BREAKING DOWN THE ROOT CAUSE FOR THE KNOWLEDGE/CULTURE GAP BETWEEN TESTING AND BUSINESS

Author: Jeremy Berriault

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Project Supervisor: Mark Alpern

ABSTRACT

Software Testing is the last step in the software development process, for the sole purpose of quality assurance; that the product is delivered a close to fault free as possible and meets the expectation of the Business. Although the Testing group within an organization has multiple partners throughout the process testing group, the most important linkage is with the Business group because they are the key stakeholder – the group that typically make requests for information system changes. Communication between these two groups must be fluid and bi-directional with each group trusting and valuing the other's input. The Testing group needs to understand what the Business group wants, create work products to meet those needs and provide assurance that the product functions as expected with little risk of failure. Like the Testing Group, Business must understand the Testing group's role and their requirements to provide a quality product. Unfortunately, there is a gap between these two groups causing a disconnect - resulting in lack of knowledge sharing, trust and value for each other's role within the organization.

In a project environment these three focal points of the relationship contain multiple sub components that if not understood by both groups, can create a strained connection. In a team environment **trust** is important to the success of any initiative. Clear **communication** regarding the work effort and **costs** involved is necessary to ensure buy-in by both parties to produce a quality product.

Loss of trust can cause decreased value of one group for the other. Although Testing groups provide more value to the organization than executing test cases and reporting issues, frequently their role is not identified in other terms by Business. Lack of knowledge by the Business group generates a perception that the testing phase of the project creates a bottleneck in production and is related to Testing's inefficiency. Information sharing with Business is needed to assist in understanding of the testing process required to ensure reduced risk for the organization. Testing also must fully understand the value of their contribution to quality assurance and prevention of organizational risk. Testing must market themselves to their Business partners.

The most important aspect of any relationship is understanding the stakeholder. Without that appreciation, all forms of relationship building will fail. Each group must not only be aware of what each group is capable of, they should also understand how their production partners communicate and what the priorities are. Testing groups have the ability to improve the quality of changes early in the process and ensure the value of future projects through quality assurance processes. If Testing is unable to identify with Business groups and convey their messages effectively, then the opportunity for knowledge sharing is lost.

This Applied project uses the meta-data of two studies on the subject of the interaction of Business and IT Testing: Basellier (2003) focused on the knowledge that each group has for the other (Business and IT) and Willcoxen & Chatham (2004) considered the perception each has for the other (Business and IT). The purpose of this analysis is to determine a correlation between what they know and how they feel. This is clear with issues regarding trust and knowledge gaps. The negative perception of each group for the other can be correlated to a lack of knowledge related to their roles within the project process. Questions regarding value indicate the same relationship issues with both groups; and Testing identifies they do not have a clear picture about what they can bring to an organization.

To improve the strength of the relationship, recommendations are outlined involving Testing and Business leadership which will improve communication and understanding;

ultimately resulting in the development and production of a stronger end product. Although the term marketing management is normally focused on attracting clients, it is recommended that Testing consider sharing information about the value of their role within the organization. Strategic management models are identified to assist Business and Testing methods for achieving a partnership with equal involvement that values the strength of the other to succeed. Bi-directional communication is advocated to ensure knowledge sharing, collaborative decision making and appropriate quality assurance practice that will reconnect these groups and benefit the organization.

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1 INTRODUCTION

1.1 Statement of the Problem

In the software testing industry it is imperative that all possible major risks involved in the introduction of new software or software enhancements have been acknowledged and resolved before distribution to the clients. Business groups within organizations rely on the expertise of the Testing groups and yet there remains a gap between the two. This gap can create increased frustration for each group, creating communication barriers that impact productivity and efficiency within the partnership. The affiliation between Testing and Business should be fluid and effective to ensure benefit for the organization's internal stakeholders and quality products for their clients.

1.2 Sub-Problems

Areas of trust, value and knowledge will be considered to determine the main reason for the strained relationship between Testing and Business.These components will contribute to the use of an improved model to close this communication gap.

In a relationship between two closely tied working groups, trust is required to create an effective workplace environment in which each partner has confidence in the decisions of the other (Holste & Fields, 2010). Investigation into the level of trust between Testing and Business departments will provide insight into the potential impact on the organization when there is a lack of value within the relationship for each other.

The determination of value is bidirectional and it is the responsibility of each faction to guarantee a clear understanding of their individual capabilities. Acknowledgment of a department's value potential by the organization or their workplace partner suggests that the group will be used to its fullest capacity. To understand the worth of Testing's expertise by Business, analysis of their appreciation for risk identification and risk prevention related to product quality and the organization's reputation will be completed. Further data examination will consider why Testing groups are unable to communicate the full substance of their expertise to the organization which is broader than just actual software testing.

Knowledge is important for groups within an organization to ensure work is completed efficiently and correctly. Lack of information sharing between Testing groups and Business departments creates barriers which decreases team effectiveness within an organization. Establishing cause for the knowledge gap between Testing and Business groups will assist in the resolution of the trust issues and lack of value which will be identified in the analysis.

1.3 Purpose of this Study

In an era where technology is continually advancing and improving, the way of life and value for organizations introducing quality software products are vital. Within these organizations one of the most important relationships is between Business and Testing. Testing groups are consumers of multiple disciplines (Figure 1) and provide assurances to Business that requests are completed to their satisfaction. Communication must afford an avenue to enhance understanding of rising issues through detailed explanations which are clear not only to the developers but also to Business to provide vision of the final product.

Figure 1 - Groups that work with Testing

To ensure a quality outcome and effective communication with the entire team, Testers require the ability to understand both sides of the project: technology and business. In software development the most important relationship is between Business and Testing and communication must afford an avenue to enhance understanding of identified issues through detailed explanations. Developers must be able to understand the justifications and Business must be able to recognize their vision in the final product.

Within the last 10 years there have been multiple studies and scholastic papers focused on differences between technology and business at a general level such as Bassellier & Benbasat, 2004; Bassellier, 2003; Blaize & Benbasat, 2000; Martin, Hatzakis, Lycett, & Macredie, 2004; Willcoxson & Chatham, 2004; and van Den Hooff & De Winter, 2011. Despite the advancement of technology in the Business sector, research into these underlying issues of disconnect have not been fully evaluated. In one of the recent research studies that occurred in 2011 by van Den Hoof & De Winter (2011) who considered the social aspect of the detachment between these two groups. Their focus was the overall relationship between the Testing Group and Business departments.

Comparison of those findings and overall observations will provide an enhanced understanding of the detailed rapport between these two disciplines. The result will afford discussion about the use of relationship and communication models which may assist the tow groups to improve their association. Determining the underlying aspects of this disconnect will contribute to future studies of sub relationships such as Project Management, Architecture, Environment, and Development (Figure 1) which would provide a better understanding of the Software Testing discipline.

1.4 Hypotheses

The following hypotheses have been determined to consider why there is a strained relationship between Testing and Business groups. Proving or disproving these assumptions will provide guidance in creating an improved communication model which when implemented may strengthen ties between these groups.

1.4.1 Hypothesis 1

Testing groups do not close the knowledge gap with Business to prevent communication issues during projects.

1.4.2 Hypothesis 2

Testing and Business groups do not fully understand the value a full quality assurance testing department can bring to the organization.

1.4.3 Hypothesis 3

Testing group leadership culture creates a barrier that strains the relationship with the Business group.

1.5 Limitations of the study

This research will not provide insight into specific software delivery models where the levels of communication between disciplines may be affected by different processes. Certifications within the two disciplines, such as ones through QAI, have not been identified and therefore will not provide any data that will impact results.

1.6 Definition of terms

Testing Group: a collection of Information Technology (IT) professionals who conduct different types of testing functions on software to ensure that changes improve function and are consistent with a quality product.

Business Group: a collection of professionals who analyze the industry market and who make change requests to the information systems to meet the needs of the organization and maintain competitiveness.

