencies, which may adopt these frameworks, in part to comply with statutory requirements such as the Sarbanes-Oxley Act (2002) in the United States and the 8th Directive on Audit (2005) in the European Union (Buchta et al., 2009, Damianides, 2005).

2.7.4.1 COBIT

While we could have grounded our IT effectiveness approach using many different IT governance frameworks, we chose to focus primarily on COBIT, since as we have noted, it is considered to be the most authoritative and widely adopted. We now review COBIT in more detail.

The COBIT 4.1 framework is broken down into 34 IT control processes which fit into one of the following four domains (IT Governance Institute, 2007):

1. Plan & Organize (PO)—strategic processes to help the organization set direction; define needs, processes, and thresholds for success; and determine staff appropriately.

2. Acquire & Implement (AI)—processes recommended for the successful identification of IT systems, their acquisition, and implementing processes to support organizational goals.

3. Deliver & Support (DS)—primarily concerned with the on-going delivery of systems, to include reliability, security, training, costs, and on-going support among others.

4. Monitor & Evaluate (ME)—processes which can be assessed and fit tightly into the concept of IT Governance by encouraging benchmarking performance and assessing results against organizational goals.

Within each of the four domains, there are many control processes labelled and numbered by domain. For example, within the Acquire and Implement domain there are currently 7 control processes, numbered AI1 through AI7. Control processes are high-level recommended steps for organizations to follow to achieve their objectives. Adopting a control process and following the steps outlined in that processes offers greater assurance that business will meet those goals (than without the process) and many negative risks can be avoided (IT Governance Institute, 2008, IT Governance Institute, 2007).

Table 1 provides a summary of control objective AI5, Procuring IT Resources.

Table 1 COBIT AI5, Control Objective: Procure IT Resources (IT Governance Institute, 2007)

Objectives	**Value Drivers**	**Risk Drivers**
Acquire IT infrastructure, facilities, hardware, software, and services for the business.	• High-quality contribution to business • Achievement of desired goals	• Supplier gaps in fulfilling requirements • Commercial and contractual exposure • Solutions not in line with plans • Insufficient quality in procured solutions • Lack of cost control

Recommended Steps

1. Define IT procurement policies that address: legislative requirements, legal expertise, licensing and leasing requirements, upgrade clauses, support and security arrangements, ensuring involvement of the business, and total cost of ownership.
2. Define and implement standard procurement procedures that use selection approaches responsive to the risks associated with the procurement.
3. Define and implement required approvals at key decision points during the procurement processes. Obtain approval from senior management in advance, if the existing policy will not be followed.
4. Record receipt of all hardware and software acquisitions in an asset inventory, and assess the quality before making any payment.

As we have noted, despite the benefits of IT governance framework such as COBIT, they are often not adopted by organizations which are not required to do so. In part this may be because IT governance frameworks can be very resource intensive (Brown et al., 1998, Albayrak et al., 2009). Furthermore, most IT governance frameworks were not developed for smaller organizations (Ridley et al., 2004) which tend to be more informally managed than larger organizations (Huang et al., 2010, D'Amboise and Muldowney, 1988, Daily and Dalton, 1993, Ghobadian and Gallear, 1997), have fewer resources to dedicate to IT governance adoption (Brown et al., 1998, Albayrak et al., 2009), and do not have the same regulatory requirements for IT effectiveness. Another hindrance of wider COBIT adoption is the highly IT-centric focus of COBIT, which requires in-depth IT knowledge and training to implement, assess, and improve.

2.7.4.2 ISO/IEC 38500:2008

The standard for Corporate Governance of Information Technology, ISO/IEC 38500:2008, is a high level advisory developed for senior managers and board level advisors (Chaudhuri, 2011, ISO/IEC, 2008). This standard offers guidance for non-IT leadership and includes many examples of normative behaviours consistent with formal IT effectiveness efforts, like the IT process standards of COBIT, ITIL and ISO/IEC.

Other noteworthy characteristics of ISO/IEC 38500:2008 which distinguish it from other IT governance frameworks is a high-level focus on guiding principles for senior leadership to evaluate, direct and monitor IT operations (ISO/IEC, 2008). The standard uses a simple framework to categorize activities and outcomes consistent with IT best practices in non-technical language.

Although it is intended to also be used by small businesses, this framework may be difficult for managers in smaller organizations to adopt. As one practitioner (Toomey, 2010) familiar with this standard noted, the principles dedicate 8 pages to discuss responsibility, 26 for strategy, 22 for acquisition, 30 for performance, 14 for conformance, and 10 for human behaviour. Another 40 pages are dedicated to the Evaluate-Direct-Monitor governance cycle. Consequently, the enormous scope and complexity is daunting for many small organizations and may be a hindrance to its wider adoption.

2.7.5 IT Governance Based Norms as Drivers of IT Quality

Normative behaviours, or 'norms,' are shared beliefs, desires, and values, which serve to influence organizational behaviours (Garrard and McNaughton, 1998, McNaughton, 1988, Smith, 1987). A key conceptual point in the search for an alternative approach to IT effectiveness is recognizing the powerful motivational forces which norms have in shaping behaviour. Norms often tend to be more effective guides to employee activities, than formal rules and procedures (Huang et al., 2010). Over time, informal normative routines tend to create a shared organizational culture (Keeble and Wilkinson, 1999). Axelrod (1986) describes how norms transfer from a key individual, such as the manager, to become shared behaviours (Axelrod, 1986), an effect Rogers (1976) refers to as *diffusion* when describing how norms related to IT adoption spread within an organization.

IT governance frameworks such as COBIT are normative drivers of IT quality because they advocate adopting standardized IT processes which are expected to positively influence organizational IT quality. For example, the normative cycle expressed by COBIT is depicted in Figure 4, and is also similar to the improvement process depicted by ISO 27001 in Figure 5 (International Organization for Standardization, 2005, IT Governance Institute, 2008).

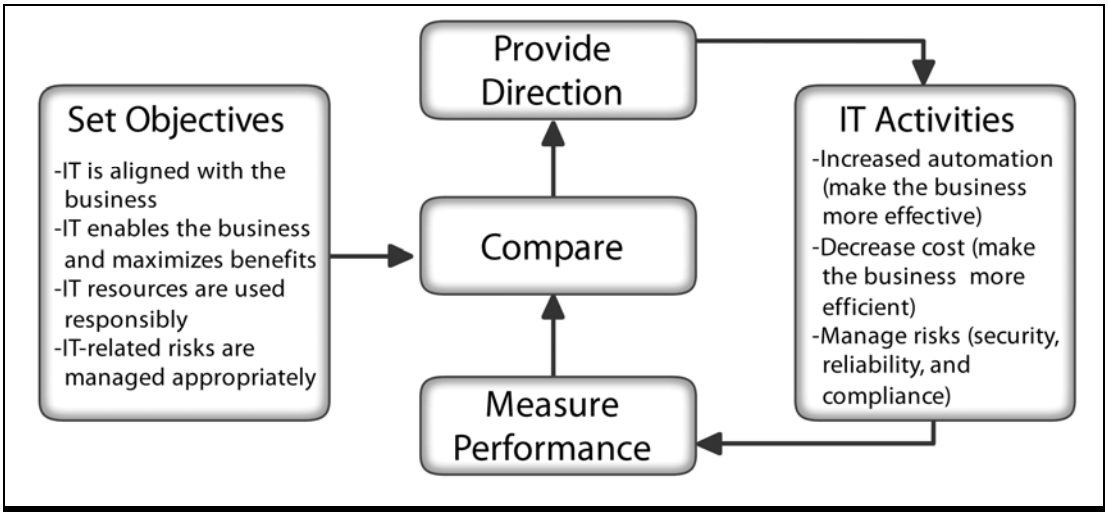


Figure 4. IT Governance framework (IT Governance Institute, 2007)

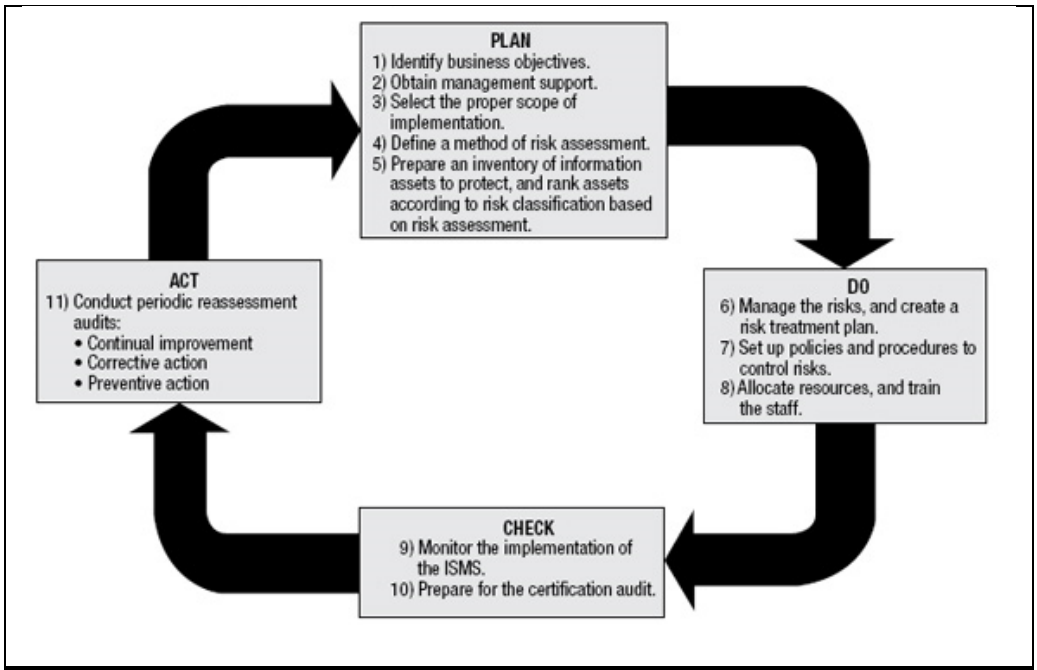


Figure 5. ISO 27001 Plan-Do-Act-Check Cycle, (IT Governance Institute, 2008)

IT governance frameworks encourage organizations to:

1. Assess their organizational needs and set goals for the role of IT.

2. Identify a subset of IT control processes (as previously noted, COBIT specifies 34 such control processes) which can help offer reasonable assurances of meeting those goals.

3. Implement these control processes within the organization while also providing some metric of performance.

4. Periodically review performance metrics against desired goals and refine related processes as necessary.

2.7.6 Important IT Effectiveness Definitions

We define *IT effectiveness norms* as routine actions which contribute to higher quality IT outcomes. We anticipate two important sources for these norms. First, some norms are patterned on established policies and procedures; simple compliance is all that is necessary for this norm to exist. However, an important second source is when employees internalize the spirit of IT best practices and act consistently.

We define *IT effectiveness efforts* as IT processes which embody the normative drivers of IT governance frameworks such as COBIT. These are the 'compliance' norms we described above. Put another way, while adopting specified practices found in COBIT can improve IT operations, we anticipate that organizations which do not adopt COBIT, but employ IT processes consistent with the normative drivers expressed by COBIT may also realize many similar benefits. This is important since we anticipate that norms may facilitate our efforts to develop an alternative approach to IT effectiveness

We also define *IT effectiveness subscription* as intellectual commitment to the normative spirit of IT effectiveness efforts. These are the 'sprit' norms we described above. While IT effectiveness efforts are procedural (and often technical) steps to improve IT quality, IT effectiveness subscription implies a set of beliefs, desires and values across the organization consistent with those efforts. Because norms have such a powerful influence on organizational routines, we anticipate that when employees extrapolate beyond what practices suggest and independently act in a manner consistent with achieving the desired IT outcomes then the organization will realize higher IT quality. Stated another way, IT effectiveness subscription serves as a proxy to determine levels of commitment to IT best practices across the organization.

For example, an organization may adopt policies which require the use of complex passwords (an IT effectiveness effort); however, if employees view this measure as an unnecessary hindrance (a low degree of IT effectiveness subscription), they may, for example, write their password down on a piece of paper taped to their desk. This behaviour would put the IT system at a higher level of risk which could also undermine IT quality. Alternatively, when there is a high degree of IT effectiveness subscription then employees may better connect their actions to the goals of IT effectiveness efforts and take more effort to create complex passwords and protect them.

2.8 Should Effectiveness Efforts Focus on IT or People?

As we have noted, many organizations, especially SMEs, are informal and socially managed. Orlikowski and Scott (2008) and Orlikowski (2010) argued convincingly that results which emphasize technology are largely meaningless in socially dominant organizations. After all, IT benefits come not from the IT artefacts such as computers, databases, and back-ups, but rather how people use those artefacts to accomplish organizational goals. People give meaning to IT (Orlikowski, 2010, Orlikowski and Scott, 2008) and therefore, we posit that IT effectiveness efforts may be more useful when they are people focused.

For instance, we interviewed a manager who experienced difficulty with adoption of an enterprise resource planning (ERP) system. Such ERP systems have been shown to evoke feelings of anger and anxiety for some, or excitement and happiness for others (Beaudry and Pinsonneault, 2005, Beaudry and Pinsonneault, 2010). In this case, while the manager was personally focused on the efficiency improvements of the new system, to his surprise, problems developed in the organization due to differences in understanding "who owned and managed" the customer database. The disparity in perspectives caused a "loss of harmony" within the organization when employees began to "distrust" the ERP system (E.M. interview response, 2012).

The preceding example helps illustrate the perils of focusing on IT instead of people, and is also supported by the literature. For example, it has been shown that individual perceptions of usefulness are accurate predictors of IT system-adoption (Davis et al., 1992, Venkatesh and Davis, 2000, Venkatesh et al., 2003). We have also noted already that user satisfaction with IT quality is a predictor of IT success (Delone and McLean, 2003, DeLone and McLean, 1992). Therefore, examining the link between how individuals perceive IT effectiveness and IT quality may offer further benefits to organizations.

2.9 Should IT Effectiveness Results Quantify or Motivate?

A focus on key performance indicators, such as those advocated by IT governance frameworks is an accepted approach from well-known cycles for business process improvement found in the management literature (see, for example: Eckes, 2005, George, 2002, Persse, 2006, Przekop, 2006). However, it is challenging to satisfy this need for IT effectiveness since there is no single, agreed-upon indicator that can provide quantified IT assessment measures for systematic improvement. We have already discussed the difficulty with focusing on productivity, for example, to demonstrate IT effectiveness. As Brynjolfsson (1993) and Brynjolfsson and Hitt (1998) note the difficulty in trying to quantify information makes calculating productivity a challenge.

Although assessing performance indicators to drive improvements can be valuable, we suggest that fostering appropriate IT norms may be an alternative approach to IT effectiveness. If IT effectiveness efforts are adopted by individuals within an organization, then we anticipate observing an organizational culture which helps motivate actions because of a desire by employees to see better quality IT outcomes.

Put another way, IT governance frameworks require a staff of IT professionals to implement process controls, assess their performance and recommend improvements. By contrast IT effectiveness norms can be gauged and expressed, using relatively non-technical terms that are shared by both IT professionals and others in an organization. Furthermore, focusing on IT effectiveness efforts and comparing them to the standards expressed in IT governance frameworks may help many organizations, especially smaller resource constrained SMEs improve IT quality.

2.10 Identification of a Research Gap

We suggest there is a gap in the current body of research and propose an approach to IT effectiveness focused on how people use IT which also emphasizes quality of the IT contribution. Rather than focusing on assessments of IT operations, measuring IT effectiveness norms could also provide useful quality improvement results.

2.10.1 Classification of IT Effectiveness Approaches

Table 2, presents the IT effectiveness approaches reviewed here, which are in the light-coloured quadrants and classified by their focus and results. Across the two rows we classify each approach as either focusing on people or on IT. Across the two columns, we classify each approach as either quantifying the IT contribution or emphasizing its quality. The shaded quadrant on the lower, right corner represents the gap in current research literature, which we propose could be filled by an approach that emphasizes normative IT effectiveness efforts.

We summarize our gap classification as follows:

- While many approaches to IT quality focus on the mechanics of IT operations, we advocate focusing on individual contributions including outside of the IT function.
- While many approaches to IT quality focus mainly on quantifying IT performance, we advocate focusing more on the qualitative contribution of IT.
- While many approaches to IT quality focus on organizational conformance with an IT governance framework, we advocate adapting existing norms to become more consistent with IT effectiveness efforts.

- While many approaches to IT quality encourage reporting metrics of IT performance, we advocate focusing instead on the spirit of IT effectiveness efforts in individual behaviours.

		APROACH RESULTS	
		Quantifying IT Contribution	**Quality of IT Contribution**
APROACH FOCUS	**IT**	Compare current practices to established best practices. IT governance frameworks (e.g. COBIT)	Emphasize IT contribution to business goals. Strategic alignment model (SAM)
	PEOPLE	Emphasize user satisfaction. D&M IT success model	IT effectiveness efforts which motivate individual contributions. **Research gap**

Table 2 Classification matrix of IT effectiveness efforts and current research gap

Although there is considerable overlap and some personal judgement required to determine these classifications we suggest they are suitable contrasts based on our review of each approach. We submit that any approach to IT effectiveness which is focused on assessing technology will be difficult for some organizations, such as the SME to adopt owing to reduced technical expertise. For example, both IT governance frameworks and the strategic alignment model primarily focus on IT mechanics as we have discussed. We have also shown that approaches which mandate compliance with a standard may be overly resource intensive for some organizations. For example, both IT governance frameworks and the DeLone and McLean model emphasize quantifying the IT contribution. IT governance frameworks do this through performance metrics, while the DeLone and McLean model assesses IT usage. However, these approaches are less suitable for organizations which lack sufficient expertise to interpret the results.

Alternatively, we suggest individuals can be motivated to behave in a manner which is consistent with the spirit of IT best practices. Rather than seeking to impose patterns of behaviour from a highly technical standard lead by the IT function, we advocate management enlist the entire organization's support in shaping norms to be aligned with IT best practices in non-technical language.

2.11 Revised Research Questions

To explore the value of a norms approach to IT effectiveness, we decompose our initial research question presented in section 1.3 into a series of more sharply focused research questions (RQ):

RQ1. Do IT governance frameworks express a set of IT effectiveness norms which can be identified and assessed?

RQ2. Do IT effectiveness efforts motivate subscription to the spirit of these frameworks?

RQ3. Do IT effectiveness efforts and/or increased subscription result in better IT quality?

RQ4. Would some organizations find IT effectiveness based on norms more suitable than IT governance frameworks for improving IT quality?

Affirmative answers to these questions could provide justification for a norms-based approach to IT effectiveness.

2.12 Preliminary Research Framework and Hypotheses

Figure 1, found in section 1.3 presents our initial research model which we formulated based on the preceding literature review. If we are able operationalize IT effectiveness efforts and subscription after an in-depth analysis of COBIT, and then we expect they can assess organizational IT processes and employee attitudes towards those processes.

We also formulated three hypotheses for how this model will operate, which we restate here:

> **H1**: IT effectiveness efforts that are adopted by the organization can make a difference in IT quality.
>
> **H2:** IT effectiveness efforts that are adopted by the organization can influence IT effectiveness subscription actions.
>
> **H3:** IT effectiveness subscription actions can improve IT quality.

The first hypothesis partially addresses our third research question by capturing the direct path for IT effectiveness to influence IT quality. As we have posited, when individuals observe IT processes in action that embody the best practice norms expressed by IT governance frameworks such as COBIT they will have a more favourable assessment of the IT quality.

Hypothesis two and three capture the indirect path of IT effectiveness efforts impact on IT quality to address research questions two and three. We anticipate that observing IT processes based on IT best practices will motivate behaviours consistent with the spirit of those practices. Put another way, H3 posits that when individuals adopt the normative spirit of IT effectiveness efforts, it will result in better IT quality. If so, then this result can also help address research question four.

2.13 Contribution

We have already noted that current IT effectiveness approaches which focus heavily on IT assessments fall short by limiting participation primarily to those with IT skills. We have also compared these approaches to early behavioural psychology efforts for helping patients improve their lives which did not properly consider the mind's intellectual capability. Just as behavioural efforts were eventually replaced by more effective cognitive methods, we believe that a norms-based approach may offer significantly better results for certain types of organizations. By allowing greater cognitive contributions from individuals, especially those outside the IT function, this new approach may have the potential to radically improve IT quality.

Our research may be particularly relevant to organizations which have greater difficulty committing resources to formal IT governance framework adoption. Although the prescriptive approaches to IT effectiveness in COBIT, and other IT best practice frameworks, are valuable resources, a norm-based paradigm provides a different perspective for framing, assessing, diagnosing, and communicating about IT processes. For instance, whereas implementation of measures advocated by COBIT requires technical skill to interpret and implement, a norm-based approach is less formal and relies on common acceptance and assent.

If a causal link between IT effectiveness efforts, IT effectiveness subscription and IT quality can be shown, it might prove useful to:

- Develop less technical IT-function assessment tools.
- Offer actionable steps for improving IT quality which are non-technical and less resource intensive.
- Help more resource constrained organizations, such as SMEs, increase IT effectiveness.
- Bridge the communication gap between the IT professionals and other parts of an organization.

We do not intend to suggest that the skill of IT professionals or the adoption of IT frameworks is not a valuable approach to IT effectiveness. On the contrary, we believe that fostering appropriate IT effectiveness norms may be an alternative approach, also capable of contributing to IT quality, better suited to organizations unlikely to adopt formal IT best practice frameworks. Therefore, we conclude further efforts to answer the research questions we have proposed are necessary and prudent.

2.14 Conclusion

This chapter began with a review of the literature associated with IT effectiveness, and the formulation of several important definitions which we restate here:

- **IT:** the technology, machines, and people which store, process and transmit information for human use.
- **IT processes:** a collection of structured activities or tasks intended to manage the IT assets for the accomplishment of organizational goals and strategy.
- **IT professionals**: individuals with training or experience, who accept responsibility for IT processes.
- **IT administrators**: individuals who are not IT professionals, yet have some responsibility for IT processes.
- **IT effectiveness**: approaches to assess the IT contribution and make improvements.
- **IT quality**: the ability of IT to make an effective organizational impact while also satisfying end users, as adopted from the DeLone and McLean (1992, 2003) model.
- **IT governance frameworks:** a collection of IT best practices intended to improve IT reliability and predictability.
- **IT effectiveness norms**: routine actions which contribute to higher quality IT outcomes. These include complying with IT processes (IT effectiveness efforts) and internalizing their spirit (IT effectiveness subscription).
    - **IT effectiveness efforts**: IT processes which embody the normative drivers of IT governance frameworks such as COBIT.
    - **IT effectiveness subscription**: an intellectual commitment to the normative spirit of IT effectiveness efforts.

We have also classified the literature we reviewed in the field of IT effectiveness and formulated a gap in this work. Notably, we posit that IT effectiveness efforts may be more useful when they are people focused rather than IT focused, and also when they foster appropriate norms instead of mandating standards and assessing performance indicators. To fill this gap, we have identified a set of research questions, and discussed the value filling this gap might have, especially for small resource constrained organizations which are less likely to adopt IT governance frameworks –such as SMEs. Finally we have formulated an initial research framework with three hypotheses which will drive the studies we present later.

Chapter 3 Research Methodology

3.1 Introduction

In this chapter, we present a justification for our epistemology to study the research questions we identified. Next, we review the common research methods employed in IS research. Finally, we conclude by outlining our research methodology and offer a critique of its suitability to answering our research questions.

3.2 A Justification of the Scientific Method

In this section, we present a justification for the use of positivist epistemology in research. We view the role of a researcher as one who seeks to understand how the world functions by proposing new theories, subjecting them to examination and retaining those not shown to be false. Therefore, the foundation of academic knowledge is a shared belief that research is able to provide explanations for the interaction of bodies, a principal also referred to as "logical empiricism" (Dancy, 1998, p. 262-264)."

We will argue that an adequate foundation for logical empiricism is justified with the current framework used by academic researchers. The framework operates as follows. Science S is justified in believing some proposition P is true, if there is empirical experiences E (or pieces of evidence e_1, e_2, etc.) which support or fail to cast doubt on P; if other researchers R believe P and E; and if this shared belief continues over time T. We presented our own shorthand definition of this framework in the following form:

(a) S believes P is true if and only if
   i. P is supported by empirical experiences E(e_1..e_n)
   ii. P and E are believed by researchers R(r_1 … r_n)
   iii. P is believed in future time T(t_{t+1}…t_{t+n}) by S

A few clarifying comments are in order. First, the population of research scientists R share some beliefs in what constitutes a valid E. Conducting research to determine E implies using methods which are observable, verifiable, accurate, consistent and, in the case of quantitative methods, demonstrate statistical significance. This is not meant to be an exhaustive list, as the standard for sufficiency of E may be refined (for example when new statistical techniques such as structured equation modelling become widely accepted).

Second, S as a body is made up primarily of critical truth-seeking researchers R committed to constructing a sound edifice of knowledge to explain the behaviour of our world. As such, they must share some common beliefs in the adequacy of E. Other researchers will accept P, provided

that it is sufficiently supported by evidence and often use this to construct higher models for explanation.

Third, the element of time implies a gradual strengthening of certainty in P and those propositions which stand the test of time are more likely to be believed. The length of time which constitutes an adequate period to believe in P is another standard that is often different for members of R and possibly dependent on how conclusive E is considered.

Two arguments we will defend this framework against are problems of justification and sufficiency (there may well be other problems but these are the most obvious). We shall discuss sufficiency first as it is the weaker of the two. One may argue that no matter how large E, R or T this still does not constitute a sufficient condition for the belief in P. For example, Gettier (2000)has successfully argued that it is possible for S to believe P even though P is false. This may be true, but since the chain of E used to support P cannot have any falsifying e_f proving P false, or even casting doubt on the certainty of P (Dancy, 1998) there is no reason to doubt P either. Thus Geittier's example is shown to offer falsifying evidence removing belief in P, and the peer review process by fellow researchers is critical to building certainty in S while the time condition allows opportunity for careful examination of P and presentation of falsifying e_f.

One drawback of this framework is that we must concede the truth of P is difficult (if not impossible) to judge. However, we can easily prove P false with only one counter example; thus as R is unable to offer some falsifying evidence e_f over a longer period of time, we become more confident in the certainty of P (through growth in E, R & T). Since there is no limit on the boundary of time or evidence, the sufficiency test can forever be extended, though the certainty of P is never fully known, a problem we will touch on again later.

Having discussed the problem of sufficiency, we now turn to the issue of justification. The foundationalist F is likely to ask for justification for our belief in e_n which we may seek to justify by e_{n-1} in which case F asks for further justification of e_{n-1} and so on in "infinite regress" (Dancy, 1998, p. 209). Undoubtedly any defence we offer will likely fail to satisfy the entrenched sceptic, so we will only make two points.

First, for the moment let us concede the infinite regress argument and consider the result is a world where nothing can be truly known and all beliefs are simply (to paraphrase Ayer) a matter of opinion (Ayer, 2000, p. 10). This is a very unsavoury outcome with implications far beyond academic research and, as Van Fraassen (2006) argues, more a dispute over whose beliefs are more rational, an argument that cannot be settled epistemologically. There are some beliefs one may be very confident in and there is *currently no proposition which is better* (Chisholm, 2000, p.

247-248) so this belief is justified. While we cannot convince F they are true, for the moment they are the best explanations available and F's disbelief does not require us to surrender our beliefs.

Second, the framework implies that over time additional evidence is contributed making converts out of more scientists eventually persuading (or marginalizing) F or demonstrating that P was not verifiable and hence false. As noted before the falseness of P can easily be shown, and though the truth cannot be fully verified, the absence of falseness (as E, R and T grow) is justification for belief. While we would like to be able to give a more convincing argument to win F to our view, we concede this argument is the best we can offer

Charles Travis in his criticism of logical empiricism has noted that if we continually appeal to the best explanation when pressed for justifications of research then what we have is not a structure of truth, but just "wishful thinking" (Travis, 2004, p. 248-259). On the other hand, Van Fraassen (1980) has defend this structure by claiming that it is not truth, but a useful fiction which facilitates our ability to create a cohesive description of how the world functions and over time we may eventually get closer to the truth. Karl Popper (Dancy, 1998), in *The Logic of Science* goes further stating that theories which survive testing should be regarded as corroborated or closer to the truth than ones which have been falsified.

As summarized by de Regt (2006), the aim of scientific research is rationality of belief, and as Van Fraassen (1980)points out, it is theory which offers to make sense of science. We must decide whether the world operates "either by coincidence or as a matter of fact," and since science is logical we are compelled to advance theories, test and refine them "until there are no inconsistencies" between what is observed and our explanation (Van Fraassen, 1980, chapter 7). It is through the theories developed in prior work that new experiments are designed, and past work is either built upon, or invalidated.

One limitation of the type of knowledge which can be built upon this foundation is that proposed theories must be falsifiable, meaning they can be proven false. Thus the statement "IT effectiveness efforts correlate with IT quality" is a falsifiable theory, but the statement "IT effectiveness efforts are good" is not. According to Popper, the role of science is actively attempting to "disprove theories" weeding out those which do not adequately explain our world (Dancy, 1998, p. 349-350). A single example can prove a falsifiable theory wrong, though empirical practices are even more stringent raising the threshold to eliminate any grounds for doubting them. For example, most research is considered statistical significance at 90 or 95% likelihood that results could not have occurred by chance, at which point it is acceptable to publish the results for review. Furthermore, researchers are expected to provide details of their work to make it verifiable by others.

Therefore, belief in a scientific theory is a process. We become more confident in P as it survives more attempts to prove it false. While this is still not a complete assurance of truth, it presumably means that the theory was sufficient to explain the mechanics of the micro-processes sufficiently to develop further theory and evidence.

The implication we believe is that there is a role for scepticism in all research. Before applying a theory we might ask ourselves 'what could be wrong with a model and how many attempts to prove it wrong has it withstood before using it for our own work?' Furthermore, we should not hesitate to call into question assumptions which do not fit with our own evidence or views of the world. To gullibly accept what others have done without challenging the work has the potential of perpetuating incomplete theory and generating additional falsehoods.

In conclusion, we have examined the epistemological justification of academic research and identified that problems with their foundation, specifically we may never be completely assured of the truth of our work. However, we have also argued that science's belief in propositions which have evidence to support their authenticity and withstand attempts to prove them false over time are sufficiently warranted. While we may never convince the determined sceptic, we appeal to the best explanation available as justification for our reliance on these beliefs. Our falsifiable theories are useful for explaining the forces we observe in our world, and though science is fallible it is also self-correcting.

3.3 Research Methods Used in Information Systems Research

Having provided a justification for the scientific method which is the foundation of our positivist research epistemology, we now briefly review common approaches to research conducted in the academic discipline of information systems (IS). Later, we will partially justify our own research methods by appealing to widely used approaches we identify here.

3.3.1 Introduction to IS Research Analysis

To study common approaches for IS research, we selected two of the top academic journals in IS research, MIS Quarterly (MISQ) and the European Journal of IS (EJIS) and reviewed all 80 published articles for the year 2010 in these two journals (38 from MISQ and 42 from EJIS). Based on this review we surmise the goal of these journals is to publish works which develop explanatory models for the underlying forces in IS. These models are theoretically derived and frequently supported by empirical evidence which is statistically analysed to validate the proposed hypotheses. While many authors confine their research to IS-centric themes such as organizational success, others are expanding their research scope to better understand human

relationships with IS borrowing from the disciplines of psychology, sociology and medicine, among others, to measure variables such as fear, trust and brain activity.

The IS discipline's approach to research reflects a positivist epistemology (Easterby-Smith et al., 2009) common in the sciences (de Regt, 2006, Van Fraassen, 1980, Popper, 2002) which assumes IS is a well-ordered phenomenon and can be accurately described. While not all researchers agree with this approach (Floridi, 2004, Travis, 2004) over 90% of articles in prominent IS journals display a positivist orientation (Reid et al., 2010).

Although EJIS had more qualitative, inductive and theoretical papers than MISQ, both relied heavily on the use of surveys to collect data (42% of studies). Both journals also frequently included theoretical papers which tended to formulate explanatory models grounded in qualitative methods (Easterby-Smith et al., 2009) such as a literature review, case study or interviews. Some papers combined approaches, using theoretical methods to establish a model which was later supported by data collection. Mixed-method research which includes multiple techniques for data collection was more common in MISQ than EISJ.

3.3.2 Methodology

Surveys are heavily used in IS research as Figure 6 indicates, although many studies employ multiple techniques for data collection −often surveys combined with another method. For example, in the *How Fear Affects Computer Security* study 311 subjects were divided into three different groups each receiving different experimental treatments. Afterwards the subjects completed a survey to assess their attitude towards security compliance (Johnston and Warkentin, 2010). While this study used a 5 point Likert-like scale on the survey instrument, a 7 point scale is also common while a 3 point scale was used in the *Process Modelling Grammars* survey (Recker, 2010).

Qualitative studies are more common in EJIS than MISQ. According to the EJIS editorial statement the journal is focused on "theory and practice of IS (de Vaujany et al., 2011)." Consequently, theory and inductive papers are more prevalent in EJIS with 31% using little or no statistics, instead grounding theory in other methods such as a literature review, case study, interviews, or document analysis. MISQ's stated focus is "communication of knowledge" concerning IT (de Vaujany et al., 2011). When qualitative methods were used in MISQ, these often included some statistical analysis of data as only 15% of MISQ papers had no use statistics at all.

Coding is another common method of collecting data. For example in examining the *Key Factors Affecting ERP Benefits*, researchers coded 126 power point slides and transcripts of presentations made by company executives describing their ERP experience at two conferences (Seddon et al.,

2010) and then correlated the results to identify key factors. A second example of coding is the effort to measure how organizations were influenced by the *Hottest IT Trends* (Wang, 2010). In this longitudinal study, researchers' coded articles from 31 years of periodicals to identify the most frequently mentioned IT trends and then coded public information from 108 companies to examine how these trends impacted their performance using a regression model.

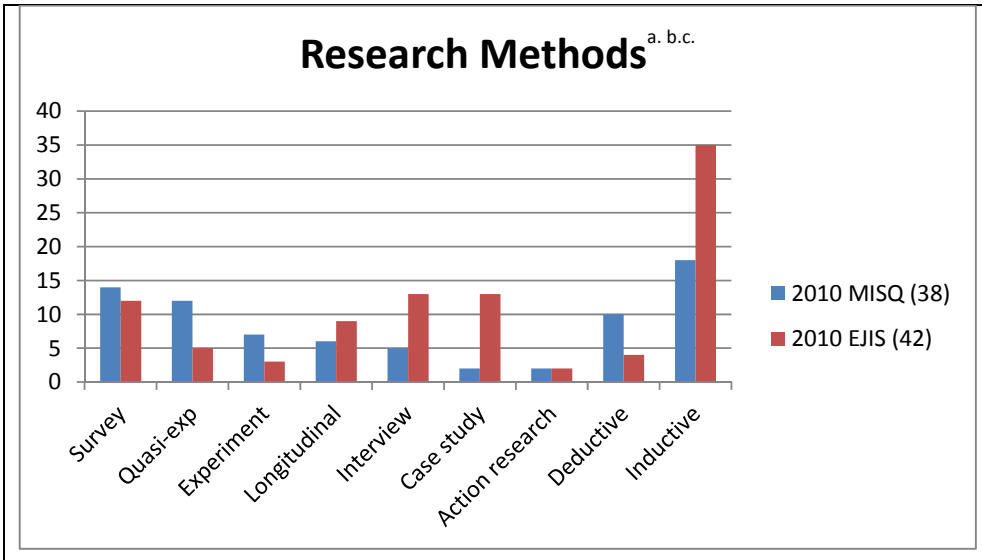


Figure 6. Research methods used in IS papers (many papers employed multiple methods)

a. When surveys were the primary measure of independent and dependent variables they were classified as quasi-experiments unless they were explicitly described as experiments.
b. Theoretical papers grounded in literature or document coding were classified as case studies if they primarily focused on a small population and/or longitudinal if they covered multiple years.
c. Papers which employed SEM to validate a theoretical model were classified as deductive.

A data collection method uniquely suitable for IS comes from IT systems developed to study research problems. For example in the study *Detecting Fake Websites* (Abbasi et al., 2010) the authors developed a software program that used a statistical learning algorithm to identify patterns employed in fallacious websites. This program was tested against 900 websites to show it identified a higher percentage of fake websites then other methods.

The use of IS systems to collect data can generate very large sample sizes compared to traditional methods of data collection. For example, in a study of online *Shopbot Vendor Coverage*, over 2 million computer generated data points were collected (Allen and Wu, 2010), and in an analysis of online shopping, the study *Online Store Visit Strategies* had access to data from over 3.5 million visitors per month generating over 60 million page views (Phang et al., 2010). These extremely large data sets give researchers the opportunity to study samples that would be expensive and time consuming to collect manually.

3.3.3 Data Validity

There are many threats to data validity that can cause researchers to reach a false positive (type I error) or false negative (type II error) conclusion (Cook and Campbell, 1979, p. 37-91). Many studies address data validity, for example, by using descriptive statistics to demonstrate the sample represents the population or that no bias existed in different experimental groups. However the one source of error most frequently discussed and treated was common method bias which was mentioned in 28% of the studies (MISQ:10, EISJ:5).

Surveys are prone to common method bias because they ask the same observer (the survey taker) to assess both the dependent and independent variables. This can cause artificial covariance to be measured which is, in fact, caused by the survey rather than any theoretical constructs the questions attempt to measure (Podsakoff et al., 2003). Because surveys are common in IS research, authors routinely perform validity checks for common method bias.

One method for identifying common method bias used by the study *Software Development Agility* is testing consistency of the survey instrument between objective and perception-based constructs (Lee and Xia, 2010). If there is a poor correlation between the two, this would indicate that the survey suffers from common method bias, although the opposite result does not necessarily indicate absence of bias.

More thorough approaches to common method bias analysis are described by Podsakoff, et al. (2003) and often cited by authors who to perform bias checks. For example, in *Technology Adoption Modeling and Analysis*, the following steps were taken:

1. One-factor test and partial correlation procedure: “All the variables of interest were entered into a factor analysis to check if a single factor emerges from the factor analysis and if one single factor accounts for a majority of the covariance in interdependent and criterion variables. Neither of the two conditions was true (Venkatesh and Goyal, 2010a).”

2. Check for meaningful relationship: “The first factor from the unrotated factor matrix was entered into a linear regression model as a control variable to check if a meaningful relationship among the variables of interest exists. We found that this condition was indeed satisfied (Venkatesh and Goyal, 2010a).”

The first test seeks to determine if one common factor accounts for the majority of the variance, while the second is a partial correlation procedure to identify whether the variance in the statistical analysis comes from different measureable sources, and can usually be compared in a theoretically supportable ratio of covariance between factors (Podsakoff et al., 2003).

An alternative approach is partial least squares regression (PLS), which is a form of structured equation modelling that combines features from principal component analysis and multiple

regression to measure covariance (Hervé, 2007). A PLS analysis can verify no single factor accounts for the majority of variance and that different ratios of variance are present in the model, which helps confirm there is no threat of common method bias.

3.3.4 Statistical Analysis Methods

We now briefly review the data analysis methods commonly used in IS research, primarily emphasizing methods unique or different to other disciplines outside IS, especially the growing use of SEM. As Figure 7 indicates, a wide range of methods are used such as correlation, t-tests, analysis of variance (ANOVA), regression, factor analysis and complex multivariate methods (ANCOVA, MANOVA, MANCOVA).

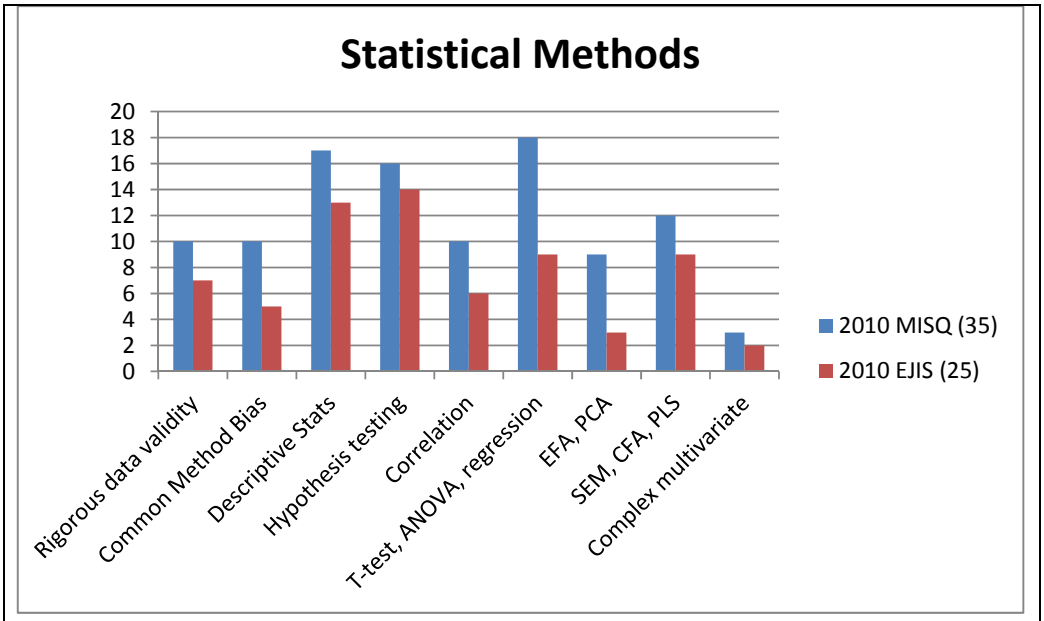


Figure 7. frequency of statistical methods used in IS papers reviewed

Most of the papers were inductive research, presenting some new model, although approximately 30% were deductive and included more in depth analysis of the hypotheses. The high number of inductive papers is likely a reflection of the fast pace of change in the IS field and also the expanding range of topics being investigated.

	Avg Study Size[a]	# SEM only[b]	% used SEM	% Theoretical[c]	% Surveys
MISQ	404	3%	32%	16%	37%
EJIS	383	5%	24%	36%	29%

Table 3. Summary of study size used in IS papers reviewed

a. Average does not include one EJIS study with over 2 million computer generated data points.
b. Studies did not use any other statistical method except SEM
c. Theoretical papers were those with no use of statistics, percentages are from total papers published for the year

As previously noted, surveys are common in IS research, and the average number of respondents for surveys in MISQ was 327, and 246 for EJIS. Smaller sample populations ranging between 50 and 200 were also common.

A widely used approach for statistical analysis is a factor analysis or component reduction to synthetically combine values from questions used to measure different variables. For example, the study *Relationships in Outsourcing* was an exploratory study into how relationships affect business outsourcing. The results in Table 3 report the principal component analysis values (Bharadwaj et al., 2010).

Variable item	*Reliability (Cronbach's alpha)*	*Convergent validity (correlation of item with total score item)*	*Discriminate validity (Factor loading)*
Successful relationship	0.645		
1		0.477	0.859
2		0.477	0.859
BPO outcome	0.789		
1		0.378	0.442
2		0.300	0.356
3		0.644	0.768
4		0.572	0.684

Table 4 Reliability, validity and factor scores reported (Bharadwaj et al., 2010).

The three values which we have circled in the table fall below desired values for statistical reliability. For example, Cronbach's α is a measure of scale reliability and should be greater than or equal to .7 (Field, 2009, p. 674-685), convergent validity a common method bias correlation should be greater than or equal to .333 and factor loading scores should be greater than or equal to .5 (Bharadwaj et al., 2010). The authors acknowledge these measures fell below the desired thresholds, but because their study was an exploratory one, use them for analysis.

Once a set of synthetic variables have been formulated and shown to be reliable and valid, they are often entered into a regression model. The regression model uses the coefficients of each predictor variable to measure the effect on the dependent variable and report the contribution of each variable and the explained variance resulting from the model (Field, 2009, p. 209-261).

For example, in *Market Value of Voluntary Disclosures*, the authors developed Equation 1, a complex regression model of variables from different sources to measure market value changes between different firms to analyse the overall explained variance (Gordon et al., 2010).

$$PRC\text{-}3M_{it} = \beta_0 \times Intercept + \beta_1 \times Dis_{it} + \beta_2 \times BVPS_{it} + \beta_3 \times EPS_{it} + \beta_4 \times LnAst_{it} + \beta_5 \times Neg_{it} + \Sigma\beta_k \times Year_{it} + \Sigma\beta_j \times Indus_{it} + \varepsilon_{it}$$

$PRC\text{-}3M_{it}$ = stock price of firm *i* for year *t*, 90 days after fiscal year close
Dis_{it} = 1 for a generic disclosure of information security, 0 otherwise
$BVPS_{it}$ = book value of equity divided by No. of shares outstanding for firm *i* for year *t*, year-end
EPS_{it} = earnings per share (basic excluding special items) for firm *i* for year *t*, year-end
$LnAst_{it}$ = log of assets for firm *i* for year *t*
NEG_{it} = 1 if EPS is negative for firm *i* for year *t*, 0 otherwise
$Year_{it}$ = 1 if current year, 0 otherwise

Equation 1. Regression equation to compute market value (Gordon et al., 2010)

While regression analysis is very common, many studies perform structured equation modelling in addition to or instead of regression. Structured equation modelling (SEM) is a second generation multivariate analysis technique that combines features of the first generation techniques, such as principal component and linear regression (Hair et al., 2012a). Although a relatively new approach to statistical analysis, SEM "is particularly useful for the process of developing and testing theories" (Chin et al., 2003) and "has become the preferred data analysis tool for empirical research in IS" (Kim et al., 2010, Hair et al., 2012a) and 35% of papers used some form of SEM (MISQ:12, EJIS:9). When using SEM, researcher must choose between either a covariance based SEM or a variance based partial least squares (PLS). While the former is meant to be primarily for confirmatory analysis and the latter for exploratory analysis (Hair et al., 2012a) these justifications were rarely mentioned in the studies we reviewed.

An example which illustrates the elegance of SEM is the *Software Development Agility* study (Lee and Xia, 2010) where a PLS model was used to analyse the data. There is an undeniable appeal to the concise simplicity of Figure 8 which depicts the regression coefficients and factor analysis results directly onto the research model.

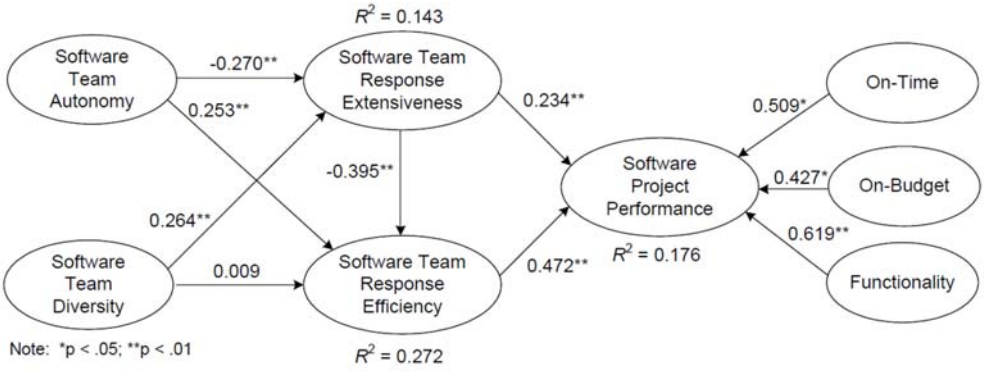


Figure 8. PLS model used in *Software Development Agility* (Lee and Xia, 2010)

Another example which illustrates the benefit of SEM is the *Effects of Emotions on IT* study, which used two identical SEM models each with different independent variables to measure their effect on IT usage. The authors' hypothesis was respondents in a positive mood would be motivated by different emotions than those in a negative mood. By using the same model and changing one variable they were able to visually and statistically demonstrate how one variable moderated a positive effect and the other a negative effect. To control for the possibility of common method bias, the authors also conducted ANOVA tests to confirm their results (Beaudry and Pinsonneault, 2010).

For studies which used SEM analysis, we rarely noted any justification for choosing one SEM technique over another. We might speculate that familiarity with a method or software program played a stronger influence than any theoretical rationale for the choice. One notable exception was the study *Process Modelling Grammars* which carefully justified the SEM analysis. First a confirmatory factor analysis using LISREL was done because this was "preferred to exploratory factor analysis in cases with strong *a-priori* theory, a focus on theory testing and pre-validated scales." Then a SEM analysis was used because it was "particularly appropriate for testing theoretically justified models (Recker, 2010)."

Another weakness of papers using SEM is their lack of consistency in analysis and reporting. For example, eight papers relied solely on SEM analysis and had little or no additional supporting statistics (see Table 3). This seems like a poor choice as using another statistical analysis technique such as correlations, t-tests, component analysis or regression might help support the SEM analysis while also giving readers unfamiliar with SEM a better context for the results.

For reporting results, several goodness of fit indexes are used to explain the SEM significance, but authors rarely justify which indexes are reported (or omitted). One exception is the results of *Process Modelling Grammars* study depicted in Table 5. Ten different indexes are reported along with their suggested values. This table is easy for the reader to see the SEM fits the data well across many indexes. It might generally benefit papers using SEM analysis to include multiple fit indexes and their suggested values.

While SEM is becoming very popular as a statistical method, there is still a debate over what value it has for IS research. As with any statistical method, improper use can falsely identify effects that have no theoretical justification. To demonstrate the risk of faulty models, in *Formative Measurement in IS Research* the authors created four SEM models, two of which were theoretically incorrect. Both the correct and incorrect models had comparable goodness of fit measures (Kim et al., 2010) which illustrates the potential risk of type I errors from SEM analysis.

Fit index	*Suggested value*	*Determinants model alone*
GFI	>0.900	0.941
AGFI	>0.900	0.913
NFI	>0.900	0.985
NNFI	>0.900	0.986
CFI	>0.900	0.989
SRMR	< 0.050	0.0451
RMSEA	< 0.080	0.0625
χ^2 (*df*, *p*)	—	253.003 *(81,0.00)*
χ^2/df	approx. 3	3.123
R^2 for ItU	—	0.413

Table 5 SEM fit indexes for *Process Modelling Grammars* (Recker, 2010)

Although complex methods such as SEM are used frequently it is fitting to highlight two examples of very basic methods which were the primary statistical analysis employed in a study, lest one incorrectly conclude complex methods are required for IS research.

In the study *Detecting Fake Websites* pair-wise t-tests were the primary method used to compare the performance of learning systems against the lookup tools. The results for one of the hypotheses is shown in Table 6 which indicate three of the four systems (left hand column) outperformed the look up tools (top row) (Abbasi et al., 2010).

	H1a – Overall Accuracy			
System	Sitehound	EarthLink	IE Filter	FirePhish
SpoofGuard	< 0.001	< 0.001	< 0.001	< 0.001
Netcraft	< 0.001	< 0.001	< 0.001	< 0.001
EBay AG	0.109*	0.066	< 0.001*	< 0.001*
AZProtect	< 0.001	< 0.001	< 0.001	< 0.001

Table 6. P-values for pair wise t-tests (Abbasi et al., 2010)

Because of its versatility t-tests are a very powerful analysis method which is also well known and understood (Field, 2009, p. 324-345). Since the authors were comparing a large number of results from different tests, the t-test was sufficient to show that the means from each group were from different populations.