1.7 Abbreviations

IT – Information Technology
QA – Quality Assurance/Testing
CMM – Capability Maturity Model
IEEE – Institute of Electrical and Electronics Engineers
BA – Business analyst
PM – Project Manager
QAI – Quality Assurance Institute
SDLC – Software Delivery Life Cycle

1.8 Assumptions

Assumption i
Software testing groups are part of the IT set of groups. Any information regarding IT can be related to the perceptions and knowledge within the sub groups,

Assumption ii
Business departments that are involved in the SDLC, specifically the testing phase, have the same perception and knowledge of IT as overall Business.

Assumption iii
There is a project management methodology and governance that is followed within the SDLC.

Assumption iv
Business includes the following roles: business leads, business analysts and management

Assumption v
When discussing data used during the analysis chapter the mean and median are equal.

2 REVIEW OF RELATED MATERIAL

Chapter 1 introduced the foundation for this research regarding the proposed analysis of the identified issues. This segment will present a literature review of the previous theoretical and conceptual research related to these problems. Subsequent chapters will consider secondary data from previous research, to provide direction in determining potential solutions and to strengthen the relationship between the Testing and Business groups.

In today's business environment technology is required to meet the needs of commerce. As a prime link, Testing is the last group in IT that ensures requirements are met and the technology works according to plan.There is a necessary connection between IT and Business that must be strengthened to satisfy those demands.The last twenty years has produced research that considered the behavioral and perceptual differences between technology and Business groups. Thus far research has included investigative articles which highlight the differences between IT and Business goups and publishings that incorporate quality assurance (Bassellier & Benbasat, 2004 ;Cao, Wiengarten, & Humphryes, 2011; Huffman Hayes, 2002; Martin, Hatzakis, Lycett, & Macredie, 2004; Politis, 2003; van Den Hooff & De Winter, 2011; Lewis, 2009; Black, 2002; Craig & Jaskiel, 2002). A collection of specific disciplines within IT was used used in those analyses with the focus on the *general level*. However, to date there is no available significant investigation that separates specific groups within IT to determine the strength of their relationship with Business.

This chapter will consider: trust, value and knowledge theories in relation to the perceptions of Business and Testing (IT). These concepts wil help determin the strength of a relationship and the effect on efficiency and project success.

2.1 Determination of trust

Trust is a major component of relationships between individuals and groups; lack of trust creates issues that will impact the productivity of the working relationship (Dirks & Ferrin, 2008). Ironically testing was created based on the lack of trust of other departments. When

clients found fault in the finished products a need was identified to create a group of specifically skilled technicians who would find and resolve the issues in the product prior to release to the consumer. These "Testers" were given governance to do appropriate quality assurance testing and make changes to the software to certify the superiority of the finished product at the time of dessemination to the consumer (Lewis, 2009). Perhaps when Lewis (2009), who documented the history of testing, stated that those who created change were those who did the testing generated a feeling of mistrust that Testing may have more control than Business in the manufacturing of the product.

Conceptually it has been argued that trust between peers is based on their view of each other's ability, benevolence and integrity which is displayed during completion of specific tasks (Hassan & Semerciöz, 2010; Holste & Fields, 2010). This observation of ability and integrity falls within the theoretical framework of trust provided by Dirks and Ferrin(2008) in which previous concepts of *Cognitive* and *Affective* forms were translated into *Relationship* and *Character* based theories of trust. Although Dirks and Ferrin focused on trust in leadership the concept can be used as a model between peers in any relationship building process. The perception of trust within the IT and Business relationship has been empirically demonstrated in quantitative research by Wilcoxson and Chatham (2004): that perceptions between these two groups potentially affect productivity and efficiency in the overall project work effort (Politis, 2003; ; Fairholm, 2006; Foster & Jonker, 2005).

Additional analysis identifying different levels of knowledge and understanding concerning IT and Business suggest these stages have contributed to a lack of confidence and poor perception between the two groups (Bassellier & Benbasat, 2004; Martin, Hatzakis, Lycett, & Macredie, 2004; van Den Hooff & De Winter, 2011). Creating extra rework may cause a loss of trust from stakeholders who's confidence in the group's productivity and ability to provide an effective service is lost (Hassan & Semerciöz, 2010). As an example: one study found a decrease in an organization's overall efficiency due to product testing and work load. Insisting on a higher workload increased quantity which did equate to quality because of the increase in the amount of rework over time (Berriault, 2011). This lack of faith in their ability could be avoided through better understanding of the testing practice by the Business groups. This potential deficiency in knowledge regarding the process will undoubtably affect the perceptions of Business for Testing and contribute to a lower level of trust (Bassellier, 2003).

2.1.1 Distribution of knowledge

Knowledge plays an important part in whether individuals and groups trust each other. The use of tacit (personal experiences, difficult to document) and explicit (process or application knowledge that can easily be documented) knowledge provide experiences which could positively or negatively affect one's confidence in others and their overall performance (Holste & Fields, 2010; Khanbabaei, Lajevardi, & Kohsari, 2011; Alshawi & Al-Karaghouli, 2003; Nonaka & Konno, 1998).

A model that utilizes a strong level of knowledge between members is considered a *work team* association; however there are multiple factors required that contribute to such an alliance before it will occur, i.e.: management support, shared language, supportive climate and sharing of resources (Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009). Without these conditions it would be difficult to guarantee knowledge is appropriately distributed within the organization.

This type of a conceptual model which is based on social capital including structural, relational and cognitive dimensions describes the interaction of knowledge transfer that gives an organization advantage over competitors (Vandaiel, 2007). Vandaiel identifies The *Socialization, Externalization, Combination and Internalization* (SECI) model which applies knowledge creation and distribution from individuals to organzation as a complimentory model for tacit and explicit knowledge (Nonaka & Konno, 1998).

Holste and Fields (2010) were able to conclude that there is a level of *affect and cognitive based trust* that is related to the willingness of people to *share* their knowledge. These findings also relate to the *Relationship and Character* models detailed by Dirks and Ferrin (2008) in which they determined that there was a *relationship belief* in the information that an individual provides. This belief is determined by personal traits such as altruism, courtesy and conscientiousness.

Alshawi and Al-Karaghouli's (2003) research focused on the culture clash between Business and Development groups. During the requirements gathering process, their findings indicated that knowledge between Business and IT created different understandings. This lack of "common" knowledge relates to each group's interpretation of the other's needs as determined by their individual explicit and tacit information about how each group works (Alshawi & Al-Karaghouli, 2003).

Further, Alshawi and Al-Karaghouli found the gap between the groups had the ability to shrink when a stakeholder management tool of *symmetrical communication* was used as described by Foster and Jonker (2005). The two-way communication between Business and Development groups helped to ensure the distribution of knowledge which benefited both parties during product development (Alshawi & Al-Karaghouli). This plan also coincides with van Den Hoof and De Winter's (2011) hypothesis regarding the *relational and cognitive* components of *social* capital which considers performance success or failure between Business and IT. Their research concluded that there is a need for collaboration between the two groups to create shared understanding (van Den Hooff & De Winter, 2011; Foster & Jonker).

Lam (2005) has indicated through his cultural model that there are other issues with knowledge sharing that block an organization's movement from a *work group* to a *work team.* Individual and group perceptions of different scenarios in capturing, distributing and reusing knowledge, are sources for a lack of information sharing (Lam, 2005). This theory contradicts the suggestion that Business is willing to have knowledge in common with IT.

Basseller and Benbasat developed a structural model which included IT/Business competence. The purpose of this plan was to provide a connection to measure each group's objectives. The findings suggested that knowledge management was considered lower priority for Business competence compared to IT capability (Bassellier & Benbasat, 2004). This was accomplished through a series of surveys completed by IT and Business professionals. Seven aspects which influenced their overall partnership were considered (Bassellier & Benbasat). These factors: *organizational overview, units, and responsibility, IT-business intergration, knowledge networking, interpersonal communication, and leadership* were identified as important when used separately by individuals. However, a definite coorelation was also acknowledged related to improved communication between disciplines when multiple factors were used together (Bassellier & Benbasat; Bassellier, 2003).