In the study *Key Factors Affecting ERP Benefits* correlations were the primary statistical method used to measure consistency between rater codings of presentations to support the hypotheses (Seddon et al., 2010). Correlations are a powerful method to demonstrate that a result is very unlikely to happen if there was not a corresponding effect in the population (Field, 2009, p. 166-

196). Since this data was originally collected from a non-quantitative source, this was an effective method of supporting the hypotheses.

However, it is fitting to conclude by highlighting one of the most complex statistical methods encountered by our review in *Polynomial Modelling and Response Surface Analysis*, a study which used confirmatory regression analysis and response surface models is depicted in Figure 9. Note the convex surface on the left hand shape which depicts a negative moderating effect of the behavioural intention variable and the concave surface on the right hand model which depicts a positive moderating effect (Venkatesh and Goyal, 2010a). Although this is a visually interesting result, it is difficult to interpret compared to better known techniques (three pages were used to explain the results). The authors also note the method has several limitations. For example, it can only be used with three variables, two of which must be closely related.

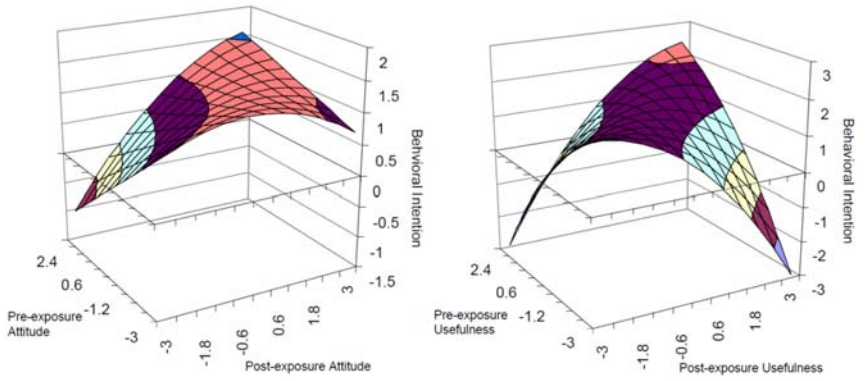


Figure 9. Polynomial response surface models (Venkatesh and Goyal, 2010a)

3.3.5 IS Research Methods Conclusion

We have reviewed 38 articles from MISQ, and 42 from EJIS published in 2010 to review common research methods of IS studies. We briefly summarize the trends of IS research we observed as follows:

- A positivist epistemology dominates the field characterized by the use of hypothesis based models.
- IS studies commonly use empirical methods although theoretical contributions are also common.
- There is a wide variety of research methods used, and frequently inductive methods are employed, perhaps in part because of the rapid rate of change in IS research topics.
- There is a heavy reliance on surveys for data collection, and consequently common method bias is one of the most widely addressed threats to validity.

- A wide variety of statistical methods are employed for data analysis, from simple correlations, t-tests, factor analysis and regression to more complex methods.
- The use of SEM is an important statistical tool frequently used in IS studies.

3.4 Thesis Research Methodology

In this section, we present our methodology for studying the research questions and also critique their suitability.

3.4.1 Introduction

We adopt a mixed methods approach to determine whether IT effectiveness efforts can predict higher IT quality outcomes. This section will first describe steps for developing a survey instrument; then how surveys are administered and statistical methods employed to analyse results. Next we discuss the use of qualitative data collection methods that include interviews and the coding of written responses. Finally we critique our methods and address steps taken to moderate anticipated risks.

3.4.2 Instrument Development

Surveys are frequently used in IS research, and one of our primary goals is to develop an instrument for reliably assessing the three constructs of our framework. For convenience, we restate them again here:

Research framework principal constructs (see Figure 1**):**

- **IT effectiveness norms**: as normative actions (IT effectiveness efforts) and intellectual commitment (IT effectiveness subscription) to IT effectiveness.
    - **IT effectiveness efforts**: IT processes which embody the best practice norms expressed by IT governance frameworks such as COBIT.
    - **IT effectiveness subscription**: shared beliefs, desires, and values consistent with IT effectiveness efforts.
- **IT quality**: the ability of IT to make an effective organizational impact while also satisfying end users, as adopted from the DeLone and McLean (1992, 2003) model.

We briefly discuss our strategy for operationalizing each of these now.

The IT quality construct, as we have described in section 2.7.2, is partially related to the IT success dependent variable frequently used in IS studies (DeLone and McLean, 1992, Delone and McLean, 2003). Adapting pre-validated survey questions to our study can help make our findings

applicable to a much wider body of research work and give us a greater assurance that our questions are assessing the dimensions we believe they are.

However, as we described in section 2.6.2, some organizations, most notably SMEs often use a wide range of measures for success (Feindt et al., 2002, Trondsen, 1997). Therefore, we also adopt questions developed by Jouirou and Kalika's (2004) who adapted Venkatraman's (1989b) organizational performance assessment questions for the SME to assess organizational impact.

Operationalizing the IT effectiveness efforts construct is the result of carefully studying the conceptual themes and recommendations found in IT governance frameworks such as COBIT to identify a set of non-technical items. Identifying the normative patterns expressed in these IT effectiveness efforts was based on reviewing multiple IT governance references to identify the expected patterns in organizations that adopt IT governance frameworks. While COBIT expresses 34 IT control processes, many of these are highly specialized and would not be universally adopted. Consequently, we sought to identify a much smaller set of generic themes for assessing whether efforts have been made to adopt IT best practices.

The most difficult challenge we face is operationalizing IT effectiveness subscription. These items are intended to assess intellectual commitment to the spirit of various IT effectiveness efforts. The Humean and cognitive theories of motivation which we will draw upon later to develop these items suggests that norms are motivated by a belief that one's actions can cause change combined with a desire to see that change (Radcliffe, 2010, Smith, 1987, Hume, 1978). Therefore, while the IT effectiveness effort items assess actions, the subscription must assess both *intent and action*. Because we hope to administer this survey to a wide sample of organizations, these items must also focus on generic themes. We developed these items based on informal conversations with various IT professionals; by reviewing the expected behaviours of organizations that adopt IT governance frameworks; and, by formulating them to express intent to act.

Because both of the IT effectiveness norm constructs are new and potentially complex to assess, we anticipate multiple studies and refinement to reliably develop these survey items.

3.4.3 Survey Data Collection

Study participants were largely selected from contacts in the business and academic community in an effort to reach a wide sample of organizations. We primarily sought to distribute our survey through umbrella organizations directly to their members. We also contacted organizations with which we have personal or professional relationships. The purpose of the survey was described as an *effort to understand the effect of IT attitudes in organizations.* No compensation was offered

for participation, but the benefits were described as helping to identify methods which could lead *to better management of IT systems that generate more value for business*.

We anticipated needing both paper and electronic surveys to collect responses using both postal and electronic mail. When contacting a 3rd party organization, we anticipated a response rate of approximately 10%. Thus for a sample size of approximately 150, we expected the need to send out as many as 1500 invitations. Of those who do respond, approximately 10% were expected to be invalid or incomplete.

We also have direct access to organizations with which we have a more personal relationship, such as students in a business class. In cases, where we asked students to participate in our study we anticipated a response rate approaching 90%. Thus, for a class of 180 students, approximately 162 responses were expected. Due to their lack of business experience, approximately 20% of the student responses may be incomplete or unusable.

Our survey asks if the respondent is willing to discuss their response with the researcher and if so to provide an email address. We anticipated that roughly 10% would consent to a follow-up interview. Thus for between 130-140 responses we expect to have a pool of approximately 10-15 candidates to interview. In cases where we did wish to conduct interviews we contacted these respondents to assess the likelihood of a follow-up interview.

3.4.4 Statistical Analysis of Survey Data

As we have described in section 3.3.4, a wide variety of statistical methods are commonly used to analyse data. For our purposes, the goals of our analysis are summarized as follows:

1. Provide descriptive information about the sample and responses.
2. Evaluate threats to validity.
3. Offer evidence to answer the research questions described in section 0.
4. Refine the theoretical research model described in section 2.12.

The first goal is an effort to make our results applicable to a wider audience and also shed more light on the interaction of constructs within our framework. The second goal is a critical examination of our methodology to assess its suitability and also offer further insights for refining our methods. The third goal is to help accomplish our primary research objectives. The fourth goal is an effort to document a richer understanding of construct interaction and to assist in further theory development.

The statistical methods we use to accomplish these goals are briefly described below.

3.4.4.1 Data exploration

Using the IBM SPSS Version 20.0 (2011) software package, the following tests are performed to explore the data.

1. **Check for missing data**. Missing responses can create challenges for analysis by skewing results (Field, 2009). A few missing responses in a case can be replaced either with the mean or coded as a neutral response (neither agree nor disagree). However cases with many missing values may indicate a lack of effort by the respondent and are removed from further consideration.

2. **Verifying analysis requirements**. The assumptions of linear regression require data which is normally distributed, linear, independent and have constant error variance (Field, 2009). Therefore, using SPSS, these assumptions are tested and reported.

3. **Checks for unusual and influential data**. A small number of cases that are substantially different from other responses can make large differences in regression analysis (Field, 2009). Tests for outliers, leverage and influence are performed to identify problematic responses removed from further analysis.

4. **Construct validity and synthetic reduction**. Common method bias, as noted in section 3.3.3 is a frequently noted threat to the validity of survey data. Tests described by Podsakoff (2003) will be used to check for evidence of common method bias. Factor analysis, is a widely used approach in IS research as noted in section 3.3.4. The Kaiser-Meyer-Olkin (KMO) measure, Bartlett's test of sphericity, analysis of Eigen values and component matrices are used to verify items correlate sufficiently to cluster in theoretically expected constructs. These constructs are then saved as synthetic regression variables for later inclusion in a regression model (Field, 2009).

3.4.4.2 Construct Interaction

Using both linear regression in SPSS (2011) and structured equation (SEM) modelling partial least squares (PLS) in SmartPLS 2.0 Beta (Ringle et al., 2005), we will examine construct interaction to test the relationships hypothesized in section 2.12.

1. **Linear regression**. As noted in section 3.3.4, regression is widely used in IS research and a well understood approach to analyse the predictive power of data. The method relies on normality of data, which proves difficult to meet in many cases. Unstandardized regression coefficients *B*, and variance explanatory power R squared values are used to evaluate these models (Field, 2009).

2. **SEM PLS**. As described in section 3.3.4, PLS is a variance based method of analysis well suited to exploratory analysis (Hair et al., 2012a). Because it uses an internal structure model and has the ability to work with non-normally distributed data, it can facilitate the development of complex predictive models (Hair et al., 2012a, Wetzels et al., 2009, Tenenhaus et al., 2005, Chin et al., 2003).

In summary, using these statistical methods to accomplish our data analysis goals helps offer evidence for answering our research questions.

3.4.5 Interview Data Collection

We also conducted interviews with different organizations to help generate a more complete picture of how our constructs behave. These were done in-person or using internet video conference software. These interviewing methods are common in IT research and each has its own strengths and weaknesses (Lazar et al., 2010, p. 203-206).

Interviews were semi-structured (Easterby-Smith et al., 2009, p. 143-145, Lazar et al., 2010, p. 189-191) using questions from the survey instrument. The interviewer began by informing the subject that the interview was entirely voluntary, that their responses were to be kept confidential and any results reported would be anonymous. Next a few demographic questions were asked to establish rapport and create a conversational atmosphere for the interview.

The interviews were structured after a subset of our survey items. Using survey items helped validate the questions measured the constructs we expected and also helped generate more complete responses than a five item Likert-like scale. When respondents failed to provide in-depth answers, the researcher used prompts such as "*what do you mean by…"* and *"can you give me an example of…"* Once the discussion of was concluded, the respondent was asked to respond to the item using the five item Likert-like scale to confirm instrument reliability.

The interviews were recorded and later transcribed. The interviewer also made notes during the interview which were scanned into to an electronic document as soon as possible. If the subject mentioned any documentation while answering a question, the interviewer asked for copies. For example, in discussing safeguarding IT, if a respondent indicated the company had a policy which governs the acceptable use of computers, the interviewer asked for a copy that was also archived.

The surveys, interviews and any documents which can identify subjects were saved in a password protected location on a computer hard drive, or locked in a secure cabinet. Only anonymous results were reported and never in a way that respondents could be identified.

3.4.6 Document Coding

As we noted, coding documents is a common form of analysis in IS research. According to Holsti (1969) coding falls within a larger family of content analysis techniques used in qualitative research to make inferences about message characteristics based on a predefined set of constructs. Because information can be viewed as signs stored in IT systems (Beynon-Davies, 2010) the interpretive analysis of written messages can help identify patterns and meanings and may help make inferences (Myers, 1997) about the relationship between human thought and data representations in IT.

Our data collection techniques also included asking respondents to prepare written answers to questions. These responses were then analysed to provide further insight for our work. In some cases, we conducted our analysis using a-priori developed constructs. In other cases, we reviewed the responses and then aggregated and synthesized them to provide more insight for theory building.

3.4.7 Critique of Research Methodology

Having presented our research methodology, we now critique it.

The first issue we address is our use of a predominantly positivist epistemology. It is entirely possible that the constructs we have identified do not behave predictably. If so, then any results derived from studies might be attributed to a faulty model. In fact, a more inductive approach to studying the drivers of IT quality might yield an entirely different and more appropriate model.

In defence of our epistemological choice, we refer back to our discussion of the scientific method in academic research in section 3.2. We view our role as researchers who advance theories which help explain the forces under observation. Our work builds on a field that is largely positivist because we believe that IT is predictable in the way other forces in science and psychology behave. While it is entirely possible the field is mistaken, as we have noted, science is self-correcting and in time these positivist methodologies may yield to other approaches. Put another way, even if the model we identify is not completely accurate, it is still a worthwhile result that helps identify something *closer to the truth* (Van Fraassen, 1980) and offers deeper insight to problems such as IT quality among others.

Finally, to moderate our epistemology, we followed the recommendations of Easterby-Smith et al. (2009, p. 66):

1. By recognizing that *how* companies achieve good IT quality is less important than *what* they accomplish we can allow for greater variation in our study. Hence our use of norms over more precise approaches, such as IT governance frameworks.

2. We realize that the IT effectiveness forces we study are artificial constructs which we treat as conceptual not concrete forces. Our data analysis techniques include tests for validity of common threats we can expect to encounter.

3. We augmented our collection of data with qualitative techniques such as interviews to provide richer responses and more insight for theory building.

The second criticism we address is difficulty we encountered isolating the constructs of IT effectiveness using a survey instrument, and the strong possibility of interdependence (Easterby-Smith et al., 2009, Venkatesh and Goyal, 2010b). For example, in studying the *diffusion* of IT across organizations, Rodgers argued there was too much covariance to separate variables independently (Rogers, 1976). Barton criticised surveys as "a sociological meat grinder" that removed individuals from their social context (Barton, 1969). We have already noted that surveys are widely used in IS research, even though some have experienced difficulty assessing distinct variable themes (for example, see Jouirou and Kalika, 2004, Venkatraman, 1989b) using surveys.

The likelihood of interdependence with a survey instrument is a valid concern. For example, we have noted that common method bias is one of the principal threats to validity mentioned in IS studies. In fact our study seeks to assess which IT processes are present, the influence of those processes on norms and also the quality of IT from a single observers' perspective. Furthermore, since many of our constructs are new we will have to design our own survey items and then verify their reliability.

To correct for the problems of interdependence, we taken several steps following the recommendations of Easterby-Smith et al (2009, p. 271-301):

1. Our research model was simplified –originally we considered the interaction of five constructs, but reduced this to three for our study.

2. We refined our survey instrument through a series of studies with conflating questions removed or revised to better operationalize the constructs.

3. Statistical methods are used to control for variable interaction and test for common method bias. Notably, the addition of PLS to our analysis allows additional explanatory interaction of constructs than using only linear regression does.

4. Interviews were added to the data collection method to provide richer responses and validate our survey questions assessed what we expect.

The last issue we address is the fact that we are assessing organizations homogenously. There is tremendous variation in how a business is organized and operates. In our relatively small sample of businesses, it is possible we have identified relationships that are not extensible to other organizations. For example, Parker's (2007) review of studies conducted on SMEs noted that researchers frequently failed to adequately refine the organizational scope to make their results transferable to specific sub-group classifications.

We concede our proposed study most likely includes too few organizations to generate a set of results which can be classified by sub-groups; however, this is not our research goal. At this stage, we hope to identify a set of generic constructs which demonstrate that IT effectiveness norms do impact IT quality in some organizations, which we argue would be a significant finding. Even if we determined that IT effectiveness norms do not impact IT quality as we anticipated, this falsifying conclusion would also be a significant finding.

3.5 Conclusion

In this chapter we have presented the following:

1. A defence of academic research, and positivist methodology on the grounds that:
    a. The role of research is advancing theories which explain the forces under study.
    b. Although truth is difficult to verify, over time research is self-correcting because a single example can prove an incorrect theory false.
    c. Even incomplete or incorrect theories are beneficial since they offer a current best explanation which can advance further research.
2. A review of IS research methods based on a study of 80 articles from two academic journals published in 2010 which presented several key findings important to our work:
    a. IS research is largely positivist in its methodology.
    b. Data collection methods include the frequent use of surveys, and qualitative methods such as case studies, interviews and document coding.
    c. A common threat to survey data validity is common method bias.
    d. A variety of statistical analysis techniques are used, to include correlations, t-tests, regression models and SEM.

3. Our own research methodology was presented which we summarize as:

    a. The development of survey questions for our constructs.

    b. The use of surveys in both business and academic contexts to collect data.

    c. Using interviews in combination with surveys to help assess constructs and validate survey questions.

    d. Statistical methods to analyse survey data, that include the use of SEM PLS to develop a complete predictive model of construct interaction.

    e. The use of coding to make inferences about characteristics of written responses to questions.

4. Finally, we have also critiqued our methodology, noting three significant risks and addressed steps taken to moderate these risks:

    a. The use of a positivist methodology that we have moderated by developing a set of constructs which are more conceptual than concrete.

    b. The risk of not being able to accurately assess constructs using surveys which we have moderated by adding qualitative data collection methods such as document coding and interviews.

    c. Problems with treating organizations homogenously which prevent any findings from being transferable to sub-classifications of organizations; we concede this may be an issue, though we argue any results, even non-transferable ones would be significant.

Chapter 4 A Norms-based Approach to IT Effectiveness

4.1 Introduction

This chapter will present a theoretical justification for the suitability of using a norm based approach to IT effectiveness based on the Humean and cognitive theories of motivation. Next, we draw from the preceding literature review of IT effectiveness to hypothesize a set of IT effectiveness norms derived from COBIT. Then we present an IT proposal study which offers initial support for the normative role that IT governance plays in influencing the quality of IT solutions.

4.2 Philosophy of Motivational and Normative Actions

We begin by reviewing the philosophy of normative motivation to understand better the role IT effectiveness efforts based on norms expressed in IT governance frameworks play in influencing actions. Specifically, we define what is meant by a shared culture of beliefs, values, and attitudes about IT effectiveness and we adapt theories of motivation to show how IT effectiveness norms can motivate actions.

4.2.1 Humean Theory of Motivation

The Humean Theory of Motivation (HTM; Hume, 1978) is based on David Hume's convincing argument "of the influencing motives of the will" (Hume, 1978) and is a prominent theory of current philosophical psychology (Radcliffe, 2010). Hume's original theory of motivation states (in part):

1. Beliefs coupled with feelings are sufficient motivation to cause action (Cohon, 2010).
2. Because of (1, we are primarily *slaves to our passions* (Cohon, 2010).
3. All passions are phenomenological impressions of pleasure or pain, which take the form of fear, anger, hope, thirst, hunger, and so on (Cohon, 2010).

The modern HTM reinterprets point one as a theory of motivation that requires both belief and desire in order to cause action (Smith, 1987), and by rephrasing the *passions* described in point three to be encompassed by the term *desire* (Radcliffe, 2010, p. 477). For this reason, the HTM is characterized as a theory about motivating reasons versus normative reasons (Smith, 1987).

According to the modern HTM, belief and desire separately are not sufficient to cause action (Radcliffe, 2010, p. 477-478). For example, Susan may desire to see her organization's IT kept secure from unauthorized access; however, since IT security is not her responsibility, she does

not know what actions to implement to accomplish her desire. Therefore, her desire alone is not sufficient to motivate any action. Alternatively, Roger understands that using complex passwords can prevent others from guessing his password, and thereby, gain unauthorized access to the organization's IT system. Roger is currently using a weak password and is aware it could be easily guessed. Despite his beliefs, Roger does not act to change his password, possibly because he does not have the same desire as Susan. Roger's behaviour is consistent with empirical evidence suggesting users often use weak passwords despite being warned otherwise (Yan et al., 2000).

Thus, HTM suggests that simply adopting an IT governance framework provides insufficient motivation to drive organizational IT success. Although frameworks are known to generate higher quality IT outcomes, those results are based on actions performed by employees who believe the steps will improve IT quality and also have a desire to see better IT.

Beliefs and desires have the ability to shape attitudes, but they each have a different functional role. Beliefs passively represent the current state of the world, while desires are active and seek satisfaction in changing the world (McNaughton, 1988).

For example, Roger knows (or holds beliefs) that:

a. He is currently using a weak password.

b. Strong passwords help prevent others from guessing his password and gaining unauthorized access to the IT system.

But despite a., and b., there is no intent by Roger to change the state of the world (McNaughton, 1988). Put another way, beliefs are like maps that describe what courses of actions one could take (McNaughton, 1988, Smith, 1987), or like inventories of what is currently available in the world (Humberstone, 1992). Beliefs may provide a rationale for our action; beliefs may also help rank order actions (e.g., from good to bad); however, beliefs do not motivate our action.

Desires actively seek to change our world (Garrard and McNaughton, 1998, McNaughton, 1988, Smith, 1987). Therefore, in order for Roger to change his password, he must desire to see a change in his current password. The HTM does not allow the possibility that Roger would develop such a desire through logic or reason, and so it may be referred to as a non-cognitive theory. Hume (Hume, 1978) argued that reason and logic play no part in our actions, although we may classify our actions as rational or irrational based on whether the beliefs we held at the time we were motivated to action were true or false (Radcliffe, 2010). In judging the merit of actions, those that satisfy more beliefs serve a greater good. For example, Roger may believe there is little risk to the IT systems, so he finds no fault with not modifying his password. If this belief were to

change, for example, if Roger learned a co-worker's account was compromised because of a weak password, this could cause him to re-evaluate his action and formulate a new desire to change his password.

The absence of a role for reason in motivating actions is contrary to the philosophy of Aristotle and Kant (Radcliffe, 2010) and because HTM views desires as non-cognitive it has been criticised as an incomplete theory of motivation (McNaughton, 1988). Disciplining ourselves to do something we do not wish to do (such as changing a password), seems to intuitively suggest that reason should be able to influence our desires.

4.2.2 Cognitive Theory of Motivation

Without reason, it becomes difficult to explain how norms influence actions. In contrast to the HTM, a cognitive theory of motivation (CTM; Smith, 1987) allows reason to provoke action and is a normative or justifying motivational theory (Smith, 1987). To illustrate the CTM, consider the following example: Roger knows his password is weak and he would like to change it. However, crafting a new complex password requires Roger to first think of a memorable non-dictionary phrase, next decide on a combination of upper and lower case letters, numbers, and special characters (e.g., the phrase: [I] [s]wam [i]n [t]he [l]ake [a]t [n]ight becomes the password: i$1tL@n); then commit this sequence to memory (McDowell et al., 2009). Completing this task requires privacy, time, and cognitive overhead that might otherwise be spent doing other actions (Yan et al., 2004, Yan et al., 2000).

In fact, Roger is very busy at work and is motivated by a desire to complete his work and a belief that *right now* fulfilling this responsibility is more important than changing his password. "I am very busy and do not have time to change my password," Roger thinks to himself. Just then, he may recall a conversation he had with Tina, his manager. "We must be more proactive about reducing security risks to the IT systems," she said. "Imagine how upset our customers would be if their personal data were compromised." Tina has expressed her value belief that reducing IT risk is a desirable goal for the organization.

Values are desires about how the world should be, which also have a strong emotional element to them (McNaughton, 1988). Tina judges that protecting customer information is more than just her desire, it is good and right. She has a strong emotional feeling that protecting customer information is superior to being careless about storing it on the IT systems. Now Roger, who is busy working on some pressing task, either does not have such strong feelings about protecting customer information, or has not extensively contemplated the consequences of unauthorized access to IT. This could change, however. For example, if he were to suddenly remember his

conversation with Tina. As he cognitively reflects on her words, her conviction makes him pause to deliberate his actions. Roger then decides to change his password.

Although it seems obvious that reason played a role in motivating Roger's action, the HTM advocate may disagree. It was a different desire that overcame him and caused his action, the Humean may argue. What desires? Perhaps, he wished to be a good employee and satisfy Tina's concern, or he may have wanted to avoid being the source of an IT security breach. Because good people desire to perform good actions, then if Roger believes one action is superior to another, this provides desire to motivate action. Many IT governance best practices are non-intuitive (e.g., using non-dictionary words for passwords), so the HTM belief-desire theory may be the best explanation to motivate action in many cases.

However, attributing Roger's actions to a new desire feels unsatisfactory. We prefer to believe that organizations have values and expectations for conduct expressed in norms that serve to guide behaviour (Beauchamp, 2010). A cognitive effort to justify actions in light of an abstract IT governance concept seems a more plausible explanation for normative behaviour (Smith, 1987). For example, Roger may have decided to change his password because he deduced the action was an effective means to reduce IT risk or to protect customer information. Either conclusion should be sufficient to demonstrate that reason can motivate action (Korsgaard, 1986, Garrard and McNaughton, 1998).