Culture plays a large part in how knowledge is distributed and how it will affect trust between individuals and groups. "OPTAPAC" is a model that was developed to create a

working culture through *Openess, Collaboration, Trust, Avoidance of negativity, Proactive decision making, Autonomy or self-direction and functional Conflict* (Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009). When appropriately applied this method encourages a positive situation where individuals and teams may effectively work together (Golden Pryor et al.). Words frequently used today in building teams and trust such as transparency, consultation, commitment, positive relationships and determination, can be compared to the OPTAPAC model.

2.1.2 Costs of effort

Every task that involves analysis and validation incurs costs. Testing requires a specialized skill-set which is dependent on gathering information from multiple groups (Figure 1) to ensure that the required changes to the system are high in quality. This specialized tacit and explicit knowledge provides the resources to estimate the effort for a project and quality costs (Nonaka & Konno, 1998; Lewis, 2009; Black, 2002). Business partners require all expected costs involved in testing the software life cycle for budget administration (Black; Lewis). This type of analysis and management requires the use of some of the components that Pfeffer and Sutton (2006) provided in their research: *No brag, just facts and the need to sell it,* to provide transparency.

Appropriate and accurate analysis facilitates credibility for organizations and leaders from others (Pfeffer & Sutton, 2006). Providing full details of the Testing group's ability and expertise in a straight forward way reveals the passion in what they do and will provide credibility to the accuracy of their information. This expectation correlates with Dirks and Ferrin’s findings on information and character traits (Dirks & Ferrin, 2008).Therefore it is important for organizations to ensure that hired individuals for testing positions should have the skill and knowledge required within the discipline (Choong, 2005).

Despite recognition of the expertise of this skill, research indicates there is a decreasing relationship between IT and Business related to issues of cost effectiveness (Willcoxson & Chatham, 2004). Budget limits are sometimes strained by aspects outside of the normal costing of a project’s testing effort and require full reporting to correctly provide the whole story to stake holders to improve understanding (Black; Craig & Jaskiel, 2002).

Testing metrics such as *Return on Investment Defect Detection Percentage, and Costs of Defects* could provide information regarding improved effectiveness between the teams (Black; Lewis). This theory proposes improvements on the defect tracking process which advances the development process and becomes an organization wide knowledge management tool with regards to costs (Berriault, 2012). This type of complementary information that provides data to improve knowledge and efficiency has also been demonstrated by Bassellier (2003). This study considered knowledge management from IT and Business perspectives and looked at the confidence that IT and Business had in each other. Data collected from each group included rating each group's level of knowledge about the other (Bassellier).

The *Cognitive Social Capital* dimension assists in detailing the problems that Business has with IT such as a lack of understanding about Business by IT. Unfortunately this research does not consider the reverse, that possibly Business does not understand IT's function. This suggests a lack of knowledge about testing and the value associated with this function (van Den Hooff & De Winter, 2011). This proposal supports Choong’s (2005) findings regarding the education structure for systems analyst which does not provide appropriate real world

knowledge to assist in communicating with their Business peers. There is also the suggestion that knowledge gained only through hands-on experience without formal training does not allow for a full understanding of productivity needs and will negatively affect costs through duplication of work (Berriault, 2011).

2.1.3 Management

In simple terms IT and Business groups do not speak on the same wavelength. Literature suggests this language defecit is a result of improper knowledge management creating situations where communication differences affect performance (Willcoxson & Chatham, 2004; Bassellier, 2003). Wilcoxson and Chatham studied the perception each group had of the other, while Bassellier looked at the knowledge that each group had about the other. These findings align with the *relational social capital dimension* which identifies a general agreement that the two groups think differently. The Relationship and Character Trust model suggests that within the group's leadership, the individual knowledge base and experience affects how they manage their peers (van Den Hooff & De Winter, 2011; Dirks & Ferrin, 2008). While studying the relationship between work teams and knowledge management, Khanbabaei et al (2011) determined that a common language between teams would positively impact performance, which assists in supporting van Den Hooff & Winter.

A conceptual model developed by Cao, Wiengarten, & Humphryes, (2011) considered contingency theory and resource based value in combination to determine Business value and provide clues to the disconnect between these groups. Five components were illustrated: strategy, structure, power/politics, process and culture. This model provides some insight into the communication methods between IT management and Business. The concept outlines possible means of resolving difference of opinions which may create added stress in the completion of tasks (Cao, Wiengarten, & Humphryes, 2011). In this assumption, structure, process and culture are linked to Politis' research (2003) on self-managing team performance. This suggests there is a relationship between value and the level of confidence that Business has with IT . These management issues are viewed by Golden-Pryor et al. (2009) as two sides (Testing and Business) that function as *work groups* rather than as *work teams* because they work independently with a lack of mutual accountability.

2.2 Determination of Value

In any organizational group more value is associated with effort than may be perceptively appreciated. Consider the analogy of the Indian Legend about the elephant and the three blind men Each man is given little information except their perception of touch on different parts of the elephant's body. Each man has a different conclusion as to what he is feeling not knowing that it is an elephant. This analogy explains how different perceptions occur when full details about the situation are not provided to all stakeholders (Black, 2002). Software testing groups role is in a similar situation related to a perceived value by Business; not knowing how they work or why the work is done in a certain manner can create misconceptions despite Testing's known ability to provide multiple resources for utilization. Understanding Testing`s value and developing this asset can improve many facets of an organization (Politis, 2003; Black, 2002; Craig & Jaskiel, 2002; Lewis, 2009; Berriault, 2012). As *transformational leaders,* in a *work* team environment IT has the ability to be a catalyst in the creation of *high performance* project teams (Dvir, Avolio, & Shamier, 2002; Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009; Daniel & Davis, 2009). The determination of value

for this group lies not only with Business but also with the Testing group itself to ensure they fully understand their capabilities (Cao, Wiengarten, & Humphryes, 2011).

2.2.1 Inability to know full impact to organization

Literature supports hiring specialized skill sets to meet the specific needs of Business, one of which would be Testing. In the IT testing field there are publishings which will assist management to identify employees who are true testers (Choong, 2005; Black, 2002; Craig & Jaskiel, 2002; Lewis, 2009). For example the Institute of Electrical and Electronics Engineers [IEEE] Standards provide insight into the value that software QA groups can provide through a series of expected *Testing Best Practices* use throughout the entire software development process.

The value of the Testers lies in part as leaders in the provision of added input into the level of successful initiatives that will reduce the amount of costly rework normally occurring at the end of a project (Feldman, 2005). As well, continued issue analysis found throughout the project life cycle provides uninterrupted improvements which can be completed while all teams continue to work on the same project (Berriault, 2012). This is a form of *indirect leadership* which has been studied as a desired element of the T*ransformational Leadership Theory.* This theory identified the use of subtle motivation and empowerment which improved performance with outside teams (Dvir, Avolio, & Shamier, 2002).

These results compare to the components of empowerment and communication identified by Golden-Pryor et al.(2009) as criteria needed to create a successful team. Their findings suggested that testing efforts and commitment affected not only the testing team but also outside groups (Golden Pryor, Pryor Singleton, Taneja, & Toombs). As much as Test groups are *transformational leaders* in providing data to help other departments improve, they are also *strategic* leaders. Rowe et al. suggested that strategic leaders do not look too far ahead in improvements and would rather focus on what is currently occuring and not what the impact would be in future initiatives. (Rowe, 2001; Rowe & Mehdi Hossein, 2009).

Test groups have the ability to provide upfront information on issues, but can also provide data and analysis on processes and procedures that could affect a more efficient organization (Berriault, 2012). Introduction of improvement suggestions would be impacted by lack of buy-in from the organization and would require marketing by the Testing groups (Kotler & Keller, 2009). Kim and Mauborgne (2003) documented a series of barriers a leader would need to overcome, to achieve acceptance and enhancement within an organization.They related skill and expertise in relation to management of: *cognitive, resource, motivation and political hurdles* as necessary (Kim & Mauborgne, 2003).