Roger was already aware that he had a weak password that could expose the IT system to risk. As a result of Tina's expression of values, Roger's attitude changed about the need to update his password. Attitudes imply caring about something, which is more than just believing they are good to do (McNaughton, 1988). This change in attitude towards reducing IT risk is an example of how IT effectiveness efforts can improve IT quality through the indirect path of influencing individual subscription to those patterns of behaviour.

Clearly, not all normative reasons produce action. For example, Susan's password is her cat's name. Susan loves her cat and secretly typing the cat's name into her computer gives her an inexplicably pleasant feeling. Susan was also present when Tina expressed the need to reduce IT risk, and like Roger, she understands why changing her password is prudent, necessary, and expected, but she does not. Instead of adopting the norm as a behavioural requirement, Susan remains sceptical about the role her actions play in reducing IT security risks, and she has chosen to override the norm (Garrard and McNaughton, 1998, McNaughton, 1988).

Some reasons are understood as being rational to accomplish a goal and may cause action, but others do not (Smith, 1987). Although Susan has not yet changed her password to reduce IT risk,

the organizational norms can still influence her attitude. Eventually, someone may decide that instead of asking everyone to voluntarily change their password, the IT system should enforce a stronger password security policy. This change is implemented, and the next time Susan logs in, the system requires that she choose a new, complex password.

A shared culture of IT effectiveness efforts is one in which the beliefs, values, and attitudes are consistent with the spirit of the IT governance framework practices. If the organization has a strong culture of IT governance norms, then it is very likely Susan will happily comply with this requirement to change her password. This is an example of how IT effectiveness efforts can improve IT quality through the direct. She was aware it was a normative requirement, but chose to disregard it before. Now, when confronted, she is willing to participate. Even though she lacks motivation (or justification), she recognizes that changing her password is the right action in light of her desire to continue working with the IT system.

Alternatively, if the organization has a weak culture of IT effectiveness norms, then Susan (and others) are likely to be upset and complain about the new password requirements. She may change her password because the system forces her to, but she will not be happy about this, and will likely not support other IT governance activities.

4.2.3 Summarizing the Role of IT Governance to Motivate Normative Actions

To summarize, we have presented a philosophical justification based on the Humean and cognitive theories of motivation to further support our assertion that IT effectiveness efforts can influence IT quality. While the Humean theory helps explain how beliefs and desires motivate actions, the cognitive theory offers a normative justification for these actions. We have theoretically justified the role norms can play in IT effectiveness by arguing they can influence beliefs, values, and attitudes in the organization –which result in actions that improve IT effectiveness.

4.3 Normative Role of IT Governance

We have noted that IT governance frameworks identify controls, measures, and accountability structures to help organizations systematically manage the IT function, reducing risk and increasing positive impact. We observe that the experts who developed these frameworks intentionally advocate a set of underlying normative practices believed to increase IT quality.

In this section we will look at what underlying norms the COBIT framework embodies for IT effectiveness. As a first attempt to distil these IT effectiveness norms we identify the following categories: business and IT alignment, risk/control perspective, systematic measurement,

accountability, and continuous improvement. These norms are supported by the structure of COBIT as described in the rest of this section.

4.3.1 Business and IT Alignment

Aligning the IT function to business processes is a key norm exhibited by the components of COBIT. Appendix I of COBIT lists 17 business goals, linked with 28 IT goals, cross referenced to 34 identified IT processes, and 7 information criteria. For example, the business goal *Manage product and business innovation* is correlated with several IT goals including *Create IT agility* which is in turn associated with several IT processes including *PO2 Define the information architecture*. In addition, 'waterfall' descriptions provided for each of the IT processes describe the 'business requirement for IT' satisfied by the process. The just-mentioned P02 process is said to satisfy "being agile in responding to requirements, to provide reliable and consistent information, and to seamlessly integrate applications into business processes" on page 33 of the COBIT 4.1 manual. As supported in both the structure of COBIT and our review of related literature in section 2.7.1, the systematic presentation of links between business goals and IT processes embodies an implicit norm favouring business and IT alignment.

4.3.2 Risk and Control

The risk/control focus of COBIT makes it especially useful for offering greater assurances of reliability to organizations which adopt this approach. The notion of risk includes an idea of probability; that is, things may or may not go wrong. Interestingly for our analysis, a risk can be either a negative event or the chance that a positive event may not occur. Thus both a system failure resulting in lost sales and the inability to enter a new market because IT systems cannot grow or change fast enough are risks. Many COBIT processes and control objectives include the word risk as in *PO9 Assess and manage IT risks* and *AI1.2 Risk analysis report.* The notion of identifying and controlling risks is also fundamentally embedded in the detailed control objectives which describe specific outcomes to be sought or avoided.

4.3.3 Measurement, Accountability and Continuous Improvement

The general notions of IT alignment and risk assessment are further developed in COBIT's structure in three systematically applied governance practices: measurement, accountability, and continuous improvement. The need to measure process efficiency and effectiveness is supported by many general management practices cited in IT governance materials and specifically implemented in a set of goals and metrics presented for each IT process. Identifying appropriate levels of involvement for people in the organization is specified for each detailed control objective in a RACI (Responsible Accountable Consulted Informed) chart. The cycle of continuous improvement advocated by COBIT is implemented in part through maturity models. Level 5

'optimized' processes are characterized by continuous improvement mechanisms that consider appropriate measures and best practices from other organizations. The continuous improvement approach is also fundamental in the organizational paradigm of the four COBIT domains. The IT function delivers value by planning and organizing, by acquiring and implementing, then by delivering and supporting, and finally by monitoring and evaluating.

4.3.4 Applying COBIT Norms to Evaluate IT Solution Quality

The implicit perspectives distilled from the composition of COBIT can be viewed as general approaches organizations are encouraged to take if they want to establish effective and efficient IT processes that achieve organizational goals and comply with applicable regulatory environments. We have restated these perspectives as norms in Table 7. Just as COBIT applies these concepts abstractly to a vetted set of IT processes, we assert that these norms can be used to support useful analysis of IT practices and solutions.

Table 7. Norms for Evaluating IT Solution Quality
Business and IT Alignment Norms:
Good practices recognize business goals.
Good practices consider organizational context. (Context includes both organizational characteristics and environmental conditions.)
Good practices include cost/benefit analysis.
Good practices explicitly connect solution components to business goals or values.
Risk Assessment Norms:
Good practices identify risks. (A risk is a negative event and may include missed opportunities.)
Better practices go beyond specific observed risks to consider more general classes of risk.
Good risk management includes estimating risk (likelihood and/or cost).
General Governance Practice Norms:
Good practices include controls that address risks and opportunities.
Good practices include measures to assess effectiveness.
Good practices include review mechanisms for continuing improvement.
Good practices establish accountability.
IT Governance Practice Norms:
Good practices address IT processes (the mechanisms an organization uses to plan, acquire, deliver, and monitor IT).
Good IT governance specifically applies governance practices to IT processes.

While these norms were distilled specifically from the structure of COBIT, a relatively similar list could be extracted from other governance frameworks as well. These ideals represent to some degree community-wide notions and can be used as a base for analysing the quality of IT solutions.

4.4 IT Proposal Study: Does Exposure to COBIT Increase Solution Quality?

We have already noted in section 2.7.4 the well-accepted connection between IT governance framework adoption and IT quality. The norms developed in the previous section may capture part of the improvement mechanism responsible for driving IT quality. If so, we anticipate that users of an IT governance framework would be more likely than others to apply the principles implicitly expressed in those norms.

We anticipate that exposure to COBIT will encourage individuals to take a systematic, governance-like approach when presented with an IT issue. This principal is captured in the following hypothesis:

Hypothesis 4: the use of an IT governance framework, e.g., COBIT, in IT problem solving leads to the presence of good IT governance norms in the proposed solution.

If using the COBIT framework increases the application of these norms, this view of the COBIT/IT quality mechanism would partly validate our first research question and help further direct our efforts to develop an alternative IT effectiveness predictive model of IT quality.

4.4.1 Study Methodology

To test our hypothesis we evaluated solution proposals created by undergraduate business students for indications of an understanding of these governance principles. Our study was conducted with 115 business students at Oregon State University—all non-IS majors—enrolled in an introductory Business Information Systems course. During the term they were exposed to IT governance using COBIT as part of a curriculum that covered a broad range of business and IT concepts. Students took a midterm exam containing 10 questions on COBIT. Performance on these questions was considered a measure of COBIT knowledge. The sum of each student's exam scores was included in the study as a proxy for overall academic ability.

4.4.2 Theoretical Model

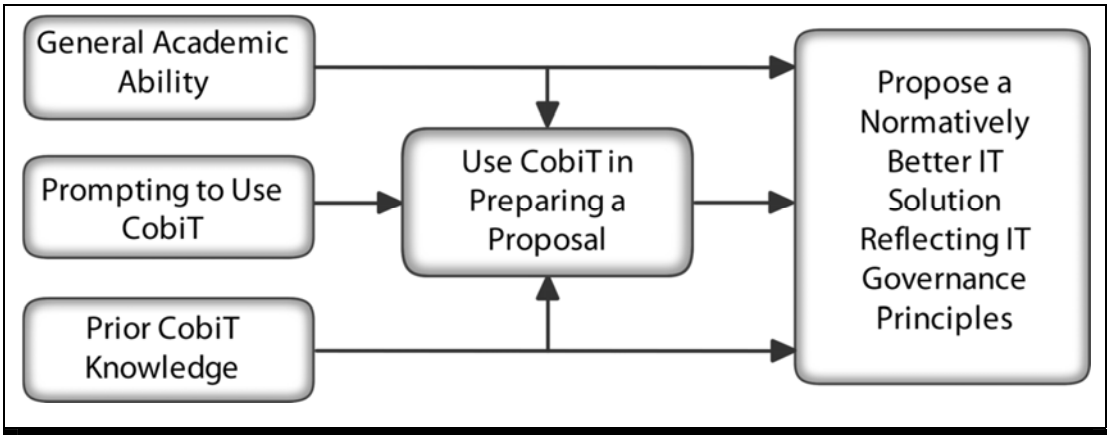


Figure 10. Experimental Design

Figure 10 depicts the projection of a general theoretical model for our hypothesis into the context of business students, including likely intermediary variables associated with the sample of participating in this study.

- *Hypothesis 4.1:* Students with higher academic ability and more prior knowledge of COBIT would be more likely both to employ COBIT in creating IT solution proposals and to produce solutions that reflected governance norms.
- *Hypothesis 4.2:* Higher academic ability would lead to COBIT use because integration of course materials would be a generally effective strategy for students who are more academically proficient.

In addition, we prompted a randomly selected subset of the participants to use COBIT. This treatment was intended to ensure that a good portion of the sample would indeed employ the IT governance framework.

- *Hypothesis 4.3:* Students who chose to use COBIT would be expected to propose solutions more closely in line with the identified norms as compared to students with comparable prior COBIT knowledge or equivalent academic ability.

If these relationships (particularly the one between using COBIT and normatively better solutions) were to be observed in the experiment, the link between the use of IT governance frameworks and application of IT governance norms proposed in hypothesis 4.1 would be supported.

4.4.3 Study Procedure

Near the end of the term, each student was presented with the instructions shown in Figure 11 and given about two hours to prepare a response. The instructions were identical for each participant except at the bottom. A randomly assigned half of the participants received the phrase "such as COBIT 4.1" while the other half, our control group, did not. Students knew the exercise did not count toward their grade, but were informed that it would help them prepare for the final exam to encourage participation. Some responses were completed in less than thirty minutes, but most took over an hour. Solution length varied from one page of text to five pages complete with diagrams and tables.

Larry's Lids is a hat retailer with both an online store and a store front in a shopping mall. One of the file servers for the online store failed one Saturday evening at 6:13pm – its power supply went out. That caused part of the web store to fail. Customers were able to look at hats, and fill out order forms, but pressing the "add it to my shopping cart" button resulted in an error message page. The problem was noticed at 9:17am on Monday morning. The outage resulted in lost sales and angry customers who might never come back.

You were brought in on Wednesday as an analyst for the company to work out an organizational response so this would not happen again in the future. Describe the actions and plans you might recommend in light of this event. Consider using material from the course, such as COBIT 4.1, when you develop your plan.

Figure 11. Practical Application Exercise Instructions

The assignment was intended to provide a context in which students could, if they chose, address the IT processes by which the organization delivered IT services or they could instead choose a less IT-governance-like solution focused on remedies to the immediate problem. The list of norms presented above was not directly presented in the course although the notions they embody were woven into various projects, presentations, and assignments as students were encouraged to conduct cost benefit analysis, assess risk, consider the fit between solutions and the organization, and identify the actors who would carry out a task. All students had also been exposed to a lecture and an exercise specifically employing COBIT in conjunction with an IT issue in a fictitious organization. Thus, all students included in the experiment should have had a working knowledge of the structure of COBIT and of IT governance principles.

4.4.4 Solution Assessment Methodology

To score the essays for the presence of governance norms, the tag list shown in Table 8 was developed from the norms listed in the previous section. Various combinations of these tags and their counts would later be used as proxies of the dependent variable; i.e., the presence of governance norms.

The first four tags, all related to governance, have both an ITP and non-ITP variant. If a response alluded to an IT process for multiple applications or systems, an ITP prefix was applied. When the proposed CTRL, WHO, IMP, or MEAS was business process-oriented or focused on a single application, it did not receive the ITP designation. For example, a reference to a strategic IT plan would be tagged as an ITPCTRL since creating a strategic IT plan would clearly endorse implementation of a generalized IT process, whereas a policy calling for coupons to be issued to customers who are thought to have been knocked off the system is a CTRL because it is not clear that the student was proposing a general IT control as opposed to a specific application control or remedy. Of course, in either case, a risk/control perspective was considered, applied, and recorded.

Table 8. Tags: Indicator Codes and Descriptions

CODE	This tagged phrase or passage:
Indications of governance practices specifically linked to IT processes are distinguished by the ITP prefix: Thus, CTRL is a control and ITPCTRL is an IT-process-specific control.	
ITPCTRL / CTRL	Proposes a control mechanism (detective, preventive, or corrective) policy, procedure, or system. Controls are proactive and intentional as compared to remedies which have a more immediate operational and corrective flavor.
ITPMEAS / MEAS	Identifies a metric of the function or effectiveness of a control or process.
ITPWHO / WHO	Specifies who should be responsible.
ITPIMP / IMP	Refers to a process by which solution components are reviewed and updated for continuous improvement.
Indications of **Business and IT Alignment** and a **Risk Perspective**	
BUSGOAL_VAL	Specifically states a connection between organizational goals and solution components.
BUSCB	Identifies a tradeoff between costs and benefits or specifically proposes cost benefit analysis.
RISKPROB	Refers to likelihood of a negative event's occurrence.

BUSCTXT_ID	Identifies a contextual factor (characteristic of the organization of environmental condition) that relates to the form or appropriateness of a mentioned risk or solution.
BUSEFF	Identifies a positive or negative business outcome.
Problem **Remediation** Indicator	
REM	Identifies a remedy for a specific business/IT problem that does not fall into previous categories.
COBIT Citation	
COBIT	Mentions COBIT
COBITPRC	Mentions a COBIT process identifier (e.g., PO1) or Domain (e.g., Acquire and Implement)

The next class of tags provides further evidence of quality criteria embodied in our norms. While COBIT embodies these concepts and we expect retention of COBIT to increase the likelihood that these tags are present, we also gave participants credit for embedding qualitative characteristics in their responses without COBIT. As described above, good responses are expected to recognize abstract concepts such as the ability of IT solutions to affect business goals, the need to balance potential benefits with expected costs, and the presence of risk in all projects which must be managed. Finally, good responses should take the characteristics of the business into consideration and be tailored to the organizational needs.

Narrow solutions that were not matched with a more generalized risk are identified using a REM (remedy) tag. We would expect that good solutions would also have specific remedies, but a response which focused narrowly on some immediate remedy without the other qualitative characteristics would be considered inferior.

Finally, we employed two COBIT-specific tags for explicit references to COBIT or any of COBIT's 34 IT processes. The use of COBIT tags is not necessarily evidence of quality. However, since the independent variables in our experiment involved COBIT, we wanted to know if the student specifically mentioned the framework in their response. Naming a COBIT process was not given any other tag. So, merely listing or copying in the name of an IT process was not considered evidence of an intention to apply it to the situation.

Assigning tags to essays required some judgment because individual tags were assigned to specific passages (usually phrases) in the texts. Coders were neither asked to make overall essay quality judgments nor to assess the appropriateness of a proposed remedy. One particularly important

evaluation called upon the coder to differentiate allusions to general IT processes from suggestions for addressing a specific IT application with a control or remedy.

Each essay was reviewed by two different coders. Three coders participated in all, each coding approximately two thirds of the essays. Coding assignments were random and indications of student name, treatment, and academic performance were removed prior to coding. This approach is adapted from previous work by other researchers (for example, see Bergeron et al., 2004, DeLone and McLean, 1992). Coders were quite consistent; less than 5% of the number of any particular kind of tags assigned to an essay by one reviewer varied by more than 2 from the other rater's assignments. Detailed descriptive statistics summarizing the coding are included in Appendix 1.

4.4.5 Results

Table 9 lists a series of linear multiple regression models—one model per row—with 'COBIT' and 'Academic' as the independent variables. Coefficients and explained variance (R squared) are reported for each model with the specific quality of proposed solution proxy indicator being the model dependent variable on each row. Contrary to expectations, the other two independent variables—'Prior' and 'Prompted'—were not statistically significant. We surmise that the non-performance of these variables is the effect of students being biased in favour of using COBIT through their Information Systems course as demonstrated by the 70/45 ratio of those who mentioned COBIT to those who did not.

Table 9. Multiple Regression Models

	(Mentioned) COBIT				Academic (Ability)		R^2
	Coefficient	P-Value			Coefficient	P-Value	
IT Governance Practice Norm Variables							
ITP	3.575	0.000	***		0.044	0.131	.15
- ITPWHO	0.794	0.020	**		0.003	0.793	.05
- ITPMEAS	0.790	0.004	***		0.020	0.032	.11
- ITPIMP	0.285	0.044	**		0.005	0.260	.05
- UniqueITP	0.464	0.012	**		0.011	0.087	.08
Governance Practice Norm Variables							
ALLGOV	2.869	0.002	***		0.052	0.104	.10
- ALLWHO	0.290	0.463			0.010	0.464	.01
- ALLMEAS	0.790	0.025	**		0.015	0.201	.06
- ALLIMP	0.263	0.069	*		0.006	0.243	.04
- UniqueGOV	0.217	0.154			0.002	0.683	.04
Risk Assessment Variable							
RISKCTRL	1.824	0.002	***		0.031	0.107	.11

Business and IT Alignment Norms							
BUSGOAL_VAL	0.290	0.299			-0.012	0.196	.02
BUSEFF	-0.120	0.574			0.007	0.574	.01
BUSCTXT_ID	0.003	0.984			0.004	0.984	.00
BUSCB	0.087	0.647			0.007	0.296	.01
AlignmentTags	0.260	0.621			0.005	0.798	.01
CTRL+Align	1.786	0.026	**		0.025	0.351	.05
*** = significant at 1%, ** = significant at 5%, * = significant at 10%							

4.4.6 Discussion

The regression results of Table 9 indicate that our most important (and most positive) results relate to indications of governance practices: control, assignment of accountability, systematic measurement, and continuous improvement. The ITP variable represents the overall frequency of IT process-related ideas in the essay. The UniqueITP construct measures completeness; i.e., high-valued answers specified all four ITP governance practices. These results were all significant at the p=.05 level, suggesting that students who used COBIT were more likely to think about IT processes and apply governance practices to them. If the results were significant only for (ITP) we might have wondered whether students actually understood anything about the IT processes they identified. However, a statistically significant effect exists for the component items ITPWHO, ITPMEAS, and ITPIMP. Thus students were more likely to identify details of how the IT practices were to be implemented and monitored.

COBIT users also tended to apply governance practices even when they did not clearly associate them with an IT process. Indeed, some difficult judgments were required in differentiating a control from an ITP control. For example, students who stated that a web server should have a battery backup power supply to avoid shutting down in case of a power outage specified a somewhat general risk and a protective practice for mitigation. Depending on how it was phrased, a reviewer might conclude that the student was proposing a general control for key IT systems based on a risk identification process—an ITP control—or an application level control to be applied to one web server—a non-ITP control in our methodology. This kind of variation in judgment accounts for a fair portion of the inter-rater differences. Fortunately we also saw significant results for the governance practice measures ALLGOV, ALLMEAS, and ALLIMP. The significance of the RISKCTRL variable, also an indicator of a general understanding of governance through risk assessment, reinforces the general conclusion that participants who used COBIT were more likely to advocate systematic governance practices.

While positive in some ways, our results did not uniformly align with our initial expectations. Our original notion that prompting students to use COBIT and/or prior COBIT knowledge would show measurable effect did not hold. Since the data show no association between these variables and the appearance of direct references to COBIT, it appears that many of the students remembered and used it without prompting.

There was also no evidence that using COBIT encouraged students to identify specific business concerns or characteristics that should be considered. The results could be interpreted as suggesting that students were just as likely to address alignment concerns with or without COBIT. What remains, however, is the important result that COBIT-based solutions have significantly higher quality as expressed in the presence of governance norms.

4.5 Conclusion

This chapter began by offering a philosophical justification based on the Humean and cognitive theories of motivation that IT governance frameworks could influence normative IT effectiveness efforts in organizations. Next, we reviewed the COBIT framework to identify a set of norms which were expressed within its structure. Finally, we presented an IT proposal study which explored the idea that using an IT governance framework like COBIT, improves the quality of proposed IT solutions by encouraging decision makers to apply governance norms. We theorized that an IT governance framework would help the decision maker think about IT problems from an IT effectiveness perspective. Our results showed that students who used COBIT were more likely to:

- Create complete, governance-based, risk aware IT solutions.
- Address IT processes as opposed to merely a fix for the current problem.
- Employ governance norms even when it is not clear that they had an IT process in mind.
- Identify ways to measure success and allude to a need for continuous improvement.

Our results also help by identifying a preliminary set of IT effectiveness effort constructs which are derived from COBIT and statistically verified as being influential indicators of IT quality. We briefly summarize those constructs which showed the most promise here:

1. Aligning the IT function to business goals.
2. Identifying IT risks and developing offsetting controls.
3. Systematically measure and continuously improve IT processes.

4. Accountability for the IT functions.

Finally, we have also taken initial steps to satisfy the research questions we set out for ourselves in this thesis and we review now.

- Our first research question asked if a set of IT effectiveness efforts and norms could be operated and assessed using IT governance frameworks such as COBIT. We have taken a first attempt to distil a set of constructs which we then operated using tags to code written solutions. Although we did find support in our study that these constructs could be operated and measured, we also recognize that developing a reliable survey instrument will require further work.

- Our second research question asked if IT effectiveness norms motivate actions consistent with these frameworks. We presented a philosophical justification that good IT effectiveness efforts can motivate COBIT-like actions even without exposure to IT governance frameworks. We have also presented initial empirical support that exposure to COBIT did encourage decision makers to adopt 'better' IT effectiveness norms. However, further studies are necessary to develop more convincing evidence.

- Our third research question asked if norm adoption and/or increased norm actions result in better IT quality. We presented a philosophical justification for answering this question, and also offered a proxy for better IT quality by extrapolating the design of our study with the students into the context of a business where we would expect them to propose better quality IT solutions. However additional support from within the organizational context is necessary to answer this question.

- Our fourth research questions asked if some organizations would find IT effectiveness adoption more suitable than IT governance frameworks. We have some evidence that business students found it easier to apply the normative spirit of IT effectiveness than an IT governance framework. In our study, we allowed students to reference the COBIT 4.1 material, and while many did, most preferred to apply the normative themes covered in the course rather than delving into the reference manual –even when they were prompted to do so.

Chapter 5 A Predictive Model of IT Effectiveness Efforts Influence on IT Quality

5.1 Introduction

We have presented some support that IT effectiveness is a driver of IT quality from 1) the research literature; 2) the philosophy of normative motivation; 3) an analysis of COBIT; and, 4) a study of IT proposals. In this chapter we present four studies to offer empirical evidence that a norms-based approach to IT effectiveness can influence IT quality. We briefly preview each of these studies:

1. Study one conducted in the Natural Areas Association (NAA) with 68 respondents is a first attempt to operationalize our constructs into a set of survey items. We evaluate them against our model across both small and large organizations. The results offer significant evidence of a direct path between IT effectiveness efforts and IT quality. While the study offers encouraging support for the proposed research framework, it also identifies a need to improve one of our IT effectiveness efforts –the business and IT alignment construct.

2. Study two conducted with the Austin Family Business Program (AFBP) is a mixed method study: 120 survey responses with 10 semi-structured interviews conducted in the SME context with small family businesses. This study provides statistically significant evidence of both direct and indirect pathways for IT effectiveness efforts to improve IT quality. The interviews offer further confirmation that survey items correctly assess expected constructs, and provide additional insights for refinements to the business and IT alignment construct.

3. Study three conducted with a large European pharmaceutical company (PHARMA) is a confirmation of IT effectiveness efforts' ability to predict IT quality (H1) within a single organization. We analyse 46 survey responses from employees in a European pharmaceutical company to identify actionable recommendations for improving IT quality. The study also offers encouraging support for refinements made to the business and IT alignment construct.

4. Study four conducted with students in business information systems (BIS) courses presents a refined model with additional items introduced for each construct. We analyse 65 survey responses and develop a second order predictive model able to explain nearly 30% of the observed variance and offer confirmatory statistically evidence for both the direct and indirect pathways of IT effectiveness efforts to improve assessments of IT.

5.2 NAA Study

This study explores the relationship between IT effectiveness norms and IT quality, developing and testing survey items to assess norm adoption. A PLS analysis shows a statistically significant direct path between IT effectiveness efforts and IT quality, and a significant link between IT effectiveness efforts and IT effectiveness subscription.