The use of *Six Sigma* and the *Capability Maturity Model* (*CMM)* frameworks could provide improved production and high quality results with increased QA involvement throughout the project life cycle. This outcome is identified in a case study by Jiju and Fergusson (2004) regarding the use of these methodologies and on the advantages of true QA in software testing. Despite recognition of the QA group's (Testing) importance to these projects Business does not appear to understand the actual testing function. Possibly, this is a reason for the lack of qualified and skilled individuals hired for IT positions with an organization. For example the hiring staff do not understand the organization`s needs when considering the expectations of the Testor`s contract. This sets the employee and organization into a perilous position because the lack of Testing knowledge restricts the employee communication ability (Choong, 2005). Such a situation contributes to an ineffectual

relationship between Testing and Business groups related to an inability to provide the right message strategy with appropriate objectives to the consumer.

Sinek (2009) suggests there is a right and wrong way to provide offered services and ensure buy in by others. Although they are two internal groups within the same organization Sinek argues that the *why* in the testing organization is more important before the *what* and *how* to properly market testing to their partners (Kotler & Keller, 2009: Craig & Jaskiel, 2002). This dialogue supports the consideration that knowledge management and relationship building occur when both sides understand what the other is doing; thus improving trust that each can effectively complete their work with little intervention from the other (Bassellier, 2003; Hassan & Semerciöz, 2010).

2.2.2 Control

Accepting the value of a group includes an ability to trust and collaborate in good faith creating a strong partnership. Business and IT have developed an adversarial relationship related to monitoring of costs and performance measures (Daft & Armstrong, 2009, p. 171). This controlling nature of Business relates directly to their level of trust for IT function (Bassellier & Benbasat, 2004; Willcoxson & Chatham, 2004). Based on their research on *system requirement gathering* between technology and business, Alshawi and Al-Karaghouli(2003) created a rich image detailing different views and perceptions IT and Business expressed during a project. Their representation indicated that Technology feels controlled by Business through budget constraints and lack of trust (Alshawi & Al-Karaghouli, 2003).

This is a *Political Hurdle* in that there are internal opponents creating barriers to a group's function and productivity (Kim & Mauborgne, 2003).These roadblocks create a lack of confidence in the Testing group's competance and a loss of IT credibility. Business may become cynical and untrusting feeling the need to further control the Testing group by decreasing their power (Kouzes & Posner, 2005). The effect of reduced empowerment, according to Gill (2003), has a direct impact on the success of any change in the management system. The loss of power affects employee motivation towards change buy-in to the use of other testing models which may support organization improvement (Berriault, 2012).

This environment of control dispute between these groups is contrary to the accepted *Partnership* which includes a supply relationship and expected confidence in the consumer/provider link. To complete their tasks with little interruption in a *work team* environment, IT becomes the consumer who needs information provided by Business (Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009; Alshawi & Al-Karaghouli, 2003). The issue of control creates an adversarial situation causing the process to become operationally inefficient. (Slack, Chambers, & Johnston, 2010, pp. 389-390).

2.2.3 Bottleneck

From an operational standpoint testing groups must not only ensure the quality of their work and their products but also ensure dependability, speed flexibility and cost efficiency (Slack, Chambers, & Johnston, 2010, p. 89; Black, 2002; Craig & Jaskiel, 2002; Lewis, 2009). Although an important QA process element, IT can also create a bottleneck during the introduction of change because the testing phase occurs at the end of a product life cycle. This generates angst between these two groups a result of different mindsets: IT (get it done with high quality) and Business (just get it done on time). This relates to *cognitive dimension* as

considered earlier in building a *cultural gap* (van Den Hooff & De Winter, 2011; Martin, Hatzakis, Lycett, & Macredie, 2004). The *bottleneck* could also create an issue with *Character based* trust as Business may consider that the testing team is not working hard enough causing a slowing of production (Dirks & Ferrin, 2008).

On the other side, Testing may not understand the impact of time lines at the Business end. Overall stress is created for Testing if they feel undervalued due to a lack of Business insight into their production needs to ensure a quality product (Alshawi & Al-Karaghouli, 2003). For example the software development life cycle relies on a form of *Supply Chain* and scheduling is dependent on timely work completion from other groups. When scheduling is delayed by any group there is a direct impact on firm timelines. These delays cause increased costs in employee workload to meet the deadline through overtime and staff additions (Slack, Chambers, & Johnston, 2010, p. 400). Business places the responsibility for meeting timelines at IT's door because Testing is the final component in the project outcome.

2.3 Determination of Knowledge Gap

2.3.1 Understanding stakeholders

Communication between stakeholders is key in the software development process. This is ensured when suitability and urgency of messages are dealt with appropriately and promptly (Huffman Hayes, 2002). Failure to communicate effectively has been identified as an issue of process within the organization between Business and IT (Bassellier & Benbasat, 2004; van Den Hooff & De Winter, 2011; Martin, Hatzakis, Lycett, & Macredie, 2004; Bassellier, 2003). It is the process that Ibarra and Hansen (2011) recommended to CEO`s regarding creating a more collaborative organization by ensuring effective communication at the department level. They suggested this could be accomplished by encouraging group engagement when completing work. This model for increased flow of information is supported by the SECI model for knowledge creation which advocates improved knowledge and understanding of groups across the organization (Nonaka & Konno, 1998; Fairholm, 2006).

A loss of communication between groups also occurs when there is a disconnect between groups related to a poor view each other (Willcoxson & Chatham, 2004). This detachment can lead to decreased value for the importance of the group's role. This lack of understanding contributes to the knowledge gap and indifference between these two groups (Sinek, 2009). Although Business and Testing are not competitors, Bass (2007) suggests there is a separation between these two groups in the strategic practices for senior leadership because failure to create a successful team occurs when there is a lack of appreciation or understanding of each partner's capabilities. A need is identified for teams to include strong collaborators to support the apropriate use of communication resources (Bass).

2.3.2 Maturity Level

To understand the stakeholders and knowledge management, there must be a high level of relationship maturity between IT and Business. A conceptual relationship maturity model CMM (process maturity model for software development) has 5 identified levels of relationship strength ranging from a fragmented relationship to full participation. This theory considered qualitative data and an action study regarding the introduction of a new role (i.e. relationship manager) and the effect on group growth and solution processes to improve productivity (Martin, Hatzakis, Lycett, & Macredie, 2004). Martin et al. concluded that the use

of a relationship manager between IT and Business groups improved performance and rapport between them. Although the model discusses the use of a new role as an interpreter between IT and Business, the value of the model lies in the suggestion of using direct communication to address issues between specific groups. Identification of current roles and boosting crossover understanding of each group will assist effective communication thereby creating an improved *fit between* the groups supporting productivity (Cao, Wiengarten & Humphryes, 2011).

To improve relationship maturity within work teams, the use of a knowledge management model like SECI and a collaboration model could assist the Test team to become a change leader in the organization (Nonaka & Konno, 1998; Gill, 2003; Ibarra & Hansen, 2011).

2.4 Summary of review

The literature indicates there is little direct data regarding the relationship between Testing and Business. The last 20 years highlight differences between IT and Business in relation to communication, culture and quality assurance. Information considering the "why" in these communication difficulties is not easily available; however, trust or lack there of, has been studied in regards to productivity. Trust is considered an important aspect in the relationship and is noted to be directly related to product quality and production efficiency. It is the lack of trust between these groups that is considered to have been the impetus in developing specialized groups to test.

Research findings suggest that with trust comes value and that mutual understanding will create a work environment where collaboration and efficiencies can grow and fourish. The information gathered regarding group leadership and the relationship between IT and Business suggests there is consistently issue with their view of trust, value and knowledge gaps. Leadership has a strong role to play in ensuring there is a well-built relationship to ensure distribution of knowledge among their peers. Recognition and understanding of each other's roles increase the value held for the other production partner improving communication flow. That knowledge provides the confidence and improvements in communication as the level of understanding increases.

There is varying opinion in the available research about the level of understanding regarding the importance and recognized value for each group by the other. Tacit and explicit knowledge contributes to the consideration of confidence in others and is identified in the *work team* model. The SECI model is also acknowledged as a framework that uses knowledge sharing that supports affect and cognitive based trust. Therefore dessemination of knowledge is recognized as susceptable to communication models which will assist with the movement of departments from a *work group* to a *work team* relationship.

Communication between IT and Business is identified as a gap which increases costs. Similarly hiring unqualified technicians puts pressure on budgets through lack of understanding from both departments about the needs of the organization. Noted investigations reveal an inability to comprehend the importance of IT's resource capacity which can benefit the organization. This lack of understanding causes Business to exercise their power of control creating a perception of loss of control Testing.

Developed models identify department leaders as integral to communicating with each other and it is suggested that some management characteristics lead to poor knowledge management. This information sharing issue is difficult to resolve because Business and IT are

said to think differently which widens the gap and increases stress between them. The level of trust is decreased and employee work related self esteem is devalued.

Testers provide the last opportunity for quality assurance issues to be resolved and it is this positionin the product life cycle that Business and Testers do not appear to value. Frameworks have been identified that promote inclusion of testing input throughout the product life cycle which may improve the confidence level within the relationship. The more mature the organization is with process and communication the more efficient they should be. The current data and corresponding concepts regarding the relationship of IT (as a department) and Business, can be used to determine the relationship between Testing and Business. There are operational, strategic and internal marketing management strategies that can be used by both groups to strengthen the affiliation and ensure improved possibilities of success.

3 METHODOLOGY

Secondary data from multiple sources will be considered in the following methodology and analysis to support or refute the truthfulness of the stated hypotheses. The data used is based on quantitative research on IT and Business relationships. Each research result is focused on two separate issues that affect the relationship between the two groups. Bassellier (2003) provides linkages to the level of competence in the knowledge IT and Business groups have for each other and the effect on their relationship. The data provided is broken down into separate categories, knowledge and experiences, which are used to determine the causality of the perceptions each group has for the other (Bassellier, 2003). Analysis will be assisted with the discussion of Wilcoxson and Chatham's research which considers the perceptions IT and Business groups have for each other (Willcoxson & Chatham, 2004). The results from these studies can be found in Appendix A and B.

The data within the two studies were completed using dissimilar Likert scales. Bassellier used a scale of 5 and Wilcoxon and Chatham used a scale of 7. To provide data that can easily be compared, the results using the 7 point scale will be converted to a 5 point scale by determining the ratio of the score on the original scale and multiplying by 5. Although it will not be the actual score provided it will provide a baseline that will allow for easy comparison. Using the questions from both studies and the same Likert scale will allow an improved correlation and analysis within the specific groups.

Results from Wilcoxon and Chatham's perception assessment between IT and Business will be analyzed and an association with Bassellier's findings regarding knowledge management between the two groups will be provided. Comparison and analysis of the averaged results from each of the source data will provide the relationship between perception and competance to validate hypotheses 1, 2 and 3.

After the completion of the comparison between the two secondary qualitative results, conceptual communication and knowledge models will be used for further analysis. This additional analysis of trust, value and knowledge gap will lead to potential solutions that both groups will be able to utilize based on diverse operational, marketing, organizational and strategic models (Daft & Armstrong, 2009; Kotler & Keller, 2009; Slack, Chambers, & Johnston, 2010; Grant, 2008).

3.1 Data

3.1.1 Sub-problem 1

Investigate the level of trust between Testing and Business departments from an individual group's perspective which impacts overall communication and productivity.

3.1.1.1 Data needed

Data needed to identify the level of trust will be acquired through the replies to questions on responsibility, influence, communication, reliability and expectations. Responses for each question are averaged within the two main groups: Testing and Business with the assumption that IT and Testing are the same (Bassellier, 2003). Business competence for IT results are grouped into general categories and will be analyzed with leadership, knowledge and testing documentation to provide answers to the identified issues (Dirks & Ferrin, 2008; Hassan & Semerciöz, 2010; Holste & Fields, 2010; Politis, 2003; Fairholm, 2006; Foster & Jonker, 2005; Bassellier & Benbasat, 2004; Martin, Hatzakis, Lycett, & Macredie, 2004; van Den Hooff & De Winter, 2011; Berriault, 2011). These components will be compared to their relationships using Wilcoxson and Chatham's data.

This information will identify the commonality within each group's perception of the other and with the use of additional conceptual models and research the supplementary information will provide direction for this investigation (Khanbabaei, Lajevardi, & Kohsari, 2011; Nonaka & Konno, 1998; Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009; Vandaiel, 2007; Lam, 2005; Black, 2002; Lewis, 2009; Pfeffer & Sutton, 2006; Choong, 2005; Craig & Jaskiel, 2002; Berriault, 2012; Cao, Wiengarten, & Humphryes, 2011). This analysis will provide an understanding of the level of affiliation trust between the two groups and offer direction for conceptual models to improve trust that may be used and modified for specific groups.

3.1.1.2 Data treatment

Initial analysis will use the averaged results from questions listed for sub-problem 1 from Wilcoxson and Chatham's research (Appendix D). This data will be used in one half of the analysis to address the level of trust between the groups. The second half of the empirical analysis will involve the results of Bassellier's research on Business and IT competence. The following sections will be considered: knowledge of system development, knowledge of management of IT and experiences with IT projects for Business and organizational responsibility, interpersonally skills and leadership for IT professionals (Bassellier, 2003) (Appendix D).

Following completion of the initial analysis this paper will compare the studies' findings regarding level of trust and perception. This comparison will assist in the identification of specific communication models which will help improve those levels. The results from Dirks and Ferrin's study and other documented models will help to uncover methods to close the gap (Cao, Wiengarten, & Humphryes, 2011; Politis, 2003; Khanbabaei, Lajevardi, & Kohsari, 2011; Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009; Holste & Fields, 2010; Hassan & Semerciöz, 2010; Berriault, 2012: Foster & Jonker, 2005).

3.1.2 Sub-problem 2

Analyze the basis behind the lack of full value for the Testing department's expertise in preventing major risk to the organization by Business groups and the inability for Testing groups to communicate their value.

3.1.2.1 Data needed

Previously published data that determines the level of IT value that is based on responses from IT and Business will be identified. This information will also assist in determining the value placed by each faction within the Testing discipline. Using components of Bassellier's research and documentation regarding testing, leadership, and organizational theories will provide a baseline of information that will assist in solving the issues within the groups (Bassellier, 2003; Bassellier & Benbasat, 2004; Berriault, 2011; Berriault, 2012; Black, 2002; Craig & Jaskiel, 2002; Lewis, 2009; Politis, 2003; Cao, Wiengarten, & Humphryes, 2011; Feldman, 2005; Jiju & Fergusson, 2004; Daft & Armstrong, 2009; Slack, Chambers, & Johnston, 2010).

Specifics are required to identify the value that Business holds for the Testing group within their organization and the self-value held by the Testing department. This data will be collected using the analyzed responses to questions based on judgment, investment, success, effectiveness and value from Wilcoxson and Chatham's research (2004). Comparing components of Bassellier's results to Wilcoxson & Chatham's data will provide a base set of information that can be used to understand the value that each group has for one another (Bassellier, 2003; Willcoxson & Chatham, 2004).

3.1.2.2 Data treatment

Based on the averaged response results from Wilcoxson and Chatham's research, answers from questions listed for sub-problem 2 in Appendix D will be used to investigate the level of value between the two groups. These results will be compared to Bassellier's Business results on knowledge of system development, knowledge of management of IT, access to IT knowledge and experiences within IT projects.