5.2.1 Introduction

We present the results of 68 survey responses from the Natural Areas Association (NAA) using our initial survey items and explain how they were operationalized. We describe the sample and our methodology for administering the survey, and then present PLS analysis results.

5.2.2 Instrument Development

We developed a set of survey items to assess IT effectiveness efforts, IT effectiveness subscription, and IT quality.

The items were cast in the form of 7-point, strongly agree to strongly disagree Likert-like scale with an additional 'not sure' option. We conducted one pilot test which resulted in the removal and adaption of several items.

5.2.2.1 IT Effectiveness Efforts Construct

After a review of COBIT, we distilled a set of generic IT effectiveness efforts previously described in section 4.3, which are summarized in Table 10.

Table 10 A Set of Effectiveness Efforts Found in COBIT

Effort	Support Found
Business and IT alignment	Appendix I lists 17 business goals, linked with 28 IT goals IT control processes describe the 'business requirement for IT' it satisfies
Identify risks	A principal goal of COBIT is to *reduce IT risk.* *Risk* focus is the foundational justification for every IT process description.
Establish offsetting controls	COBIT is divided into 34 IT processes, each made up of *control objectives.* Control objectives are designed to minimize risk.
Measure performance	Each IT process includes a set of *goals and metrics.* *Control objectives* encourage systematic process measurement.
Continuous improvement	*Control objectives* also encourage process review and improvement. COBIT is structured with a *Plan-Execute-Monitor* cycle.
Accountability	Identifying involvement for people is specified for each detailed control objective in a RACI (Responsible Accountable Consulted Informed) chart

To help make our assessment more reliable, we paired related constructs. 'Identify risks' was combined with 'establish offsetting controls' into one construct: risk/control (items prefixed with RC) because we found it difficult to formulate an item which focused on one constructs without also suggesting the other. Likewise, 'measure performance' was also combined with 'continuous improvement' into one construct measure/improve (items prefixed with IMP). The 'business alignment' items are prefixed with ALIGN. Finally, in our analysis of student proposals for IT solutions we noted difficulty in discerning 'accountability' as a separately identifiable construct. We speculate that distinguishing *who* from *what* is difficult to formulate in items and therefore included 'accountability' within other constructs.

Table 11 Items to Assess IT Effectiveness Efforts

Effort	Item
Risk/Control	
RC_1	Our IT systems and practices help us avoid making mistakes and/or prevent operational problems.
RC_2	We take action to try to avoid future IT-related problems.
RC_3	IT operations are organized to support the timing of key events on our organization's business calendar.
Measure/Improve	
IMP_1	Our organization records specific events or activities to assess whether or not our IT is doing a good job.
IMP_2	Our organization routinely monitors the effectiveness of our IT systems.
IMP_3	Appropriate people in our organization receive and accept feedback on the effectiveness of our IT.
Business alignment	
ALIGN_1	Our organization has a long-term IT plan.
ALIGN_2	Our IT plans are periodically checked against organizational goals.
ALIGN_3	In our organization, managers with responsibility outside of IT actively participate in IT planning.

5.2.2.2 IT Effectiveness Subscription Construct

Items designed to measure IT effectiveness subscription (SUB) are listed in Table 3. These items are intended to assess whether individuals believe that IT effectiveness norms are superior to alternatives in achieving IT outcomes. All the items use direct references or clearly imply the intention to act consistently with a norm. These items were developed after informal

conversations with several IT professionals who were asked to describe actions users take which suggest they willingly support IT operations. We also reviewed the COBIT process controls to identify characteristics of organizations with optimized IT control processes. We also reviewed the ITIL and ISO/IEC standards for descriptions of organizational practices consistent with the ideals expressed in those frameworks.

Table 12 Items to Assess IT Effectiveness Subscription	
SUB_1	Non-IT people in our organization actively participate in the improvement of our IT systems.
SUB_2	People in our organization gladly comply with efforts to safeguard and improve our IT operations.
SUB_3	People in our organization recognize the need to have and safeguard strong passwords for access to IT systems.
SUB_4	People in our organization understand the need for and are willing to follow policies that restrict the use of computers.

5.2.2.3 IT Quality Construct

Our IT quality variable was assessed using the items listed in Table 13. The IT success items were selected after reviewing previous work in the IT assessment literature. Four of the items (OS_1 – OS_3) were adopted from Jouirou and Kalika's (2004) SME adaptation of Venkatraman's (1989b) organization performance assessment. IT user satisfaction (IS_1 and IS_2) has a long history as a dependent variable in IT evaluation studies (Delone and McLean, 2003, 1992), and our questions are similar to those used by other survey instruments.

Table 13 Items to Assess IT Quality	
Category	**Item**
IT Contributes to Organizational Success	
OS_1	IT has increased our organization's capacity for innovation.
OS_2	IT helps our organization better support the needs of our customers.
OS_3	IT helps our organization manage costs.
OS_4	Our IT has improved productivity in our organization.
Individuals are Satisfied with IT Function	
IS_1	I am satisfied with our organization's IT services.
IS_2	People in our organization are generally satisfied with our IT services.

5.2.2.4 Demographic Items

We developed additional items to determine what level of IT responsibility the respondent had in the organization. We also anticipate many in our sample would indicate that they used IT (IT_2). Finally we anticipated many organizations rely on many IT administrators –those who were not IT professionals but accept responsibility for IT (IT_3).

We also wanted to determine how many respondents were managers, so the MGR item was intended to broadly identify those with management responsibility. Finally, we also wanted to determine the size of the organization, which the SIZE item assesses.

Table 14 Demographic Items

Category	Item
IT_1	I consider myself to be an IT professional.
IT_2	My role requires me to use IT to accomplish organizational goals and objectives.
IT_3	I am responsible for delivering or managing IT services in my organization.
MGR	I am responsible for managing others in my organization.
SIZE	The approximate number of people working in my entire organization is: 1-25, 26-49, 50-100, 100-999, 1000+

5.2.3 Research Framework with Constructs

We now refine our research framework by adding individual constructs to the model as depicted in Figure 12.

5.2.4 Methodology

We invited 800 members of the Natural Areas Association (NAA) to participate in the survey. The NAA advances the preservation of natural diversity and works to identify, protect, manage, and study natural areas across landscapes and ecosystems. The NAA has a diverse membership that includes government and non-profit land and resource managers, conservationists, biologists, ecologists, researchers, land trusts, educators, and students, as well as other individuals involved in the conservation and management of natural areas. The research goal of discovering how to better achieve IT quality would be important to these organizations as they seek to more efficiently accomplish a wide variety of organizational goals. The NAA agreed to send email invitations to our web based the survey, and also sent out three reminders spaced one week apart.

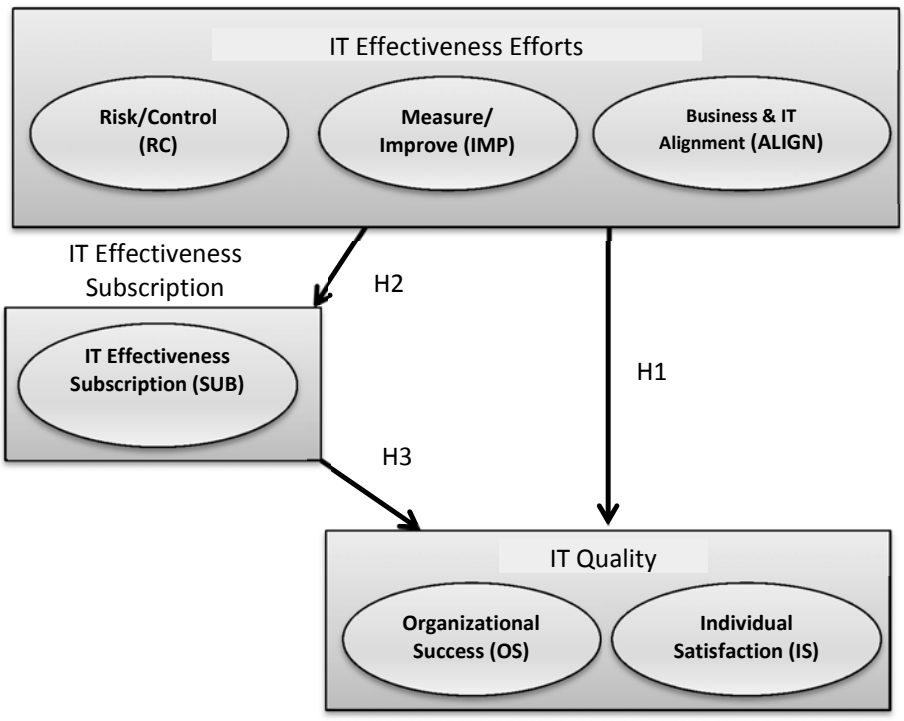


Figure 12. Research framework with constructs added.

5.2.5 Results

We now present the analysis of our results.

5.2.5.1 Data Exploration

Filtering out surveys with few or obviously useless cases (e.g., answering 'neither agree nor disagree' to every question) left us with 86 useable cases. Further refinements included replacing five missing values with neutral (neither agree nor disagree) and identifying cases that appear to be inconsistent with the remainder of the data set. After examining outliers, levers and influence, (Barnett and Lewis, 1994), 18 cases with leverage higher than twice the number of explanatory variables divided by the number of observations (Hodge and Austin, 2004) were removed leaving 68 responses. As discussed in section 3.4.4.1, substantially different cases can bias analysis and skew the results of any regression or PLS analysis. Table 15 presents descriptive statistics of the data.

Table 15 Data Descriptives		
Demographic	**Frequency**	
Size <100	28	41%
Size 100-999	17	25%
Size >1000	23	34%
IT admin	7	10%
IT professional	11	16%
Manager	48	70%
End User	17	25%

Table 35, found in Appendix 2 presents the test for normality of all independent items. None of the items are normally distributed; all are positively skewed, with two items (RC_1 and ACT_3) falling outside of the acceptable range 1.0 to -1.0 (Field, 2009); and, three items (RC_1, ACT_4 and ALIGN_2) have positive kurtosis outside of the acceptable range 1.0 to -1.0 (Field, 2009). Figure 13 graphically portrays how three items lack normality. Since the data is not normally distributed, this suggests that methods such as linear regression analysis, which have assumptions of normality, may not be appropriate for analysing the data.

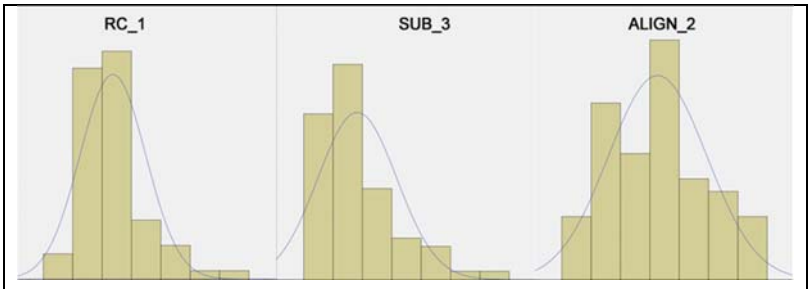


Figure 13 Histograms with normality plots for select items

5.2.5.2 Common Method Bias Analysis

Following the recommendation of Podsakoff et al. (2003), we also checked for common method bias using the approach reported by Venkatesh and Goyal (2010b) in section 3.3.3. Two tests were performed to determine if one common factor accounts for the majority of observed variance. This condition was not true. Next, a correlation analysis was used to identify whether the variance came from different theoretically supported factors. This condition was indeed true. Therefore, we conclude that common method bias is not an issue.

5.2.5.3 Analysis with Partial Least Squares

As described in sections 3.3.4 and 3.4.4.2, we elected to use PLS for data analysis because it has the ability to work with non-normally distributed data (Hair et al., 2012a). Additionally, PLS is the appropriate choice for exploratory analysis of data and developing complex predictive models (Chin et al., 2003, Hair et al., 2012a).

5.2.5.3.1 Initial NAA Study PLS Model

We designed the PLS model depicted in Figure 14. The three constructs were modelled as latent variables (LV) built reflectively using their respective construct items as manifest variables (MV). For example, the latent variable risk/control was built by using survey items RC_1, RC_2 and RC_3. The choice for modelling reflectively or formatively is based on whether items are true assessments of a construct or simply indicators (Cenfetelli and Bassellier, 2009). Since our items are indicators, the model is built using a reflective design.

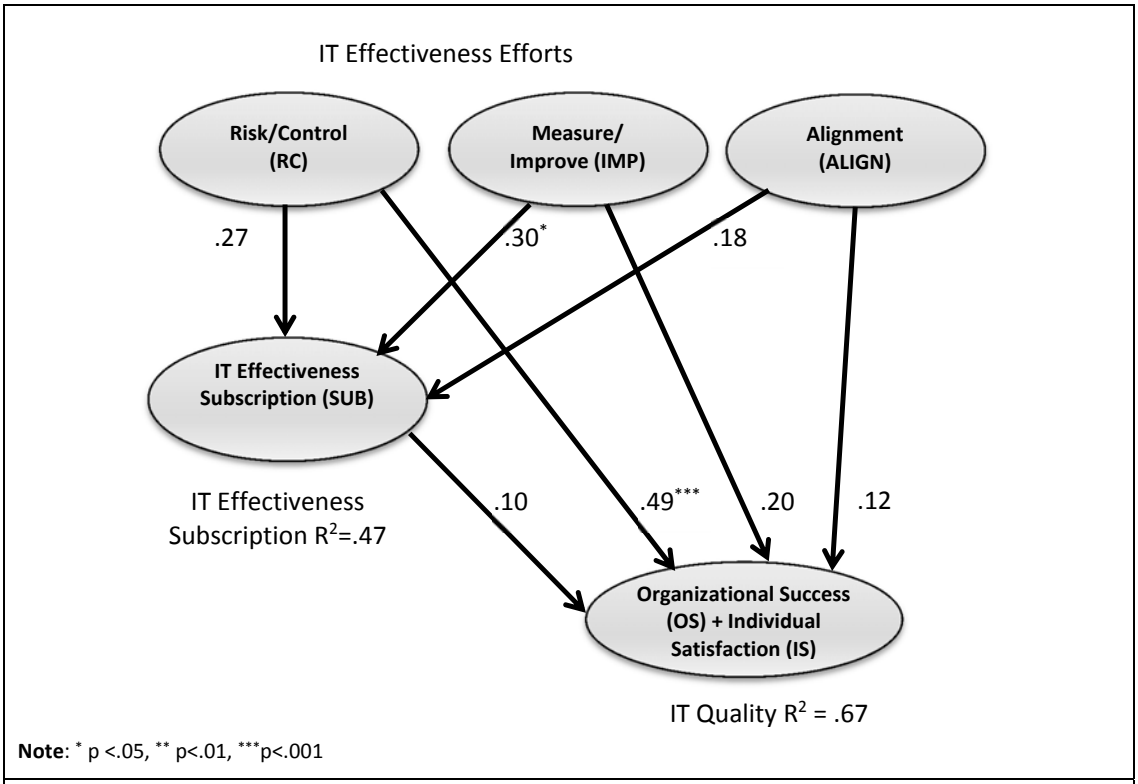


Figure 14. NAA Initial PLS Model Results.

While the overall R squared for IT quality represents a 'large' effect according to Cohen's (1988) guidelines, many of the LV regression coefficients are small and non-significant, which implies a poor model. We examined the internal consistency indicators presented in Table 16 for clues to improve our model. A brief explanation of each indicator is provided now:

- AVE is the average communality, which measures the quality of the measurement model. For reflective LVs, the AVE should be greater than .5 (Wetzels et al., 2009, Hair et al., 2012b), which implies that at least 50% of the variance is explained by the modelled LV. All constructs meet this guideline.

- Composite reliability is an internal consistency check similar to AVE and for reflectively modelled LVs should be greater than .6 for exploratory research (or .7 for confirmatory research) (Chin et al., 2003, Hair et al., 2012b). All constructs meet this guideline.

- Cronbach's Alpha is a measure of scale reliability and for reflectively modelled LVs should be greater than or equal to .7 (Field, 2009, Wetzels et al., 2009). All constructs meet this guideline.

Since all of the indicators meet the acceptable guidelines, additional analysis is necessary to determine why regression path weights are so low.

Table 16 NAA PLS Internal Consistency indicators

	AVE	Composite Reliability	R Square	Cronbach's Alpha
ALN	0.61	0.86		0.78
IMP	0.73	0.89		0.81
RC	0.64	0.84		0.73
SUB	0.55	0.83	0.47	0.73
IT Quality	0.66	0.92	0.67	0.89

We analysed the cross loading correlations between MV and LV, which is presented in Table 36 found in Appendix 2. Although we hypothesize three IT effectiveness effort constructs, the ALIGN items did not coalesce consistent with theoretical expectations. While there is some cross loading between the IMP and RC manifest variables, there is considerably more cross loading between ALIGN and other MVs. We confirmed this with principal comportment factor analysis (PCA) of loadings after orthogonal (varimax) rotation for the IT effectiveness effort items and also found ALIGN items cross loaded across components.

Based on this analysis, we concluded that the ALIGN items do not form a separately identifiable LV based on the manifest variables available. Consequently, we remove alignment from further analysis.

5.2.5.3.2 Revised NAA PLS Model

The revised PLS model without alignment is presented in Figure 15. Although there is little change in the R squared values for the model, the regression weights are larger and significant for all but the H3 path between and IT effectiveness subscription and IT quality.

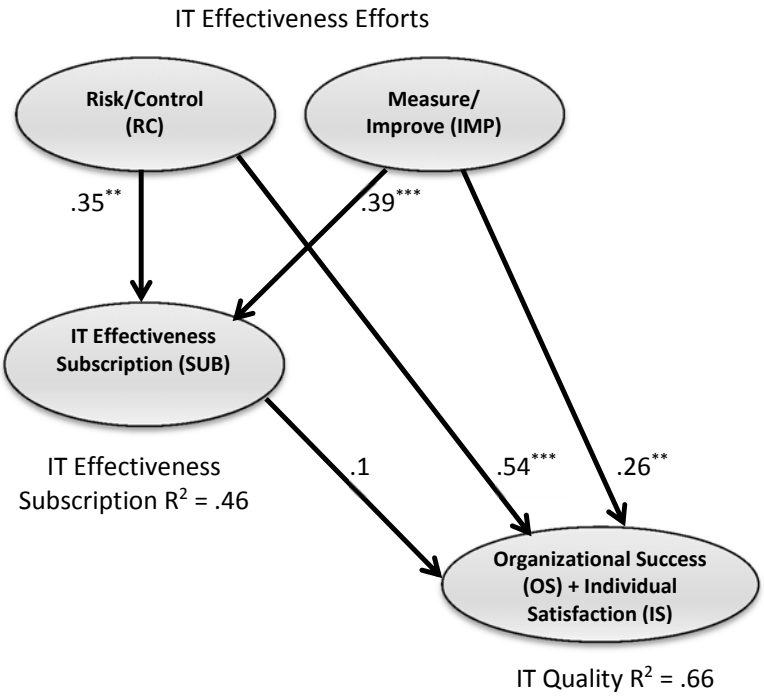


Figure 15. NAA Revised PLS Model Results.

The internal consistency indicators presented in Table 17 are all above the recommended guidelines.

Table 17 NAA Revised PLS Internal Consistency indicators

	AVE	Composite Reliability	R Square	Cronbachs Alpha
IMP	0.73	0.89		0.81
RC	0.64	0.84		0.73
SUB	0.55	0.83	0.46	0.73
IT Quality	0.66	0.83	0.66	0.89

5.2.5.4 Discussion of NAA Results

This study was designed to explore the relationships between adoption of IT effectiveness norms and IT quality. First we sought to identify a promising; i.e., widely-accepted and differentiated, set of IT effectiveness efforts, consistent with the processes advocated by COBIT. We next partially

validated a set of survey items to assess construct levels. Although we theoretically identified three constructs, we experienced difficulties in coalescing the ALIGN items along theoretically expected constructs. Therefore, ALIGN was removed from our analysis. Later we will reanalyse the ALIGN items in view of our theory and determine what steps should be taken to better assess this construct.

However, the two other IT effectiveness efforts: a 'risk and control perspective' and 'commitment to improvement' showed a promising level of coherent consistency, which coalesced largely with our theoretical expectations. Thus, we have some promising initial evidence for the validity of those survey items. This helps address our first research question, which asked whether IT effectiveness norms can be identified and assessed.

Our revised PLS model depicted in Figure 15 addresses research questions two and three by more directly exploring the association between efforts, subscription and IT quality. The model anticipates IT effectiveness efforts to have both a direct (efforts increase quality) and an indirect (efforts increases subscription which increases quality) influence on IT quality. Although our results do not show that subscription increased quality with statistical significance, all other theorized relationships exhibited statistically significant associations.

The model explains 46% of the observed variance in IT effectiveness subscription, a 'large' effect according to Cohen's (1988) guidelines. This result helps address our second research question which asks whether IT effectiveness efforts motivate subscription. The model also explains 66% of the observed variance in IT quality, also a 'large' effect according to Cohen's (1988) guidelines. This result partially addresses our third research question which asked whether IT effectiveness would result in better IT quality.

One interpretation of the insignificant H3 effect is in our sample of NGOs had low levels of IT effectiveness subscription. When we discussed our results with the NAA board, several members commented that they did not believe their actions played any role in influencing IT quality. One board member explained many NAA organizations were a small part of some larger organization (e.g. a state government) and they had little input towards what IT services were available. We might expect low levels of IT effectiveness subscription if NAA respondents believed their actions had little minimal impact on IT quality. Therefore, we might conclude that in order for a norms-based approach to IT quality to succeed, individuals should feel a connection between their actions and organizational IT outcomes.

5.3 AFBP Study

This study further explores the connection between IT effectiveness norms and IT quality in the small business context. Since we have suggested that small businesses may realize the greatest benefit from our work this study is designed to test this contribution.

5.3.1 Introduction

We present the results of 120 survey responses and ten semi-structured interviews from the Oregon State University Austin Family Business Program (AFBP, 2012), beginning with a discussion of survey instrument refinements. We describe the sample and our methodology for administering the survey, then present a PLS analysis which indicates that both the direct and indirect paths for IT effectiveness to influence IT quality are significant. Finally, we present evidence from our interviews that a) confirm our survey instrument; and, b) provide even further insight for refinements to the constructs.

5.3.2 Instrument Refinements

Several refinements were made to your survey instrument. A five five-point, Likert-type scale from “strongly disagree” to “strongly agree” was used instead of the seven-points used in the previous study. Both five and seven point scales are commonly used in IS research and are valid Likert-type scales (Carifo et al., 2008, Carifo et al., 2007). This change was made in a belief that fewer choices might result in less missing responses to items since fewer choices would be less confusing for respondents.

Additional demographic items developed are depicted in Table 18. One question, MGR_2, asked if a respondent was part of the senior leadership, to help identify those with strategic management responsibility. We noted wide variations in small business levels of IT adoption in section 2.6.3, and two CPLX items were added to determine whether a baseline level of IT complexity existed. Our small businesses experience suggests that routine operational use of data stored in an information system other than personal computers is a baseline complexity that may facilitate our study of IT effectiveness.

5.3.3 Survey Administration

Survey participants were primarily small, family businesses chosen from the Austin Family Business Program (AFBP, 2012) contacts list. Approximately 1500 invitations were sent out. About half of the businesses were sent email invitations to a web-based survey. The other half did not have email addresses on record, so paper surveys were mailed to them. Two follow-up reminders were also sent, approximately three weeks apart. Participation in the survey was also encouraged at the AFBP winter conference.

Table 18 Additional Survey Instrument Questions	
Category	**Item**
Management Responsibility	
MGR_2	I am part of the organization's senior leadership.
IT Complexity	
CPLX_1	Approximately 30% or more of people in my organization need routine access to information which we store on a network (e.g. a computer server or website)
CPLX_2	My organization routinely uses information which we store on a network (e.g. a computer server or website)
Organization Size	
SIZE	The approximate number of people working in my entire organization is: 1-9, 10-49, 50-99, 100-249, 250-499, 500+

After nine weeks, 176 responses were obtained. Filtering incomplete and unusable responses left 133 cases. Further refinements included replacing three missing values with neutral (neither agree nor disagree) and identifying outliers and/or cases with excessive levers and influence. Following the methodology reported in section 5.2.5.1, 13 cases which appeared to be inconsistent with the remainder of the data set were removed, leaving 120 usable cases.

5.3.4 Survey Results

The descriptive demographics for the survey are presented in Table 19. They indicate that a large number of respondents were senior leadership, which may be a result of how the survey was administered. Although we asked members of the AFBP to invite other members of their organization to participate in the survey, in most cases the business owner was the individual contacted and also most likely to complete our survey.

36% indicated being IT administrators (non-IT professionals who accept some responsibility for making IT function) and 28% considered themselves to be IT professionals, with 9% non-IT users. 83% indicated their organization met our baseline IT complexity, with 10% having somewhat complex IT (answered affirmatively for one of the two IT complexity questions) and only 7% indicated they did not have complex IT.

Table 19. AFBP Descriptive Results							
Not management	16 (14%)	**Managers**	11 (9%)	**Senior leadership**	91 (76%)		
Non-IT users	11 (9%)	**IT users**	45 (36%)	**IT admins**	30 (25%)	**IT pros**	34 (28%)
Not complex IT	8 (7%)	**Somewhat complex IT**	12 (10%)	**Complex IT**	100 (83%)		
Size 1-9	30 (25%)	**Size 10-49**	39 (36%)	**Size 50-250**	31 (26%)	**Size 250+**	20 (16%)

Following the methodology reported in section 5.2.5.2, tests for common method bias were negative and correlations were thematically consistent between factors. Therefore, we conclude that common method bias is not an issue.