Review of the data from the IT professionals in Wilcoxson and Chatham's research will provide insight into these issues and then compared and analyzed with the organizational overview, units and responsibility, knowledge network interpersonally skills and leadership response from IT professional responses in Bassellier's research (Bassellier, 2003; Willcoxson & Chatham, 2004). It is expected that these results will provide the actual expectations and amount of understanding of value each has for the other group. Following this initial analysis further inquiry into the determination of value and its impact on the project team's performance will be completed (Dvir, Avolio, & Shamier, 2002; Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009; Choong, 2005; Hassan & Semerciöz, 2010; Berriault, 2011; Berriault, 2012; Martin, Hatzakis, Lycett, & Macredie, 2004).

3.1.3 Sub-problem 3

Analyze the knowledge gap that exists between Testing and Business groups.

3.1.3.1 Data needed

The data required for this final sub-problem will be determined by the analysis of the previous two sub-problems. Verifying the level of trust and value between these groups will

clarify the existing knowledge gap. The baseline will be established with Bassellier's findings in comparison with Willcoxson and Chatham's (2004) research. The outcome of this evaluation will generate the data required to identify the level of understanding that Business and Testing have for each other regarding processes and needs (Bassellier, 2003; Willcoxson & Chatham, 2004; Bassellier & Benbasat, 2004).

Review of conceptual models and theories from other academic papers will provide additional information to support the analysis and validate the outcome (Cao, Wiengarten, & Humphryes, 2011; Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009; Khanbabaei, Lajevardi, & Kohsari, 2011; Lam, 2005; Nonaka & Konno, 1998; Huffman Hayes, 2002; van Den Hooff & De Winter, 2011; Ibarra & Hansen, 2011; Fairholm, 2006; Gill, 2003). It is expected that the data acquired from the previous two sub-problems plus the combination of the remaining components in this section will provide a suitable analysis to find the knowledge gap.

3.1.3.2 Data treatment

Data from Bassellier's and Wilcoxson and Chatham's research will be used for the foundation of this study (Bassellier, 2003; Willcoxson & Chatham, 2004). This data will be combined, compared and analyzed to identify areas of gaps. The additional information from the previous sub-problems will add support to these findings regarding the effect of trust and value on the knowledge gap between the two groups. Results will then be tested in theoretical models of organizational, operational, marketing and strategic management to determine if there are commonalities within documented issues in current testing publications (Black, 2002; Craig & Jaskiel, 2002; Daft & Armstrong, 2009; Grant, 2008; Kotler & Keller, 2009; Lewis, 2009; Slack, Chambers, & Johnston, 2010).

Data results from Bassellier (2003) and Willcoxsen and Chatham's findings (2004) will be collated and entered into the Comprehensive Meta-Analysis Version 2 (CAM v2) program to determine the statistical relationship between groups and individual questions (Appendix C). Correlation will be calculated using a positive directional effect function within the CMA v2 program. Correlation values and their definitions will be as follows:

0.00 = No relationship
0.30 = Weak positive relationship
0.50 = positive relationship
0.70 = strong positive relationship

The TM Plot manager add-in for Excel will be used to graph the results, with the minimum and maximum range equaling 1 to 5.

4 ANALYSIS

Gaps associated with knowledge and perception within the relationship of Business and Testing will be determined through the use of correlation analysis of the responses provided in Bassellier's study (n=576,) and Willcoxsen and Chatham's (n=1156) research (Appendix A, B) (Bassellier, 2003; Willcoxson & Chatham, 2004). The following table identifies the responses from IT and Business:

Study	IT Respondents	Business Respondents
Bassellier (2003)	109	467
Willcoxsen and Chatham (2004)	653	503

This investigation will focus on three sub-problems: Trust, Value and Knowledge gap to establish possible root causes of the relationship disconnect. The above data was applied to the CMA v2 and the resulting analysis provided a correlation output with an upper and lower limit. As previously stated the data from Willcoxsen and Chatham's (2004) study was converted from a Likert scale of 7 to 5 as described in the methodology to provide appropriate comparisons between this study and Bassellier's research (2003).

4.1 Trust

4.1.1 Business responses

Willcoxsen and Chatham's Business responses data for questions associated with trust resulted in a Mean of 3.01; on the 5 point scale the negative responses (disagree) fell below the 3 and the positive responses (agree) are above the Mean. The standard deviation was determined by averaging the study's standard deviations which is 1.02. Using statistic methodology regarding distribution and standard deviation, approximately 50% of the respondents had an overall rating of negative to neutral; a rating score of 1 to 3. These questions focused on communication, quality of service and reliability.

Questions in this study which were explicit to communication were scored at an average of 2.84 in the converted scale which is below the neutral rating (Standard deviation of approximately 0.94). Considering the original scores with the 7 point scale, the average score was 3.98 which is similar to the level on the 5 point scale. The responses from explicit questions regarding the level of experience in communication with IT groups are indicated in Appendix A and are BITP 4, 7, 14 and 16.

Bassellier's study divided Business's responses regarding their knowledge of IT into sections related to different components. These responses considered the level of knowledge and experience of the IT department as reported by Business, scoring from the lower end of little or none, to expert. Averaging the scores from knowledge of system development, management of IT, and experience in IT projects and Line leadership (Appendix D), provided a score of 2.55 (Standard deviation of 1.18). Knowledge of IT management and experiences in IT projects revealed the lowest averages with scores far on the negative (below the mean) side of the scale. The average scores of each study were calculated using the CMA program and were determined to have a correlation factor of 0.285 with a Z-value of 9.31. This result indicates a connection between perception and knowledge of IT from Business respondents.

The above correlation and scores relate to the level of trust of Business for IT and their ability to complete a task. A negative perception is developed when gaps in knowledge occur as verified in the response of BITP15. This question relates to the negative responses associated with the cost benefit of the project (Hassan & Semerciöz, 2010; Holste & Fields,

2010) and affects the *Relationship Trust* factor because a lack of understanding by stakeholders in a project can cloud judgement (Dirks & Ferrin, 2008).

Although there is correlation with all the questions involving communication, management and project experience identified in the previous section for sub-problem 1 regarding trust, further analysis of specific parings between the findings of Bassellier and Willcoxsen and Chatham's studies is required. As well, there is an association in questions related to change to IT systems and project work. BITP1 speaks to Business and their responsibility for *business benefits realization* for technology changes they have requested and used; for example: decreasing wait times for transactions.

BITC19 considers the participation of Business or their part in leading projects. The upper limit correlation of 0.505 with approximately 65% of the Business respondents stating they take responsibility for reaching the *benefits realization* with IT, suggests they may have had some involvement in the change process. However, approximately 60% of Business respondents state that they rarely, if at all, participated in the development of the system.