5.3.4.1 PLS Analysis

The PLS model for the AFBP study is presented in Figure 16 shows that both the direct and the indirect paths for IT effectiveness to influence IT quality are statistically significant. The model explains 33% of the observed variance in IT effectiveness subscription, a 'medium' effect according to Cohen's (1988) guidelines. The model also explains 49% of the observed variance in IT quality, a 'large' effect according to Cohen's (1988) guidelines.

We also measured the indirect effect of IT effectiveness efforts and IT effectiveness subscription by comparing the overall R squared of a model with both constructs to ones with each construct removed (Cohen, 1988, Hair et al., 2012b, Chin et al., 2003). The size of IT effectiveness efforts was 51%, while the size of IT effectiveness subscription was 6% –the latter a 'large' effect, while the former is a 'small' effect according to Cohen's (1988) guidelines.

The internal constancy indicators are presented in Table 20, with all measures at or above recommended values. The cross loadings presented in Appendix 3 show all constructs load in a thematically consistent manner as expected. The PLS analysis was also confirmed with principal component and linear regression analyses which generated comparable results.

Table 20 AFBP PLS Internal Consistency indicators				
	AVE	**Composite Reliability**	**R Square**	**Cronbach's Alpha**
IMP	0.7	0.87		0.7
RC	0.65	0.85		0.74
SUB	0.5	0.8	0.33	0.66
IT Quality	0.5	0.85	0.49	0.79

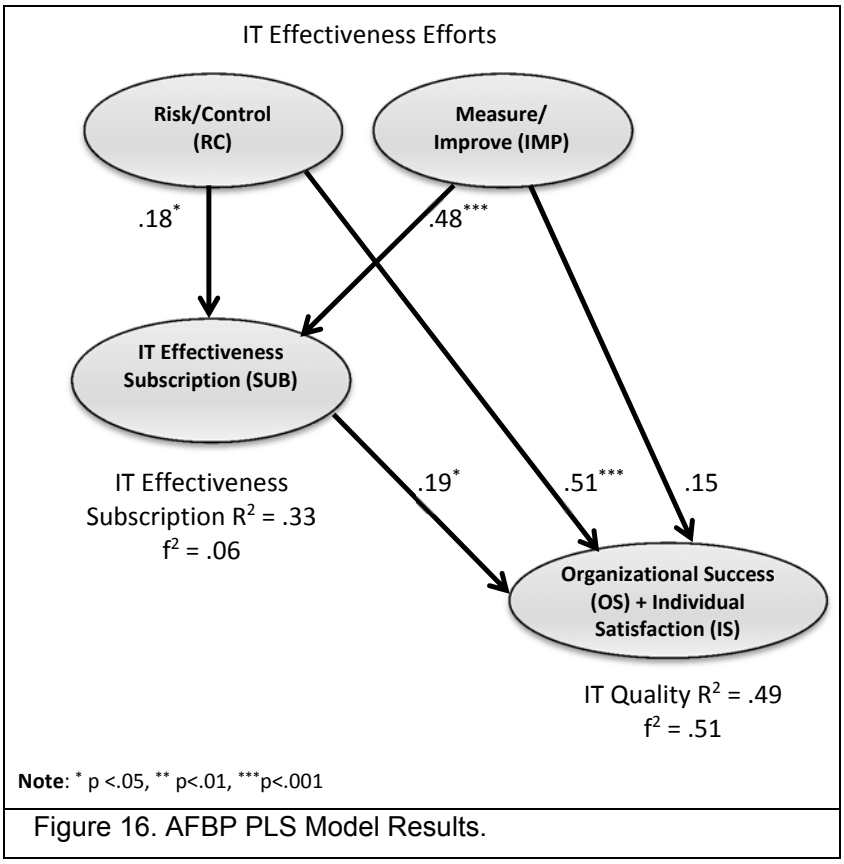


Figure 16. AFBP PLS Model Results.

5.3.4.2 Discussion of Survey Results

While the NAA study suggested most of the IT effectiveness efforts' effect travelled through the direct path, in the AFBP study of small family businesses, we observe a small but significant contribution by IT effectiveness subscription to IT quality. These results offer additional support for our second and third research questions, which asked whether IT effectiveness efforts motivate subscription, and whether subscription can, in turn, influence IT quality.

While most modelled paths were significant, the one exception is the path between measure and improve (IMP) and IT quality. In our sample of small family businesses, it appears that most of the effect for this construct is carried through IT subscription. This suggests that efforts to measure IT performance and improve have a more significant influence on subscription than on IT quality. We might speculate that assessments of IT performance are unlikely to be viewed as improving IT in smaller businesses.

5.3.5 Interviews

We augmented our survey instrument with ten interviews to collect qualitative data for in-depth investigation (Dubé and Paré, 2003) and further theory generation (Walsham, 2006), following the approach reported by (Gable, 1994) and recommended by (Yin, 1994). Approximately 43% of

survey respondents indicated that they were willing to be contacted by the researcher. From the list of candidates, we selected organizations for interviewing participants where the following criteria were met:

1. Close in proximity and convenience to the researchers.
2. Diversity of role: manager, non-manager, and IT administrator.
3. Variation in organizational size and industry.

The first criterion enabled more interviews than might otherwise be possible. The second ensured variety in the IT perspectives gathered, and the third was an effort to glean results representative of the larger SME population.

The interviews lasted 20–40 minutes, depending on time availability and amount of discussion. Questions drawn from the survey instrument were asked in the interviews and recorded with a digital recorder. We developed follow-up prompts for each question to elicit a richer response from participants. A pilot interview generated improvements in the prompts, but no further changes were made to the questions. After each interview, a transcript was made from the audio recording. Copies of the transcripts, field note observations, audio, and any documents collected were electronically archived for reference.

Clear objectives help focus qualitative data collection (Dubé and Paré, 2003, Yin, 1994), and the primary questions we set out to answer with our interview were:

1. Do survey items accurately assess the constructs we expect?
2. How does business and IT alignment impact IT quality?

Answering the first question helps further validate our first three research questions by offering evidence of the survey instrument reliability (Straub, 1989), while providing further explanation of how IT effectiveness norms influence IT quality. Answering the second question is necessary because the NAA study results indicated business and IT alignment items did not effectively assess this construct. Further insight into how business and IT alignment becomes a norm was added by adding a prompt to invite discussion on how organizational strategy and goals are affected by IT.

5.3.5.1 Interview Results

The transcripts of ten semi-structured interviews, reviewed in light of our objectives, are listed in Table 21.

Table 21. Interview excerpts to support survey items	
Construct	**Excerpts intended to offer support for assessing this construct**
Identify risks and establish offsetting controls (RC)	1. "We use software combined with physical inventories so we know we have accurate data." 2. "There are no checks of the video and blogs we post. So there is nothing in place to say 'woops that was wrong'." 3. "This new inventory management system has made the data less accessible to some people. It's more accurate, but also harder for them to find. I am of the opinion we need to make it simpler."
Continuous improvement through on going assessments of performance (IMP)	4. "We track order mistakes and their cost… Having orders standardized has helped reduce mistakes." 5. "We use website sales to measure the effectiveness of our promotional videos" 6. "IT allows us to see the growth levels and where we needed to focus." 7. "We constantly compare what the database reports versus what the staff who work in that area have to say"
Wilfully subscribe to IT effectiveness initiatives (SUB)	8. "I was directed to make the website easier to use. Now every time I making a change I ask myself will it make things better for the sales staff or for the customer?" 9. "The owner has expressly asked us to not use IT for personal use as much as possible, and there is strong culture here to follow that" 10. "Our employees love working here and genuinely want to do what we ask them to do"
Individual satisfaction (IS)	11. "I know we are doing a lot of good things with our IT, but I would like to see more" 12. "It gives me timely information at my fingertips"

	13. "It took 30 steps to process an order [before], but now it's down to a fraction of that."
Organizational success (OS)	14. "You have to have accurate data in order to make business decisions, and IT lets us manage cash flow carefully right now while we are expanding our operations." 15. "Lowering inventory was another improvement resulting from changes in our website" 16. "Our IT has given us a fivefold increase in productivity"
Aligning business goals and strategy with IT capabilities (ALIGN)	17. "The technology enabled us to realign who does what." 18. "IT has allowed new directions in the company goals like making training videos of the products we sell" 19. "Our POS tells us what time of day is most profitable and what items were sold so we can staff and merchandise better to handle the expected business"

5.3.5.2 Discussion of Interviews

A number of respondent comments helped to validate our survey instrument while also providing additional thematic insight. For example, items used to assess our first IT effectiveness effort construct were focused on assessing evidence of a norm to identify risks and adopt offsetting controls (RC). Cases 1, 2 and 3 each identify risks associated with data inaccuracy, though only case 1 described an offsetting control (physical inventories).

Items used to assess our second IT effectiveness effort construct assessed evidence of a norm to emphasize continuous improvement by setting goals, measuring progress and improving processes (IMP). Cases 4 through 7 offer clear examples where respondents easily identified examples of reviewing data for the purpose of improvement. As we noted, the PLS analysis showed IMP did not have a strong effect on IT quality, and we also found support for this in our interviews; while all four cases identified IMP as a norm, only one of those four had a strong positive assessment of overall IT quality.

Our IT effectiveness subscription (SUB) items were intended to assess an intellectual commitment to behave in a manner consistent with IT effectiveness efforts. Cases 8 through 10 provide examples where respondents described norms (e.g. "[a] strong culture" and "our employees…

want to do what we ask") for taking actions consistent with the spirit of IT effectiveness efforts. In addition to validating our items, these cases offer further support for our claim that norms contribute to IT quality by influencing individual actions, even outside of the IT function. While we have presented a philosophical justification and limited statistical support for this effect, we are further encouraged by the additional qualitative support.

Finally, cases 11 through 16 present evidence that items were able to assess the two IT quality constructs: individual satisfaction (IS) and organizational success (OS). As predicted by the DeLone and McLean success model (2003, 1992), better system and information quality impacts individual satisfaction, and cases 11 through 13 provide examples of this relationship. It is interesting to note that the opposite is also true as in case 11, where the respondent was not satisfied. Our items intended to assess success in the small business context also provided clear examples of how respondents were able to connect the IT contribution to organizational outcomes.

We also found evidence of consistency between our interview findings and the demographic survey items. The one notable exception was a respondent whose survey response indicated self-identification as an IT professional, but the researcher found her answer on the survey was not accurate because she did not fully understand the question.

5.3.5.3 Interview Insights for Business and IT Alignment Assessment

The second goal of our interviews was to develop additional theoretical insight to refine our items for assessing alignment. We have described in section 2.7.1 that alignment is challenging to assess in organizations which do not perform strategic planning, such as small businesses. In light of difficulties assessing alignment we encountered during the NAA study (described in section 5.2.5.4); we reviewed our transcripts for insights to better assess alignment as a normative IT effectiveness effort.

Cases 17 through 19 present evidence of alignment organized from general (case 17) to specific (cases 18 and 19). Case 17 is notable because the word "realign" is used, which suggests on-going efforts to align goals with IT capability. Case 18 is more explicit indicating that IT has opened up "new directions" not previously possible which can now be exploited. Case 19 is the most specific description of how IT impacted staffing and merchandising strategy.

Of the alignment items used (see Table 11) in the NAA study, it appears that ALIGN_1 and ALIGN_2 assess whether strategic planning was formally conducted. However, after reviewing the aforementioned excerpts, what we observe (at least in the small family business context), is a more opportunistic capitalization on strategic capabilities after they become apparent, but not necessarily the result of a strategic plan. For example, case 17 describes how "technology

enabled," and case 18 notes that IT "allowed new direction in company goals." These observations are theoretically consistent with the SME literature reviewed in section 2.6.3, which describes how IT adoption allows smaller organizations to be flexible and innovative in exploiting new strategic directions.

In critiquing our business and IT alignment survey items, originally informed by COBIT and the strategic alignment literature, we conclude that whether the organization has achieved a level of business and IT alignment maybe less important than whether there is a process for recognizing the contribution of IT and aligning these capabilities with strategic interests. Burn's (1997) description of cyclical alignment, which we reviewed in section 2.7.1.3, of IT alternating between leading and lagging business strategy (and vice versa), continually balanced by management seems to better fit with our interview excerpts, than COBIT's focus on levels of optimization.

5.3.6 Discussion of AFBP Study

The goal of this study was to further explore the relationship between IT effectiveness norms and IT quality within the context of small businesses. Our study presents survey results which offer limited evidence of both the direct and indirect path between IT effectiveness norms and IT quality as hypothesized.

While these results are encouraging, we note that they also suggest additional theoretical refinements could benefit the IT effectiveness subscription items which had internal consistency factor scores at the margin of acceptable levels. Additionally, the direct modelled path between the IT effectiveness effort measure and improve (IMP) and IT quality was not statistically significant, which may indicate that these items, like the business and IT alignment items, do not effectively assess the construct.

Still, despite these relatively minor issues, what remains is confirmatory evidence of a model that aligns with our theoretical expectations and is capable of explaining nearly 50% of observed variance between the interaction of IT effectiveness efforts, subscription and IT quality in small family businesses. We also presented qualitative data to confirm that our items were assessing the theoretical constructs and to also provide additional theoretical insights. One key insight gleaned from this effort was a possible explanation for difficulties we experienced in assessing business and IT alignment. Because two of the three items emphasized strategic planning, they may have been less effective than items which instead focus on the process of aligning business and IT. These are insights we will consider further in the next studies.

5.4 PHARMA Study

Having demonstrated that individual assessments of IT effectiveness norms can predict assessments of IT quality in both the NAA and AFBP studies, the PHARMA study was conducted in a single organization, a large European pharmaceutical manufacture to test the model's predictive ability.

5.4.1 Introduction

Our third and fourth research questions focus on determining whether some organizations might find that a norm-based approach to IT effectiveness results in better IT quality, and if this approach might be an alternative to formal IT governance frameworks. Having developed a predictive model which connects normative actions to better IT quality, the goal of this study is to provide evidence of the model's ability to diagnose a single organization and show that norm-based assessments offer reliable indicators for framing, assessing, diagnosing, and communicating about IT processes.

We now present the results of 46 survey responses from four different job functions within a large European pharmaceutical manufacturing firm. We begin by describing the administration of this study, and present a modified instrument used to assess a direct path between IT effectiveness and IT quality. Then we present an analysis of survey results and discuss the actionable steps for improvement they suggest.

5.4.2 Study Motivation and Organizational Overview

A pharmaceutical innovation is commonly defined as a new molecular drug approved by the US Food and Drug Administration (Munos, 2009, Hu et al., 2007). Innovations are a key driver of success for the pharmaceutical industry (Acemoglu and Linn, 2004, Hu et al., 2007); for example, Acemoglu and Linn (2004), show that significant links exist between innovation and market share in their comprehensive analysis of the industry from 1965 to 2000. Similarly, Munos (2009) presents evidence of the link between innovation and firm revenues in a 60 year industry analysis.

Like many pharmaceutical organizations, the PHARMA organization is focused on understanding its capabilities and limitations for innovation. To this end, a survey designed to assess those drivers of innovation, which management wished to focus on was developed and administrated across the organization. Because Information technology is one key factor in innovation (Gassmann et al., 2008, Cantwell, 2001) we were asked by management to provide survey items for assessing IT processes. The company agreed to allow data collected in this study to be anonymously reported, and we have obfuscated some identifiable details in order to respect their privacy.

PHARMA is a multi-national organization, but the primary responsibility for developing innovations falls to their manufacturing division where this study was conducted. The principal job functions within this division are engineering, management, quality assurance, and other support services.

Pharmaceutical engineers must have strong and broad technical knowledge of many disciplinary functions in order to successfully develop innovations. According to the International Society for Pharmaceutical Engineering (ISPE, 2013), engineers should be knowledgeable of:

- Product development
- Production systems
- Facilities and equipment
- Information technology
- Supply chain management
- Quality systems
- Regulatory compliance

Managers are those responsible for supervising the work of others and part of the organizational leadership. Quality assurance individuals use investigative skills to conduct analysis and assessments of prospective innovations. Individuals in other service job functions include supply chain management, human resources and administration, among others.

5.4.3 Instrument Items and Survey Administration

The instrument PHARMA developed consisted of 48 items to assess various drivers of interest. Because IT effectiveness was only a part of the study, we were asked by management to limit the number of items to a smaller sub-set of our instrument. After careful deliberation, items presented in Table 22 were selected for the study.

Table 22. Items used to assess IT effectiveness for PHARMA study	
Construct	**Item**
IMP_2	Our organization routinely monitors the effectiveness of our IT systems
RC_2	We take action to try to avoid future IT-related problems
ALIGN_1a	Our organization periodically reviews our long term plans and current IT capabilities
ALIGN_2a	Our organization looks for new ways to leverage IT.
ALIGN_4	In formulating new business plans, our organization considers any IT implications of those plans
OS_4	Our IT has improved productivity in our organization
OS_5	Our organization is well supported by the IT service

To select items for the risk and control (RC) and the measure and improve (IMP) constructs, we reviewed the NAA and AFBP analyses cross-loading tables. The RC_2 item was the largest contributor to the RC construct in the AFBP study, and a strong contributor for the NAA study. Likewise, the IMP_2 item was the largest IMP contributor for NAA study, and a strong contributor in the AFBP study. Although we might have preferred to use all items for assessment, we wished to respect management's request to limit our items where possible and were confident these items would be reliable indicators.

Additionally, we included three newly refined business and IT alignment questions in the IT effectiveness effort construct. Two of the original items used in the NAA study (ALIGN_1a and ALIGN_2a) were adapted based on insights learned from the AFBP interviews. These new items more clearly focus on assessing processes which consider IT capabilities in light of business strategy and vice versa. For example, ALIGN_1a focuses on a norm to conduct "periodic reviews;" ALIGN_2a focuses on a norm to "leverage IT" in new ways, and ALIGN_5, an entirely new question, focuses on "IT implications" of "new business plans."

No IT effectiveness subscription (SUB) items were included because management was not interested in studying the influence of individuals' wilful participation in IT effectiveness efforts. We were also asked by management to omit items which assessed individual satisfaction, and only included organizational satisfaction items for the IT quality construct. Item OS_4 was selected because it was the largest contributor for the OS construct in the AFBP study, and a strong contributor in the NAA study. OS_5 was an adaptation of items OS_1, OS_2 and OS_3 collapsed into a single item.

All items were translated into the European language of the region, and the translation was reviewed by a researcher fluent in that language. One verb tense choice was changed based on this review, but no other changes were made. Of the approximately 300 employees at the manufacturing location, nearly 250 were sent email invitations to a web-based survey. Respondents had a choice of taking the survey in English or the language of the region.

72 responses were recorded with many incomplete or useless cases; possibly due to survey fatigue since IT effectiveness items were placed at the end of the survey. Removing these left 51 usable cases. Further refinements included replacing ten missing values with neutral (neither agree nor disagree) and identifying outliers and/or cases with excessive levers and influence. Following the methodology reported in section 5.2.5.1, five cases that appeared to be inconsistent with the remainder of the data-set were removed leaving 46 usable cases.

5.4.4 Survey Results

We analysed our survey results with the following goals in mind:

1. Validating the adaptation of our instrument using reduced items for assessment.
2. Identifying actionable steps for improving IT quality outcomes to offer support for our fourth research question, which asks whether some organizations would find a norms-based approach to improve IT quality more suitable than IT governance frameworks.

We now report our results for each of these goals.

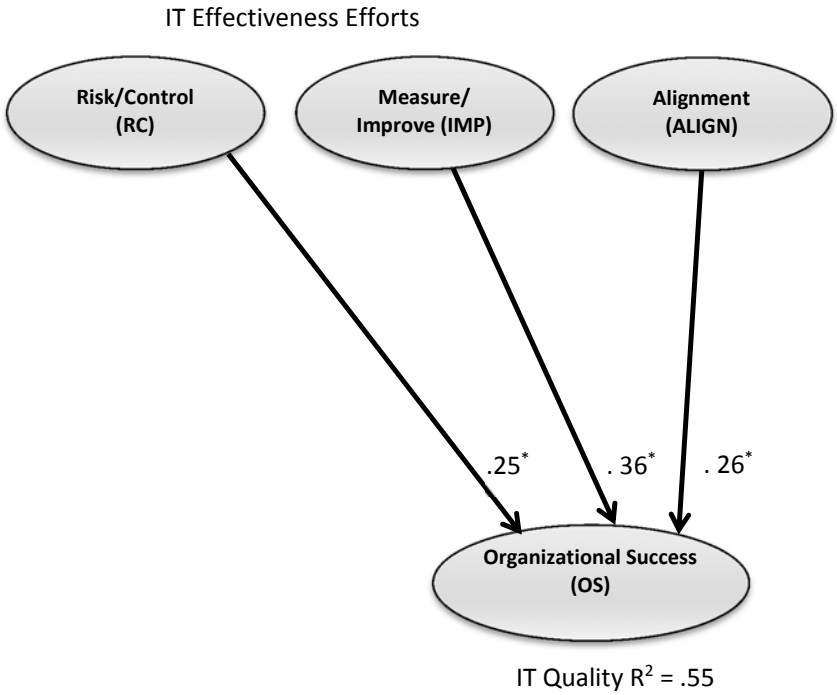
5.4.4.1 Validating the Restricted Model's Predictive Ability

Following the methodology reported in section5.2.5.2, tests for common method bias were negative and correlations were thematically consistent between factors. Therefore, we conclude that common method bias is not an issue. Table 23 presents the demographic composition of the responses which are roughly proportional to those within the organization.

Table 23. PHARMA Demographic Results

Engineers	10 (22%)	**Managers**	10 (22%)	**Quality assurance**	16 (35%)	**Services**	10 (22%)

The PLS model presented in Figure 17 shows that all three IT effectiveness efforts contributed significantly to IT quality and the contributions were balanced –though in PHARMA, measure and improve (MI) appears to have contributed more than the other two constructs. The model explains 55% of the observed variance in IT effectiveness subscription, a 'large' effect according to Cohen's (1988) guidelines. The PLS was also confirmed with linear regression analyses which generated comparable results.



Note: * p <.05, ** p<.01, ***p<.001

Figure 17. PHARMA Study PLS Model Results.

The internal consistency indicators are presented in Table 24. While we have reported on both IMP and RC, because those are each composed of a single item, the consistency indicators are 100%. Indicators for ALIGN suggest that refinements to that construct were satisfactory since all are above recommended levels. Likewise, the IT quality construct also has all indicators above recommended levels despite omitting the IS construct. The cross loading correlations are presented in Appendix 4 and show that the ALIGN items exhibit convergent reliability.

Table 24 PHARMA PLS Internal Consistency indicators

	AVE	Composite Reliability	R Square	Cronbach's Alpha
IMP	1	1		1
RC	1	1		1
ALIGN	0.73	0.89		0.81
IT Quality	0.87	0.93	0.55	0.86

5.4.4.2 Identifying Actionable Steps for Improving IT Quality

We conducted a series of independent t-tests to compare the results between job functions and identified significant differences between engineers and the rest of the organization. Those

results are presented in Table 25, and show that engineers were only in agreement with the rest of the organization when assessing risk and control. For all other constructs, one or more items were significantly below assessments made by other job functions.

Table 25 t-Test Contrasts Between Engineers Assessments and Other Functions

	Engineers Mean		All others Mean	t-test, p, (df)		Managers Mean	t-test (vs. engineers), p, (df)
IMP_2	2.3		3.36	2.8* (16)		3.7	3.5* (18)
RC_2	3.1		3.31	0.5 (18)		3.4	0.7 (17)
ALIGN_1a	2.5		3.14	2.0* (18)		3.3	2.3* (18)
ALIGN_2a	2.5		3.17	2.0* (18)		3.3	1.8 (17)
ALIGN_4	2.3		3.11	2.5* (12)		3.3	2.5* (18)
OS_4	2.5		3.14	1.5 (16)		2.8	0.5 (17)
OS_5	2.7		3.53	2.3* (15)		3.3	1.5 (17)

Note: * p <.05

As we have described, pharmaceutical engineers have strong technical knowledge across many disciplinary functions, including information technology. Thus, while other job functions may be satisfied with IT processes, or simply give IT the benefit of doubt, engineers feel less satisfied and may be in a unique position to evaluate IT more critically. Specifically, the results indicate significant disagreement that PHARMA has adequate IT effectiveness efforts for business and IT alignment, or measure and improve.

The measure and improve item had the highest difference between responses, which, we surmise may suggest engineers do not feel adequately supported by IT in their efforts to develop innovations. We might speculate our conclusion is further supported by the fact that while the organization on a whole assessed OS_4 and OS_5 either neutral (neither agree nor disagree) or positive (agree), engineers, on average assessed these items negatively, with the difference in OS_5 being significant.

Additionally, engineers were negative in their assessments of norms to align business and IT strategy. Given that the context of this study was around innovations, our second speculative conclusion is that engineers are also critical of management's efforts to coordinate strategy and IT capabilities for the purpose of developing innovations. This conclusion seems to be supported by significant contrasts in ALIGN_1a and ALIGN_4 assessments between managers and engineers.

We were able to partially corroborate our two speculative conclusions by discussing these results with the researcher who collected the PHARMA data. In this researcher's opinion, the engineers' primary concerns were that IT was slow to adopt new technologies (e.g. smart phone access to corporate email) and also slow to resolve service issues. In his opinion, IT was not adequately staffed to meet their needs. Assuming our first conclusion and this researcher's opinion were accurate, we might recommend the IT function develop plans to better adopt new technologies and methods for becoming more responsive to service issues. Further, we might recommend management carefully review these plans and support their implementation.