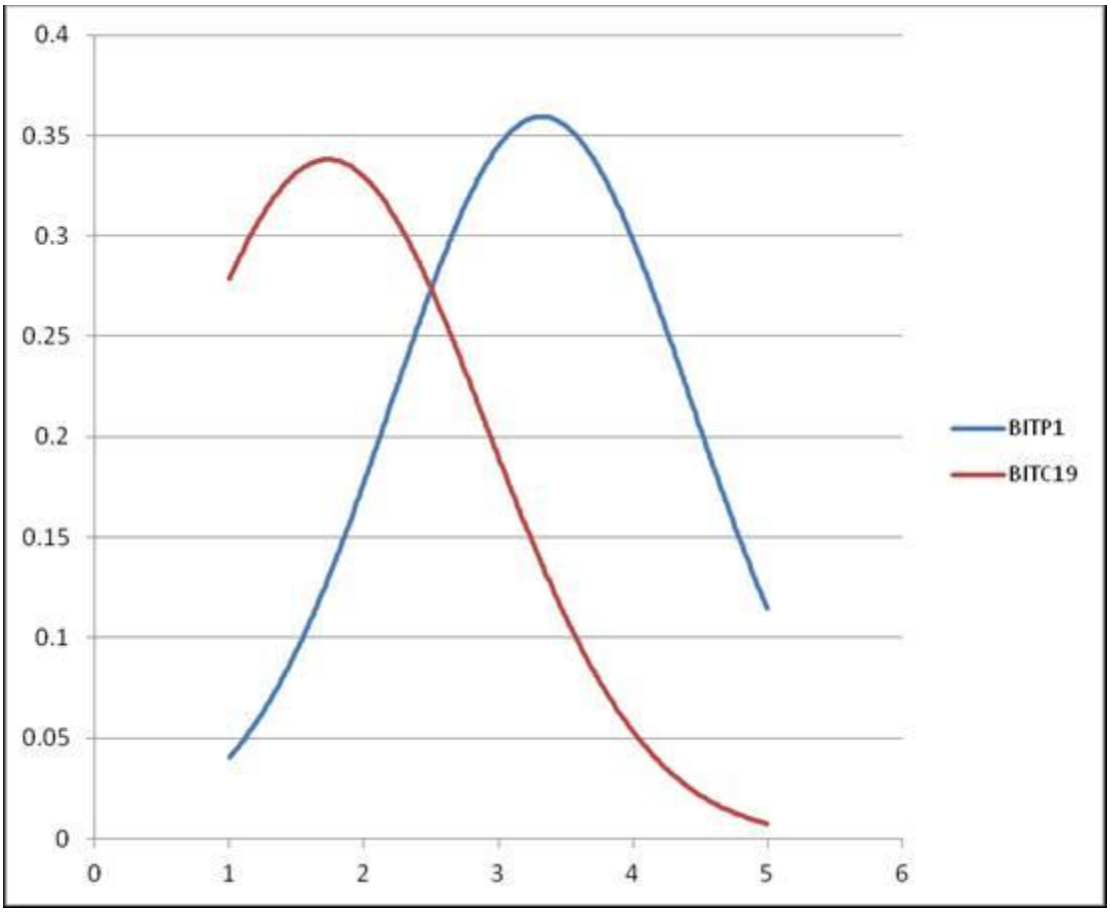

Figure 2

The depiction of data in Figure 2 indicates a skew to the left which would suggest that Business has a high level of trust for IT. Their responses point to a willingness to take responsibility for reaching the benefits while rarely participating in a project which demonstrates this level of trust for IT. Analyzing other combinations will provide a clearer picture of how communication and trust affect the relationship.

In Figure 3 the graph for both sets of data reveals cresting at 40% (BITP10) and approximately 32.5% (BITC1) on the negative side of the scale, this diagram suggests a lack of participation may contribute to communication breakdown between the two groups. Questions BITP10 and BITC1 reveal that information on procedures within the development and testing in software production are absent.

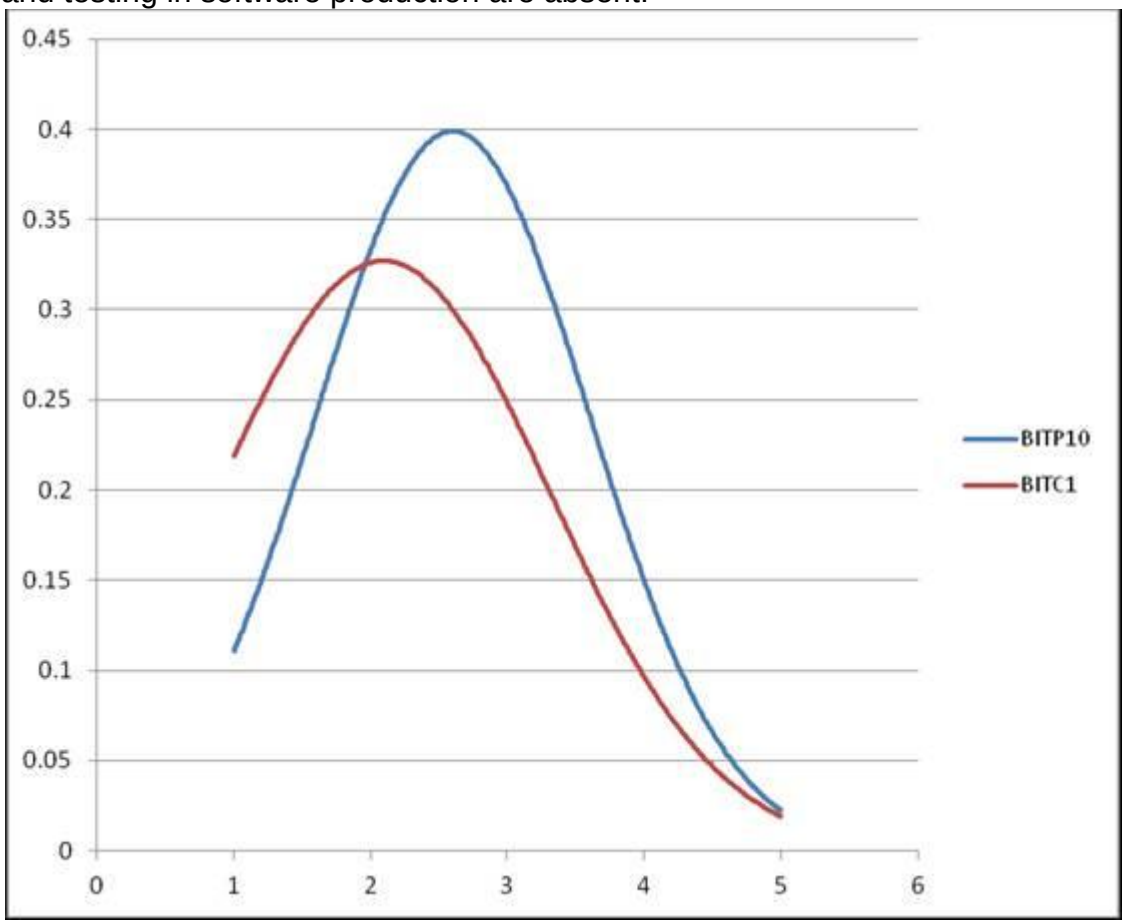

Figure 3

The results as graphed in Figure 3 slope towards the negative. The findings are not distributed evenly across all ratings and this shift to the left indicates the majority of respondents gave ratings of 1 or 2, compared to those that scored 4 or 5 in both studies. A correlation score of 0.222 confirms that the responses for each question are related with similar graph curves. This indicates a deficiency in knowledge by Business for procedure which could cause a lack of understanding of the work involved for IT. The result would be misconceptions and a negative outcome. Within the findings in these two studies four combinations of questions focused on communication and collaboration related to managing IT projects, policy and budgets. The negative scores from Business with correlation scores ranging from 0.31 to 0.45 reveals that the level of knowledge and involvement with IT's policies and budgets are related to their feelings about the lack of communication from that group.

The level of service, reliability and ability to communicate in relation to project knowledge and experiences scored on the lower half of the scale with a stronger correlation range of 0.38 to 0.49. These results can be related to the *relationship –based trust* model where reliability and integrity play a role in how trust is built. Findings in another study

confirmed a relationship between job satisfaction and performance that is relative to the level of trust that is given to others (Dirks & Ferrin, 2008). Low scores indicate trust issues between Business and IT groups in a project driven environment. This data can be directly related to the impact on the Testing group because they hold the final function role in a software development project. More than half the respondents rated low scores. With this in mind, analyzing the language barrier between the two will provide additional insight.

Adding to the perceived communication issues Business has with IT, language differences and conflicting strategies contribute to the mix. Responses indicate a lack of involvement in the creation of strategies or knowledge of the strategies. This suggests there is an asymmetrical dialogue occurring in which the IT group provides information but does not allow Business to be fully engaged to provide input. This encourages one sided communication (Foster & Jonker, 2005). To further understand the connections between the two groups, the next section will analyze the data IT groups gave for Business.

4.1.2 IT responses

The averaged ratings of the IT professionals' responses for the same questions regarding communication, quality of service and reliability are comparable (Appendix D) and almost identical to that of the Business respondents with a 3.01 rating (Standard deviation of 1.01). Note the correlation generated by CMAv2 when grouping all the responses in one set of data.