The researcher also opined that a contributing factor to assessment differences resulted from engineers being unclear about management goals and what steps should be taken to accomplish them. If accurate, this may support our second speculative conclusion that engineers were critical of management's efforts to coordinate strategy and IT capabilities for developing innovations. If accurate, then we would recommend engineers become more involved in helping management identify goals and approaches to accomplishing them. Furthermore we might also recommend the IT function be involved in this planning in order to better support these new innovation goals.

5.4.5 Discussion of PHARMA Study

The goals of this study were to apply our assessment model in the context of a single organization and offer evidence that a norms-based approach to better IT quality can help accomplish many of the same outcomes which formal IT governance frameworks offer. To accomplish this, we worked with the management of PHARMA to adapt our instrument to assessments of IT effectiveness for diagnosing pharmaceutical innovation drivers. The simplified instrument consisted of seven questions, which our statistical analysis suggests were able to satisfactorily explain the observed variance and provide reasonable predictions for how IT effectiveness efforts impact IT quality. Furthermore, refinements to our business and IT alignment construct appear to have resulted in thematically consistent items.

To partially address our third research question focusing on whether organizations might find our approach to IT effectiveness results in better IT quality, we demonstrated how a norm-based assessment can offer indicators for framing, assessing, diagnosing, and communicating about IT processes. To partially address our fourth research question focusing on whether some organizations might find our approach more suitable than formal IT governance frameworks, we presented actionable steps for PHARMA in non-technical language easily understood by non-IT individuals.

We might further speculate that our conclusions:

1. Required fewer resources to produce than formal IT governance adoption.
2. Generated recommendations easily communicated in non-technical terms.
3. Produced actionable steps for generating benefits similar to IT governance frameworks.

The researcher working in PHARMA left shortly after this study was completed, so we were unable to confirm whether our recommendations were adopted, generated the expected benefits, or were more suitable than adopting IT governance frameworks. However, what remains is that we demonstrated how our approach produced recommendations to address business and IT alignment and measure and improve efforts, which, if adopted, may allow PHARMA to realize many of the benefits adopting formal IT governance frameworks offer.

5.5 BIS Study

Our final study further develops the structural model of construct interaction and includes refinements made to the IT effectiveness constructs. All hypothesized paths and constructs are statistically significant, and the analyses offers confirmatory evidence that IT effectiveness efforts impact IT quality through both the direct and indirect pathway.

5.5.1 Introduction

The preceding NAA and AFBP studies each offered some support for our theoretical model. Those studies also suggested additional item refinements to our instrument may better assess the constructs we wish to measure. One such refinement was the new business and IT alignment items used in the PHARMA study. While the items were thematically consistent and contributed to IT quality, they still need to be evaluated in the full model.

Another refinement we hoped to accomplish was developing additional survey items to assess constructs for our instrument. In comparing the analysis of NAA to AFBP, we note variations in how effectively items were able to assess IT effectiveness subscription, which we have interpreted to suggest less subscription in NAA than in AFBP. However another difficulty in assessing subscription may be the result of having only four generic items to measure this construct. Using the insights from our AFBP interviews combined with additional theoretical insights from our literature review can help identify additional items to measure IT effectiveness subscription.

Likewise, identifying new items for IT effectiveness efforts may also help better assess constructs making our instrument suitable to study a wider range of organizations. For example, in the NAA study, a continuous improvement norm significantly contributed to IT quality predictive, though it

was not significant in the AFBP study. We have speculated this may indicate assessing continuous improvement is slightly different in non-profit and government organizations than in small businesses, so having additional items able to capture variations in adoption of IT effectiveness norms may facilitate richer assessments.

5.5.2 Instrument Refinements

We performed additional principal component analyses (PCA) to examine varimax rotated correlations between all IT effectiveness effort items on theoretically separated components. The Kaiser-Meyer-Olkin (KMO) measure, Bartlett's test of sphericity, analysis of Eigen values and component matrices all suggest our items correlated sufficiently in theoretically expected constructs. However, several items showed levels of cross-loading with other constructs, which suggests these items might benefit from refinements. In reviewing these items, we noted that when an item used complex wording (e.g. "timing of key events on our organization's business calendar") and/or asked for a complex assessment (e.g. the impact of "systems and practices" on "mistakes" and "problems") there tended to be more cross-loading. Consequently, our first refinements were focused at simplifying items.

Table 26 presents changes made to the IT effectiveness effort risk and control items. We speculate RC_1 was ambiguous ("avoid making mistakes") which may have caused inconsistent assessments and was modified as item RC_1a ("avoid business mistakes") to more narrowly assess a norm of aligning IT and business operations. Likewise, RC_3 required a more complex value assessment about the consequences of IT operation scheduling and was replaced with two narrowly focused items: RC_4 assesses the norm of identifying risks ('threats'); and, RC_5 assesses the norm of adopting offsetting controls ('safeguards').

Table 26 Refinements to IT Effectiveness Effort: Risk/Control Items

Risk/Control	
RC_1a	Our IT systems and practices are designed to avoid business mistakes and/or prevent operational problems.
RC_2	We take action to try to avoid future IT-related problems.
RC_4	Our organization gives appropriate consideration to assessing new threats to our IT
RC_5	Our organization establishes safeguarding measures to protect our IT from significant risks

Table 27 presents changes made to the measure and improve items. Item IMP_1 asked for an ambiguous assessment ("records events or activities"), and was refined as IMP_1a to more

narrowly assess a norm to "measure IT performance." Likewise, IMP_3, included complex wording ("receive and accept feedback") which may have caused inconsistent responses. This item was replaced with three narrowly focused items: IMP_4 assesses a norm to review IT effectiveness; IMP_5 assesses a norm to make improvement to IT.

Table 27 Refinements to IT Effectiveness Effort: Measure and Improve

Measure/Improve	
IMP_1a	Our organization measures IT performance to assess whether or not IT is doing a good job.
IMP_2	Our organization routinely monitors the effectiveness of our IT systems.
IMP_4	Appropriate people in our organization review the effectiveness of our IT.
IMP_5	Appropriate people in our organization assess IT usage in order to make improvements

Table 28 presents refinements made to our business and IT alignment items. While the PHARMA study analysis indicated business and IT alignment items were thematically consistent, our PCA analysis identified some cross loading of ALIGN_4 with other IT effectiveness efforts. Like RC_1, RC_3, IMP_1 and IMP_3, we note this item requires a complex value assessment of how plans are "formulated" as well as their "IT implications." It was refined in ALIGN_4a to more simply ask if "organizational priorities" impacted "IT expenditures."

Table 28 Refinements to IT Effectiveness Effort: Business and IT Alignment

Business and IT alignment	
ALIGN_1a	Our organization periodically reviews our long term plans and current IT capabilities
ALIGN_2a	Our organization looks for new ways to leverage IT.
ALIGN 4a	Our organizational priorities are considered in managing IT expenditures
ALIGN 5	Our organization encourages proposals for innovative uses of IT to better accomplish goals and objectives
ALIGN 6	New IT recommendations for our organization receive thoughtful and deliberate consideration

We also reviewed the ISO/IEC 38500:2008 standard for corporate governance, discussed in section 0, to identify additional assessments of IT effectiveness norms. As we noted, this standard offers senior leaders guidance on normative behaviours consistent with IT effectiveness efforts. One example norm consistent with our theoretical view that business and IT alignment items

should assess processes which contribute to alignment suggested leaders should "encourage the submission of proposals for innovative uses of IT that enable the organization to respond to new opportunities or challenges" (ISO/IEC, 2008, pg. 11). We infer from this guidance that a norm to encourage IT proposals and give them careful consideration is a standard which can result in higher business and IT alignment, which we adapted in items ALIGN_5 and ALIGN_6.

Table 29 presents refinements made to our IT effectiveness subscription items which are intended to assess whether individuals believe that IT effectiveness norms are superior to alternatives in achieving IT outcomes. Our PCA analyses identified some cross-loading in item SUB_3, which asked for two assessments ("to have" and "to safeguard"), so it was refined in SUB_3a to only ask for one assessment ("to safeguard"). We also identified cross-loading in item SUB_4, and since this item was used in our interviews, we had additional insight that the wording may have been confusing to some. It was refined into item SUB_4a to assess whether there was a policy that "people gladly comply with." Cheerful compliance suggests that

The IT effectiveness subscription items introduced in section 5.2.2.2 were our first effort to operationalize and assess whether individuals subscribed to generic IT effectiveness efforts (e.g. protecting passwords). It was always our intent to develop additional assessments for this norms paradigm, once we validated our theoretical hypotheses. Our review of ISO/IEC 38500:2008 identified guidance with obvious references to acting in a manner associated with an IT effectiveness norm. Three examples we used to develop new IT effectiveness subscription items:

- Business managers should be "assisted by IT specialists who understand business values and processes" (ISO/IEC, 2008, pg. 9). This was adapted into item SUB_5 to assess subscription to considering IT specialists' perspective for accomplishing goals. This item replaced SUB_1 which exhibited cross-loading.
- "All actions relating to IT be ethical" (ISO/IEC, 2008, pg. 14), was adapted into item SUB_6 to assess subscription to the norm of using IT ethically.
- "Evaluate IT activities to ensure that behaviours… consider risks [which] should be managed" (ISO/IEC, 2008, pg. 15), was adapted in SUB_7 as an item to assess subscription to the norm of acting appropriately to reduce risks.

Table 29 Refinements to IT Effectiveness Subscription	
SUB_2	People in our organization gladly comply with efforts to safeguard and improve our IT operations.
SUB_3a	People in our organization recognize the need to safeguard their password
SUB_4a	Our organization has policies on the acceptable use of IT and people gladly comply with them
SUB_5	IT specialists who understand our organization assist in accomplishing our goals and objectives
SUB_6	Our organization follows ethical standards in its use of IT.
SUB_7	People in our organization take appropriate safeguards in light of existing threats

5.5.3 Methodology

To test our revised instrument we invited undergraduate business students at Oregon State University enrolled in a Business Information Systems (BIS) course to participate in our study. Most students were in either their third or fourth year of study and were exposed to a broad range of business and IT concepts as part of the curriculum. Each student had been exposed to the elements of an information system by being required to demonstrate proficiency with IT artefacts and complete tasks such as writing a program in Visual Studio, creating a database in Access and collaborating with others using SharePoint.

Students were informed that the purpose was to study "IT attitudes," and the study was administered during the last week before final exams in two separate classes. While the preceding studies included senior managers, managers, IT professionals, and IT administrators among others, this study's sample consisted entirely of students. However, these students are IT administrators, individuals who are not IT professionals but accept responsibility for IT, as defined in section 2.3, since they must make their computer program or database accomplish assignment goals. Although drawing from a single demographic limits the organizational perspective of our study, we have already noted the important role IT administrators play, especially in small businesses. Therefore, validating our instrument with this demographic is one important benefit of this study.

Although the instructions asked students to think of the university as "their organization," informal discussions afterward suggested some students who were employed outside of school may have focused on their employer's organization instead of the university. Assuming these students focused on the same organization throughout their survey, the only difficulty we envision would be interpreting the results as part of an organizational assessment. Since assessing

the university is not a goal for this study some variation between organization focus should not create difficulties in analysing the results.

We collected 96 responses, and filtering out incomplete and obviously useless cases left 85. Further refinements included replacing 5 missing values with neutral (neither agree nor disagree) and identifying outliers and/or cases with excessive levers and influence. Following the methodology reported in section 5.2.5.1, 13 cases which appeared to be inconsistent with the remainder of the data set were removed leaving 72 usable cases.

5.5.4 Survey Results

We analysed our survey results with the goal of validating the instrument refinements and developing a more complex second order model to better explain constructs interaction. Following the methodology reported in section 5.2.5.2, tests for common method bias were negative.

5.5.4.1 Initial PLS Analysis

Figure 18 presents our initial PLS model. The model explains 42% of the observed variance in IT effectiveness subscription, a 'large' effect according to Cohen's (1988) guidelines. The model also explains 35% of the observed variance in IT quality, a 'medium' effect according to Cohen's (1988) guidelines. While IT effectiveness subscription and risk/control were both statistically significant, many of the other LV regression coefficients are small and/or non-significant, which implies a poor model. The PLS was also confirmed with linear regression analyses which generated comparable results

We also examined the internal consistency indicators presented in Table 30 for clues to improve our model, though all were within acceptable limits.

Table 30 BIS Initial PLS Model Internal Consistency indicators

	AVE	Composite Reliability	R Square	Cronbach's Alpha
IMP	0.59	0.85		0.77
RC	0.54	0.82		0.72
ALIGN	0.53	0.85		0.78
SUB	0.49	0.85	0.34	0.79
IT Quality	0.49	0.82	0.31	0.73

The analysis of cross loading presented in Appendix 5 depicts minimal cross loading with high convergent reliability between constructs and suggests our constructs benefited from the item refinements.

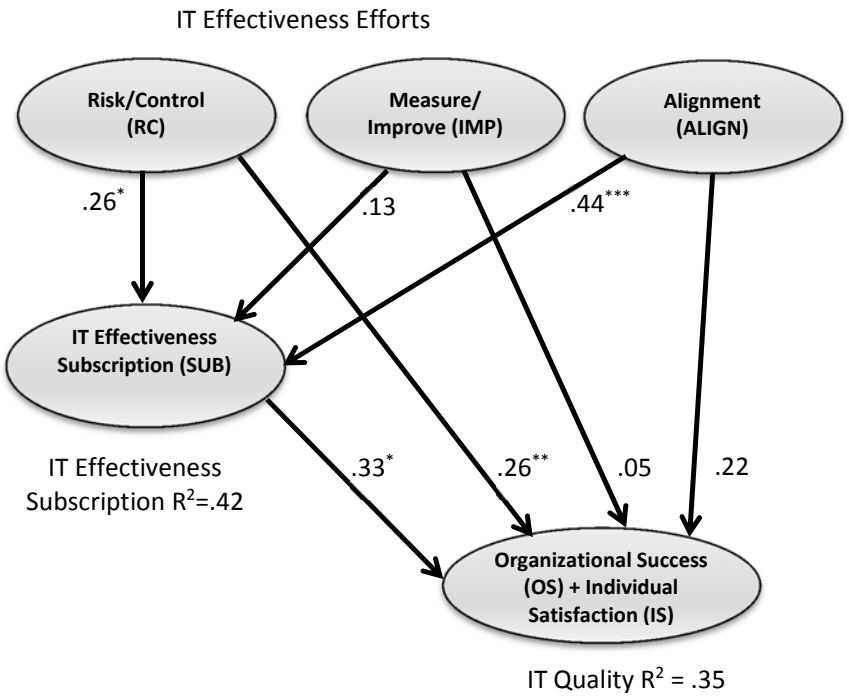


Figure 18 BIS Study Initial PLS Model.

5.5.4.2 Second Order PLS Model

Our initial PLS model attempted to narrowly fit IT effectiveness effort interaction; however the low and non-significant regression weights indicate these paths did not accurately depict interaction. Therefore, we refined the PLS model to use higher order constructs which model more broadly generalized interactions (Wetzels et al., 2009, Cenfetelli and Bassellier, 2009) between IT effectiveness efforts. Creating a higher order model allows the PLS algorithm to measure alternative patterns of covariance among the lower order factors (Wetzels et al., 2009, Chin et al., 2003).

We developed the second order IT effectiveness effort construct by using RC, IMP and ALIGN as formative indicators. While the observed measurement items each "reflect" latent constructs, the three constructs together become IT effectiveness. Put another way, items used to assess RC, IMP and ALIGN are indicators of norms in the organization; however, these three latent constructs "form" IT effectiveness efforts (Ruiz et al., 2010, Esposito Vinzi et al., 2008). Therefore, our second order IT effectiveness effort construct measures the influence of the underlying IT effectiveness norms rather than being influenced by them (Ruiz et al., 2010, Cenfetelli and Bassellier, 2009).

We also developed a second order reflective construct for IT quality. While we have presented support that individual satisfaction and organizational success are both well-established measures of IT success, it is outside of the scope of our work to validate them as formative measures and therefore we treated them as reflective.

The second order model is depicted in Figure 19 with results of the PLS analysis and shows all paths are statistically significant. Importantly, we see nearly equal IT effectiveness efforts and IT subscription contributions to IT quality. The overall explanatory value (R squared) of 26%, decreased slightly from the initial model, though it still represents a 'medium effect' according to Cohen's (1988) guidelines. Internal consistency measures and cross-loadings were largely unchanged.

We also measured the effect size of IT effectiveness efforts and IT effectiveness subscription by comparing the overall R squared of a model with both constructs to ones with each construct removed model (Cohen, 1988, Hair et al., 2012b, Chin et al., 2003) guidelines. The effect size of IT effectiveness efforts was 5%, while the effect size of IT effectiveness subscription was 9% –both a 'small effect' according to Cohen's (1988) guidelines.

5.5.5 Discussion of BIS Study

The goal of this study was to refine and test survey items while also developing a better explanatory model of construct interaction. We also sought to make our survey instrument more robust to better facilitate assessments across a wider range of organizations. We begin our refinement with a PCA analysis of IT effectiveness items. We concluded items which exhibited cross loading either used confusing language, were unspecific, and/or required complex assessments; these items were rephrased or replaced. We also drew from the ISO/IEC 38500:2008 IT governance standard to develop one new item for business and IT alignment and three new items for IT effectiveness subscription.

Our study was administered to students in two introductory BIS classes, largely IT administrators, an important demographic in many organizations such as small businesses. IT administrators work with systems and artefacts to accomplish goals. They may also attempt to troubleshoot issues when they arise. Consequently, they are more likely to have informed views on IT effectiveness efforts, which the results seem to support since internal consistency measures for IT effectiveness efforts RC, IMP and ALIGN were all well above acceptable levels.

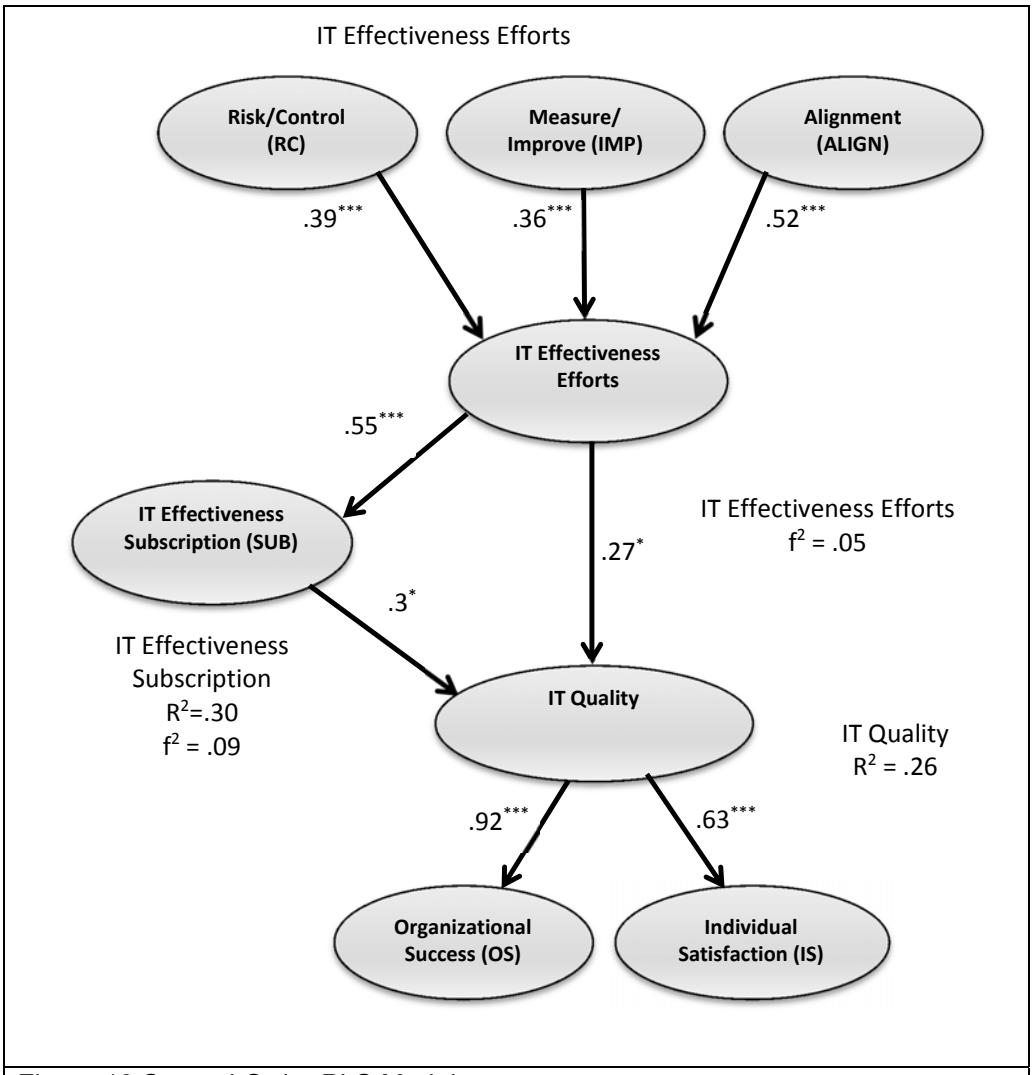


Figure 19 Second Order PLS Model

However, the measures were at the border for IT effectiveness subscription (SUB) and IT quality. We examined the cross loading in Appendix 5 which shows SUB_2 and SUB_6 had the lowest correlations. Because SUB_2 was used on the NAA and AFBP study where it displayed minimal cross loading, this may suggest students had difficulty assessing how others contributed to IT operations. SUB _6 was a new item and the low correlation may indicate students felt ambivalent about adhering to ethical guidelines in IT practices.

We also examined the IT quality item cross-loading and found that both IS_1 and IS_2 had the lowest levels of correlations. These items were used on the NAA and AFBP study where they displayed minimal cross-loading and high internal consistency measures. The low consistency values may have resulted from students' conflating their satisfaction with university IT systems and the challenges they experienced completing their programming and database assignments. Student feedback tends to be bi-modal: one segment finds these classes less satisfying than their

other courses; another segment finds these classes more satisfying than their other courses. Consequently, it is likely that low correlations for satisfaction items result from this bi-modal variation.

Because respondents may have been less likely to consistently distinguish between their assignment artefacts and the university systems, this may also have contributed to the decreased explanatory value (26%) of our results when compared to the previous studies. However, an alternative explanation is that survey item refinements may also have contributed to the decrease in explanatory value.

The low statistical significance of our initial PLS model helped suggest that a higher order model might be a better representation. Adding the second order formative IT effectiveness construct channels the underlying IT effectiveness norms influence in a more generalized way through the model. While each of the IT effectiveness efforts added a 'small' but significant effect, the sum of their contribution is a 'medium effect' according to Cohen's (1988) guidelines.

Put another way, while having a norm, such as, aligning business and IT strategy will influence IT quality, the collective effect of all three IT effectiveness efforts is far more significant. Importantly, the collective effect of IT effectiveness also influences the intellectual commitment for individual subscription to the normative spirit of IT effectiveness, which in turn also contributes to IT quality.

The effect sizes of efforts and subscription on IT quality are very similar suggesting both the direct and in direct pathways are equally important in influencing IT quality. In comparing these results to those of NAA and AFBP, we might conclude that subscription is more likely to influence IT quality in IT administrators.

Adding a second order reflective construct for IT quality made little statistical difference in this study. However, the higher order construct, does allow for a more generalized interaction between IT quality and other constructs which may facilitate future refinements to the IT quality constructs. It may also allow us to model how other constructs besides IT effectiveness influence IT quality.

5.6 Conclusion

The goal of this chapter was to present empirical evidence which supported our claim that a norms-based approach to IT effectiveness can influence IT quality. We have presented four studies with the goal of offering empirical evidence to answer our research questions, and the results are summarized in Table 31.

Table 31 Summary of Study Results				
Study	**IT Effectiveness → IT quality**		**Overall R^2**	**Accomplishments**
	direct path	**indirect path (thru SUB)**		
NAA	Significant	Not Significant	66%	Initial survey items developed and many validated; IT effectiveness efforts shown to influence IT quality.
AFBP	Significant f^2=.51	Significant f^2=.06	49%	IT effectiveness efforts and subscription influence IT quality in SMEs; 10 interviews help validate survey items and offer additional insight.
PHARMA	Significant	N/A	55%	Diagnostic study in single organization offers non-technical and actionable recommendations; new alignment items tested.
BIS	Significant f^2=.05	Significant f^2=.09	26%	Refinements to items tested; IT effectiveness efforts and subscription shown to influence IT quality in study of IT admins; second order model of construct interaction developed.

The NAA study was our first effort to operationalize and test constructs in a model. While this study offered some evidence of the direct path between IT effectiveness and IT quality, it also suggested that additional refinements to our instrument were necessary; especially for the business and IT alignment construct.

Our second study in AFBP using the same survey instrument showed more promise by offering limited evidence of the indirect path between IT effectiveness subscription and IT quality. It also offered confirmatory evidence of the direct path between IT effectiveness efforts and IT quality. As we have speculated, the difference in IT effectiveness subscription's contribution between the NAA and AFBP sample may suggest higher subscription in small family businesses than in non-profit and government organizations of NAA.

We also conducted ten interviews during the AFBP study to collect qualitative data in support of our goals. These interviews confirmed that our surveys items largely assessed the constructs we expected. They also offered additional insights into how constructs behaved.

Our third study in PHARMA was conducted with the goal of assessing a single organization to demonstrate how a norms-based approach can be used to assess, diagnose and frame discussions of IT effectiveness. We also tested refinements to business and alignment items which assess whether a process existed to identify and capitalize on IT contributions for accomplishing business goals. We identified that engineers were, on average, significantly less optimistic about IT effectiveness and IT quality than others in PHARMA. We used these results to formulate actionable and non-technical recommendations for improvement.

Our fourth BIS study was conducted to validate our model using IT administrators, an important demographic, especially for smaller organizations. We also made additional minor refinements to our instrument to better assess constructs while facilitating assessments across a wide range of organizations. We developed a second order model that helps to generalize the influence of IT effectiveness constructs on IT quality. We found that both the direct and indirect paths had nearly equal influence on IT quality and that our overall model explained 26% of the observed variance.

We also reanalysed the NAA and AFBP results using the second-order construct model. In both studies the direct path between IT effectiveness and IT quality remained significant, though the indirect was not. We might speculate the reason AFBP's indirect path was insignificant in the second order model was because the generalized interaction allowed more influence from IT effectiveness efforts to follow the direct path. Notably, measure and improve was not a significant contributor to IT quality in the original model with most of the influence being carried through IT subscription. In the second order model, the 'small' effect made by subscription seems to have been lost in the 'large' effect of IT effectiveness efforts.

One explanation for why IT effectiveness subscription's influence on IT quality is more significant in the BIS study than in either NAA or AFBP is likely because our sample consisted of IT administrators. This group of students was motivated to behave in a manner consistent with the spirit of IT best practices, which they adopted in order to successful complete their BIS class. We might expect the same level of commitment to be exhibited by IT administrators in other organizations as well. Such an intellectual commitment to the normative spirit of IT effectiveness efforts is consistent with the behaviour we expect in organizations that adopt IT processes closely related to those advocated by COBIT and other frameworks.

Chapter 6 Discussion, Contributions, Limitations and Future Work

6.1 Introduction

This chapter offers a comprehensive analysis of our work. We review our findings from the preceding chapters in light of the research questions and discuss the contributions they make. We also address limitations and future efforts we hope to undertake.

6.2 Discussion

The purpose of this thesis was to determine whether a norms-based approach to IT effectiveness could help organizations achieve many of the benefits which more formal IT governance frameworks offer. To guide our work, we presented a set of research questions that, if answered, would help accomplish our stated purpose. Table 32 summarizes our findings.

Table 32 Summary of Support For Research Questions

Research Question	Support Found	Conclusion
Do IT governance frameworks express a set of IT effectiveness norms which can be identified and assessed?	1. Careful study of COBIT identified many potential norms. A study of IT proposals demonstrated three raters were able to reliably identify many of these norms. 2. Four studies indicate many norm assessment items behave consistent with theoretical expectations. 3. Interviews with respondents in the AFBP study offers support that survey items assess what we expect. 4. A study within a single organization (PHARMA) indicated that the items were able to distinguish between norms-based on job function.	**Supported**
Do IT effectiveness efforts motivate subscription to the spirit of these frameworks?	1. Philosophical justification based on theories of motivation offer support that IT effectiveness efforts can motivate subscription. 2. Three studies (NAA, AFBP and BIS)	**Supported**

	offered empirical evidence of H2 and explain between 30-40% of observed variance in IT effectiveness subscription (a 'medium' to 'large' sized effect according to Cohen, 1988).	
Do IT effectiveness efforts and/or subscription result in better IT quality?	1. Philosophical justification based on theories of motivation offer support that IT effectiveness efforts can result in better IT quality. 2. A study of written IT proposals demonstrated the use of COBIT based IT effectiveness norms did improve the quality of the proposed solutions. 3. Four studies (NAA, AFBP, PHARMA and BIS) examined the relationship between IT effectiveness norms and IT quality. In the BIS study, our model explained 26% of observed variance, a 'small' effect according to Cohen's (1988) guidelines. 4. Interviews with respondents in the AFBP study offers further support that norms were partially responsible for better quality IT.	**Supported**
Would some organizations find IT effectiveness based on norms more suitable than IT governance frameworks for improving IT quality?	1. Students found it easier to apply the normative spirit of IT effectiveness than using an IT governance framework. 2. Interviews in the AFBP study offered support that a less technical approach to IT effectiveness would be well received by small businesses. 3. Actionable, non-technical recommendations developed in the PHARMA study offer support that a norms-based approach can offer many of the same benefits as formal IT governance framework adoption.	**Somewhat supported**

We have largely answered the first three research questions. Our first question asked whether IT governance frameworks express a set of IT effectiveness norms which could be identified and assessed. After a careful analysis of the COBIT framework, we were able to identify a set of IT effectiveness norms. Furthermore, we also found support in our study of student written proposals that a set of norms were consistently identified by three raters. Many of these were operationalized in our instrument which we used in four empirical studies.

Our second question asked whether IT effectiveness efforts motivate subscription to the spirit of these frameworks, while our third question asked if efforts and subscription improved IT quality. We developed theoretical support for our answers by reviewing the research literature and formulating our research model and hypotheses. We also presented a philosophical justification for how norms are able to influence behaviours which in turn drive outcomes. Finally, we have presented empirical evidence from four studies which support our claim that the answers to these questions are affirmative. Each of these studies shows that IT effectiveness efforts improved IT quality through the direct path.

The BIS study offers the most evidence for the indirect path's effect on IT quality through substitution. Although there was also a small effect along this path in the AFBP study, the effect was not significant in the second order model. We have noted that second-order models allow a more generalized interaction, and speculated that the 'large' effect of IT effectiveness efforts captured the interaction of measure/improve which previously travelled through IT effectiveness subscription in the original model.

Still, the BIS and AFBP results both offer evidence that when organizations exhibit subscription to IT effectiveness efforts, these norms help individuals extrapolate beyond simple compliance with IT best practices to internalize the spirit and act in an independently consistent manner. As a result the organization can realize higher IT quality. Furthermore, we have evidence from all four studies that IT effectiveness efforts directly influence IT quality, and this evidence alone is sufficient to support our claim that a norms-based approach can result in better IT quality.

Put another way, we have presented evidence that IT effectiveness efforts may be more useful when they are people focused rather than being strictly IT focused, and also when they foster appropriate norms instead of mandating standards and assessing performance indicators.

Unfortunately, we have only limited evidence to address our fourth research question that some organizations may find a norms-based approach more suitable than adopting IT governance frameworks. Our study of IT proposals found that most students preferred to draw upon norms in preparing their proposal rather than directly applying COBIT. Interviews we conducted in the

AFBP study of small businesses offer support that many individuals prefer informal guides to action. The assessments we conducted with PHARMA and actionable recommendations for improvement were capable of accomplishing many of the same benefits which formal IT governance practices offer. Still, we concede additional work is necessary to answer this question conclusively.

Despite a limited answer to question four, we are very encouraged by our results. We set out to determine whether a norms-based approach to IT effectiveness could help deliver many of the benefits that more formal IT governance adoption offers and found that norms are an important driver of IT quality.

Our approach is one which is more focused on how individuals contribute to organizational IT outcomes. As we have noted, many organizations are unable to maintain a permanent staff of IT professionals and must instead depend upon individuals who are not well trained to deliver IT services. Consequently, they may not have the technical skills or experience to assess or interpret IT the same way that IT professionals can. Therefore, an approach which focuses instead on adapting existing individual norms to be more consistent with IT best practices would likely be better suited for many organizations.

6.3 Implications and Contributions

6.3.1 Introduction

We previously compared current IT effectiveness approaches to early behavioural psychology efforts for helping patients improve their lives which largely emphasized cause and effect. If the organization is the patient in our analogy, then IT process and performance measurement focused approaches such as COBIT are the behavioural efforts to improve outcomes. Sadly, these approaches limit the contributions of those less qualified to assess and interpret complex systems. Individuals are frequently coerced into compliance without being told why the practice contributes to better outcomes; for example, when an IT system forces them to choose a complex password. While larger organizations have more resources to better support the adoption of these complex approaches, smaller organizations may not.

Our work shows that while adopting policies such as restricting passwords choices can make a difference in IT quality, there is an equally important contribution from the intellectual subscription of individuals to behave in a manner consistent with IT best practices. To complete our analogy, subscription is the greater cognitive contribution of the human mind to change outcomes, which cognitive psychology helped introduce. Likewise, we hope that greater emphasis

on the normative contribution to IT quality might lead to IT effectiveness approaches better suited to smaller, resource constrained organizations.

6.3.2 Implications for Management

The implications of our findings should be welcome news to organizations that are unable or unwilling to adopt formal IT governance frameworks. Managers should find it easy to adopt the norm-based approach we advocate, since it is less formal than governance frameworks and relies on common acceptance and assent. We presented evidence that IT effectiveness subscription is a significant contributor to better IT quality, so, promoting consistent normative behaviours can benefit organizations. For example, we encourage both IT and non-IT employees to:

- Anticipate IT risks and proactively mitigate them (e.g. periodic risk assessment reviews).
- Identify measures that indicate IT does a good job (or not), and routinely monitor them (e.g. frequency of service disruptions, user satisfaction surveys, etc.).
- Review business and IT goals, and encourage innovative recommendations for IT use (e.g. periodic strategic reviews).

We further suggest enlisting the entire organization's support to foster norms consistent with IT best practices. When IT effectiveness efforts are part of the organizational culture, they serve to motivate actions because of employees desire to see better quality IT outcomes. Specifically, encouraging IT professionals to frame issues in less technical normative language allows greater diffusion of best practices across the organization. Put another way, instead of the IT function imposing patterns based on technical standards, using non-technical normative approaches to IT processes will encourage wider participation, and result in better IT outcomes.

It is important to note that we do not find fault with IT governance framework adoption or with the important contributions of IT professionals. Quite the opposite is true; we believe that formal frameworks and a dedicated team of skilled IT professionals is a sound business practice. We simply acknowledge that for many organizations, these may not be feasible alternatives and suggest that for them, a norms-based approach could be more suitable.

However, even organizations with an IT staff that adopt a framework like COBIT can benefit from using our norms-based approach. For example, our survey instrument can help bridge the communication gap between IT professionals and other parts of an organization by facilitating less-technical feedback on IT operations.

6.3.3 Contributions

One important contribution of our work is the development of an alternative IT assessment tool. Our survey instrument, which assesses many of the key IT effectiveness norms advocated by COBIT, has been validated in multiple studies, and is generic enough for most organizations. Given its light-weight nature, managers can easily administer the instrument and identify actionable steps for improving IT quality with less resources than many other approaches necessitate. For example, the PHARMA study, demonstrated how results could generate such recommendations. We found lower assessments by engineers on business and IT alignment, risk/improvement and organizational success constructs then used these results, combined with observations made by the researcher who administered the study to develop recommendations for management. Just as adopting IT governance frameworks offers better likelihood of IT quality, so too, could these recommendations offer greater assurances to PHARMA, if adopted.

Another important contribution of our work has been the development of a model to explain how IT effectiveness efforts influence IT quality. While we originally anticipated that each effort would make its own contribution to IT quality, our analyses showed these efforts act collectively to influence IT quality. Consequently, we refined this model based on data from our studies into a second order construct model which can more easily accommodate other constructs in the future. This model may allow managers to better understand how a norms-based approach can influence IT quality.

6.4 Limitations

To assess the limitations of our work, we refer back to the methodology critique of section 3.4.7. The first threat we noted was our largely positivist epistemology, which hypothesized that IT effectiveness would behave predictably like other forces in sciences and psychology. Instead, it is possible that the research model we proposed is incomplete and/or imprecise. We did address this threat by treating IT effectiveness as conceptual constructs instead of concrete forces. The fact that our statistical analysis showed survey items clustered thematically along theoretical components, helps support our claim to have isolated IT effectiveness constructs. Furthermore, tests for common method bias and PLS analysis showed that these constructs did behave as expected.

While it is entirely possible that IT effectiveness constructs are not predictable, we have advanced a well-supported theory, which seeks to explain how they behave. As we discussed in section 3.2, science is self-correcting, and explanations not proven false are accepted by more researchers and are the best ‘truths’ our scientific method can offer. Consequently, a limitation of our work is

having not yet being widely reviewed, challenged and/or confirmed by others, though we hope our results may encourage others to study IT effectiveness further.

Interdependence in our survey instrument items was another threat we considered earlier and also a limitation of our work. We experienced difficulty reliably assessing other IT effectiveness norms suggested by COBIT, besides the ones operationalized in our study. For example, we initially anticipated measuring risks separately from controls and IT performance separately from improvement efforts. However, we chose to combine these closely related concepts because of difficulty constructing items which focused exclusively on one without also suggesting the other. A limitation of our approach then is that some norms seem to be more easily operationalized than others. While our assessment instrument is a contribution, we must qualify that it does not yet discern the same level of detailed analysis that, for example, a formal IT governance audit is capable of doing.

The IT effectiveness subscription is also operationalized generically using proxies such as password protection and IT policy compliance. While we widened its scope to include additional norms in the BIS study, the instrument may not yet be able to discern subscription for some complex IT effectiveness efforts that are often necessary to manage IT operations.

Not having an independent confirmation of the survey data is another limitation. We attempted to mitigate this by adding interviews to validate the survey. However, ten interviews were not sufficient to confirm assessments across an entire organization, or all organizations in our sample.

Another threat we discussed earlier was treating organizations homogenously which limits the transferability of our results. Our results show IT effectiveness influences IT quality, which is a significant finding. It offers support for our fourth research question that some organizations may find a norms-based approach able to generate benefits similar to IT governance adoption; however, we have inconclusive evidence that our claim is true. Because our approach has not yet been translated into a methodology for improvement, the lack of efficacy evidence is also a limitation.

We did administer a study in one organization, the pharmaceutical company, and were able to identify recommendations for improvement based on our assessment. However, we were not able to determine whether our recommendations were of any measureable value. Additionally, we often limited our study of IT effectiveness to better understood norms and have only limited evidence of how other, less well-known, norms behave. More in-depth studies of organizations would help overcome this limitation.

In conclusion, most of the limitations to our work were previously anticipated and addressed in our methodology critique. We have argued that while being valid limitations, none are substantial enough to diminish the contributions or significance of our work. In the next section we describe how our efforts may eventually overcome these limitations.

6.5 Future Work

We hope to conduct more in-depth studies and employ a method to verify our survey. For example, IT auditors are skilled at conducting formal assessments of operational compliance with the normative prescriptions in formal IT governance frameworks. Having independent IT effectiveness confirmation from an auditor would further validate the survey instrument; offer additional insight into how constructs behave; and, suggest techniques to overcome problems.

We also want to administer our survey multiple times in the same organization to determine which techniques best affect outcomes. As we suggested in the introduction, we hope to adapt this research into a consultative methodology and actively seek opportunities to use our work in practitioner settings. If successful, then we hope to eventually report case studies from organizations that benefit from our approach.

Finally, we are interested in finding other effectiveness norms –even ones outside of the IT function –that contribute to better IT outcomes. We believe that this norms-based approach has great promise and seek to extend its capability into other areas of management practices.

6.6 Conclusion

The purpose of this thesis was to examine if the norms that guide individual actions in an organization can be used to improve IT effectiveness. Unlike formal IT governance practices which focus on improvement from the 'top down,' we formulated a 'bottom up' approach, which focuses on comparing observable IT effectiveness norms to IT best practices found in IT governance frameworks such as COBIT. A major contribution of our work was the formulation of a predictive model based on theoretically derived constructs validated in multiple studies. We demonstrate two important drivers of IT quality: 1) routine IT processes which are meant to manage the IT function (IT effectiveness efforts); and, 2) the intellectual commitment of individuals to behave in a manner consistent with those efforts (IT effectiveness subscription).

Our work is grounded in a literature review of approaches to IT effectiveness and IT governance frameworks, especially COBIT. We also identified a significant research gap that a norms-based approach to IT effectiveness can address. Our research methodology was based on the scientific method which we justified and is also consistent with methods widely used in IS research.

Our theoretical framework was also justified with a philosophical examination of motivational theories and supported by a study that showed norms grounded in COBIT can improve the quality of proposed IT solutions. Based on the results of this study, we identified a first set of constructs, which were operationalized and evaluated in four studies to show that IT effectiveness influences IT quality.

The NAA study was conducted with 120 respondents from non-profit and government organizations and demonstrates IT effectiveness has a direct influence on IT quality. The AFBP, study conducted with 120 respondents from small businesses offers support for both a direct and indirect path between IT effectiveness and IT quality. Further, ten semi-structured interviews offered support that survey items assess what we expect. The PHARMA study, conducted with 46 respondents from a European pharmaceutical company, offers support that IT effectiveness efforts are a valid predictor of IT quality within a single organization. Finally, the BIS study, conducted with 72 business students, in an information systems class validates refinements to our survey items and presents a second order predictive model of construct interaction. In this final model, which explains nearly 30% of observed variation, both the direct and indirect paths between IT effectiveness and IT quality are statistically significant and make nearly equal contributions.

Finally, we have examined our research goals in view of our results and identified that although we have largely satisfied these goals, some minor work still remains. Notably, efforts to develop additional IT effectiveness constructs and studies which adapt our work into a practitioner methodology, would offer additional value.

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Appendix 1

Descriptive Statistical Output from Student Coding Study

Table 33 lists the independent variables considered for analysis as well as their observed means and standard deviations. The dependent variable—inclusion of governance norms in proposed solutions—was operationalized in a series of proxies (Table 7) as well as by a variety of more or less complex combinations of these proxies. Table 34 lists all the used proxies, as well as the means and standard deviations of their counts.

Table 33. Independent Variables Considered for Analysis

		Range	Distribution
COBIT	True if COBIT or one or more specific COBIT processes is mentioned by title or number	True or False	70 true, 45 false
Academic	Sum of participant's exam scores for the term; a proxy for academic ability	105-187	Mean: 152 Std. Dev: 14.4
Prior	Score on the COBIT questions on the midterm; a proxy for prior COBIT knowledge	2 - 9	Mean: 5.2 Std. Dev: 1.36
Prompted	Whether or not the case solution included the words 'such as COBIT' as shown in Figure 4	True or False	55 Prompted, 60 not

Table 34. Operationalization of the Dependent Variable

Variable	Description (Tally of source tags - see Table 3)	Range	Mean / Std. Dev.
Indicates Governance Practice Norm Understanding Specifically Associated with IT Processes			
ITP	Count of all ITP tags including ITPCTRL, ITPWHO, ITPMEAS, and ITPIMP	0 -24	8.3 / 4.8
	Indicates the number of times an IT process was included in the solution		
ITPWHO	Count of ITPWHO tags indicating assignment of responsibility for an IT process to a person	0 - 9	2.0 / 1.8
ITPMEAS	Count of ITPMEAS tags identifying a measure associated with an IT process	0 - 7	1.2 / 1.5
ITPIMP	Count of ITPIMP tags identifying an ongoing improvement of an IT process	0 - 5	.33 / .75
UniqueITP	Count of Unique ITP tags, e.g., one or more ITPCTRL and one or more ITPWHO with no ITPMEAS or ITPIMP = 2	0 - 4	2.6 / .98
	Indicates IT process description completeness - a maximum score		

	includes a control, a responsible party, a measure of effectiveness, and allusion to ongoing improvement		
Indicates Governance Practice Norm Understanding (ITP and non-ITP)			
ALLGOV	Count of all ITP tags and their non-ITP counterparts, ITP + CTRL + WHO + MEAS + IMP	3 - 27	11.5 / 5.4
ALLWHO	Count of WHO + ITPWHO	0 - 10	3.2 / 2.1
ALLMEAS	Count of MEAS + ITPMEAS	0 - 10	1.6 / 1.9
ALLIMP	Count of IMP + ITPIMP	0 - 5	.34 / .76
UniqueGov	Like UniqueITP this indicates solution completeness considering both ITP and non-ITP governance tags	1 - 4	2.8 / .79
Indicates Understanding of Risk Assessment Norms			
RISKCTRL	ITPCTRL + CTRL + RISKPROB	2 - 17	7.7 / 3.1
	Indicates a risk/control perspective in which a risk or a goal is matched to a solution or a risk is mentioned (presumably related to a solution) in such a way as to indicate probability – a chance of something bad happening.		
Indicates Understanding of Business Alignment Norms			
BUSGOAL_VAL	Count of BUSGOAL_VAL	0 – 8	1.4 / 1.5
BUSEFF	Count of BUSEFF	0 – 5	1.0 / 1.1
BUSCTXT_ID	Count of BUSCTXT_ID	0 - 4	.47 / .87
BUSCB	Count of BUSCB	0 – 4	.97 / .98
AlignmentTags	BUSGOAL_VAL + BUSEFF + BUSCTXT_ID + BUSCB	0 - 13	3.8 /2.7
CTRL+Align	AlignmentTags + CTRL + ITPCTRL	2 - 24	10.2 /4.2
The Business Alignment Norm tags may have been neglected by the coders who probably coded many instances of these tags as controls. CTRL+Align addresses this possibility.			

Appendix 2

NAA Study Tests for Normality

Table 35 presents the test for normality of all independent items, and none are normally distributed (note Sig. < .05). All are positively skewed; however RC_1 and ACT_3 fall outside of the acceptable range 1.0 to -1.0 (Field, 2009). Three items: RC_1, ACT_4 and ALIGN_2 have positive kurtosis outside of the acceptable range 1.0 to -1.0 (Field, 2009).

Table 35. Tests for Normality

	Kolmogorov Smirnov	Sig.	Shapiro Wilk	Sig.	Skewed-ness	Kurtosis	Mean	Std Dev
RC_1	.262	**.000**	.847	**.000**	**1.258**	**2.42**	2.87	1.12
RC_2	.234	**.000**	.877	**.000**	0.929	0.38	2.81	1.40
RC_3	.150	**.001**	.932	**.001**	0.462	-0.49	3.49	1.58
IMP_1	.133	**.004**	.937	**.002**	0.165	0.68	4.06	1.56
IMP_2	.152	**.001**	.937	**.002**	0.187	-0.86	3.76	1.78
IMP_3	.224	**.000**	.884	**.000**	0.844	-0.98	3.41	1.53
ACT_1	.217	**.000**	.907	**.000**	0.514	-0.03	3.9	1.69
ACT_2	.187	**.000**	.923	**.000**	0.458	-0.75	3.18	1.55
ACT_3	.272	**.000**	.830	**.000**	**1.322**	-0.60	2.32	1.34
ACT_4	.301	**.000**	.849	**.000**	0.978	**1.72**	2.51	1.30
ALIGN_1	.175	**.000**	.922	**.000**	0.413	0.28	3.22	1.70
ALIGN_2	.150	**.001**	.938	**.002**	0.247	**2.42**	3.76	1.68
ALIGN_3	.185	**.000**	.944	**.004**	0.236	0.38	3.75	1.56
ALIGN_4	.229	**.000**	.888	**.000**	0.869	-0.49	3.09	1.49

NAA PLS Cross Loading Correlations

The cross loading correlations between the MV and LV which is presented in Table 36. The columns represent the three LV constructs, while the rows are the MV items. The numbers in the table indicate correlations. While there is no set range for cross loading, the narrower the range and higher lowest loading, leads to greater convergent reliability (Esposito Vinzi et al., 2008). Some cross loading is present between the IMP and RC manifest variables, but there are more correlations with ALIGN and the other manifest variables. This is an indicator that alignment is not a separately identifiable latent variable based on the manifest variables available.

Table 36 NAA Cross loadings between MV and LV[a]

	ALIGN	IMP	RC
ALIGN_1	0.73	0.6	0.56
ALIGN_2	0.86	0.71	0.66
ALIGN_3	0.66		
ALIGN_4	0.84	0.73	0.76
IMP_1	0.61	0.81	
IMP_2	0.79	0.9	0.65
IMP_3	0.65	0.85	0.58
RC_1	0.61		0.84
RC_2	0.57		0.71
RC_3	0.68	0.7	0.85

[a]Values below .5 suppressed for readability

Appendix 3

AFBP PLS Cross Loading Correlations

The cross loading correlations between the MV and LV from the AFBP study is presented in Table 37. The low cross loading and narrow ranges indicate convergent reliability between all constructs.

Table 37 AFBP Cross loadings between MV and LV[a]

	ACT	IMP	RC	IT Quality
Act_1	0.58			
Act_2	0.8			
Act_3	0.73			
Act_4	0.7			
IMP_1	0.52	0.86		
IMP_2		0.81		
IMP_3		0.84		
RC_1			0.84	0.51
RC_2			0.87	0.66
RC_3			0.71	
OS_1				0.67
OS_2				0.6
OS_3				0.56
OS_4			0.5	0.81
IS_1			0.5	0.8
IS_2			0.53	0.75

[a]Values below .5 suppressed for readability

Appendix 4

PHARMA PLS Cross Loading Correlations

The cross loading correlations between the MV and LV from the PHARMA study is presented in Table 38. Because of the limited number of items used in this study, the table's value is limited to reviewing alignment items. While all three alignment items do converge, there is some cross loading with the MI item.

Table 38 PHARMA PLS Cross loadings between MV and LV[a]

	ALIGN	RC	MI
RC_2		1	0.56
IMP_2	0.68	0.56	1
ALIGN_1a	0.94		0.73
ALIGN_2a	0.85		0.51
ALIGN_4	0.76		

[a]Values below .5 suppressed for readability

Appendix 5

BIS PLS Cross Loading Correlations

The cross loading correlations between the MV and LV from the AFBP study is presented in Table 39. The low cross loading and narrow ranges indicate convergent reliability between all constructs.

Table 39 BIS PLS Cross loadings between MV and LV[a]

	ALIGN	IMP	RC	SUB	IT Quality
RC_1a			0.63		
RC_2			0.7		
RC_4			0.73		
RC_5			0.86	0.5	
IMP_1a		0.76			
IMP_2		0.6			
IMP_4		0.82			
IMP_5		0.86			
ALIGN_1a	0.78				
ALIGN_2a	0.79				
ALIGN_4a	0.64				
ALIGN_5	0.72				
ALIGN_6	0.7				
SUB_2				0.58	
SUB_3				0.76	
SUB_4				0.79	
SUB_5				0.71	
SUB_6				0.57	
SUB_7				0.76	
IS_1					0.44
IS_2					0.47
OS_1					0.77
OS_2					0.82
OS_3					0.86

[a]Values below .5 suppressed for readability