	Correlation	Lower limit	Upper limit
IT to Business	0.180	0.111	0.247

The correlation of IT's knowledge and perception of Business relating to trust is weak when considering the range of data in the main score provided by the Business group's responses about knowledge and involvement with IT. This outcome suggests a closer look at the pairings of responses to judge if specific combinations exist that may have an effect on communication.

IT's responses to Business assuming responsibility, scored lower compared to those responses of Business with the adjusted score 2.91 compared to 3.32 (ITBP1 Appendix A) and a smaller standard deviation.

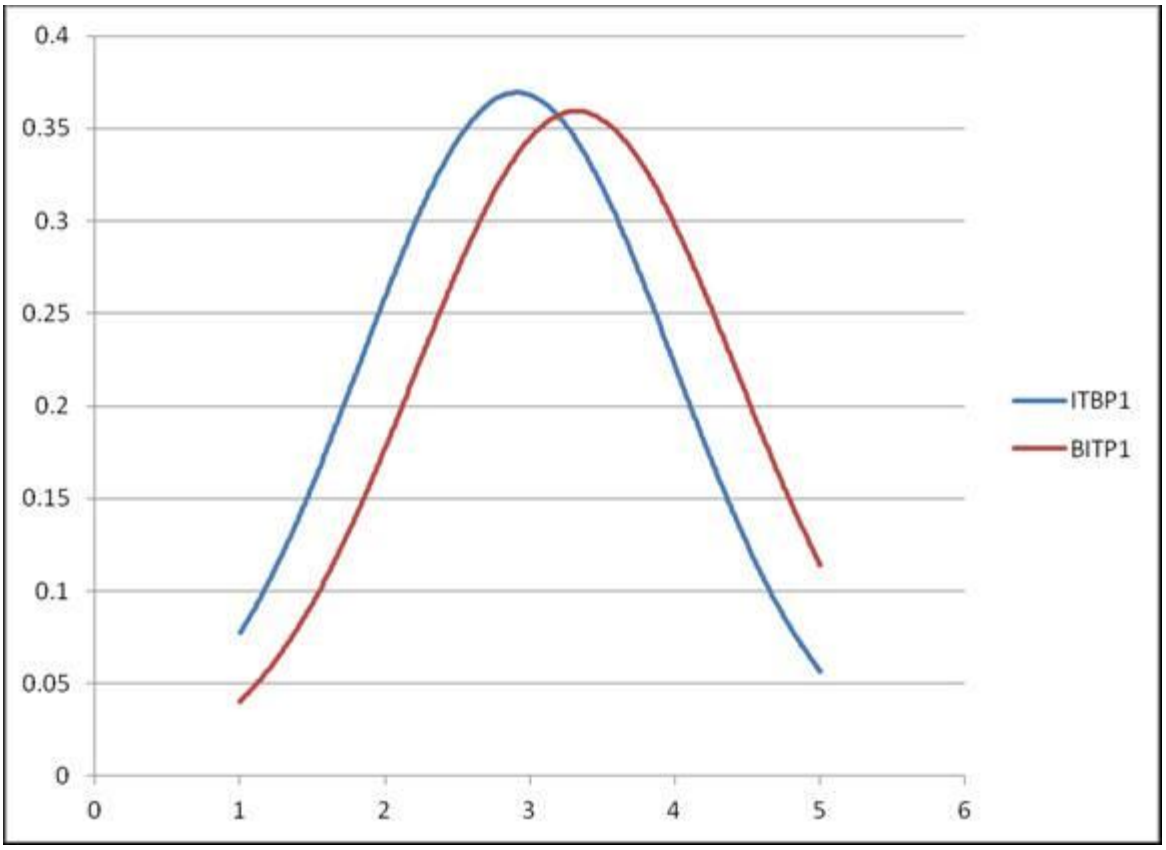

Figure 4

Comparison of the two graphs in Figure 4 suggests that IT has a different perception of what Business does in regards to project procedure; they have more knowledge and experiences with completing a project in software development from beginning to end.

Investigation into the responses related to “speaking a different language” are comparable with the IT's adjusted score 2.59 and Business' responses to the same question regarding IT at 2.68. In question ITBC6, IT rates their project management at 3.6 recognizing that both sides IT and Business speak a different language (ITBP16: rating 2.59). Issues rise from the manner in which these numbers are produced and what they involve. A lack of knowledge on the part of Business generates a gap creating a barrier and as with previous Business component efforts, communication is key. Not attempting to come to a common language by IT (Testing) raises more barriers to communication. For example the type of reports that Testing groups could provide to Business would be effectively communicated by using simple statistics such as percent complete and success rates (Black, 2002; Lewis, 2009).

IT acknowledges that there is an issue in the level of understanding between the two groups and yet they rate their level of communication skills as 4. This outcome suggests there is an asymmetrical dialogue providing one-sided information which encourages a lack of involvement of other stakeholders such as Business. This type of discourse creates barriers that become trust issues (Foster & Jonker, 2005).

These outcomes can be related to the Testing group who perceive that Business does not understand the processes and tasks involved in a project’s testing effort. Testing’s

leadership identifies that Business has misunderstandings related to their work; however the responses do not indicate that there is an effort to resolve these issues. The rating given to ITBC6 and BITP6, 4 and 3.23, would indicate that IT leadership does not fully disclose what occurs within the group. BITP6 refers to the Business rating of the senior IT's (management) integration into their team. The scores indicate that although Business generally accepts IT management into the team, IT management does not disclose the inner workings of the Testing group. This creates scenarios where Business raises questions constantly about each section of a project. This level of micro managing provides a catalyst for friction between Testing and Business, creating a wider knowledge gap. From this data, it is apparent that IT (Testing) groups do not close the knowledge gap with Business to prevent communication issues during projects.

4.1.3 Recap

Trust is an important aspect in a team environment to ensure that productivity is effective (Dirks & Ferrin, 2008). Business experiences provided insight into the high level of expectation for the Testing group to find all errors, despite knowing it is impossible to completely test 100% of the variables (Black, 2002; Lewis, 2009). When errors were missed and affected clients, Business lost confidence that the Testing group could be trusted to complete the task at hand. This lack of confidence is amplified by the little knowledge Business has regarding Testing practices in a project environment creating micro-management situations.

Testing leadership is in a unique situation working with multiple groups throughout the life of a project. They must be able to communicate effectively with all stakeholders to ensure success of a project and yet it is apparent they do not make the effort to resolve communication efforts. Testing rated high on effectively communicating yet at the same time indicating that both groups speak a different language. This is counter productive to a dynamic team effort environment (Daniel & Davis, 2009; Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009). Although Testing groups may think they know how Business works a gap is apparent in Testing's ability to communicate their function. This gap creates scenarios that could harm the relationship and impact future work.

4.2 Value

4.2.1 Business responses

The mean score of Willcoxsen and Chatham’s questions involving the perception of IT's value (Appendix D) is slightly higher than that involving trust at 3.10 compared to the mean of 3.01 (Figure 4). This indicates that more of the Business respondents rated themselves as having a better understanding of IT value although there are some trust issues. Yet when averaging the final Business response scores in Bassellier’s study regarding sections of: knowledge of IT projects, access to information, management and experience with IT, and the result was 2.356. This suggests there may not be a true understanding of IT value a result of a lack of knowledge of IT's work.

There is a stronger correlation for Business between the two than from IT's responses.

	Correlation	Lower limit	Upper limit	Z-Value
Business to IT	0.321	0.265	0.375	10.65

This correlation demonstrates that Business's perception and knowledge of IT's performance are linked to the overall value they afford to IT. This is seen in specific questions within the Willcoxsen and Chatham's study regarding IT involvement in business tasks, views of effectiveness in dealing with business needs and costs, as compared directly to similar questions about knowledge in Bassellier's study. The adjusted results for BITP17 that explicitly asks if IT provides value to the organization scored 3.56 with a standard deviation of 0.90 while information regarding how they are informed about IT strategies, BITC was 2.421(Standard deviation of 1.22).

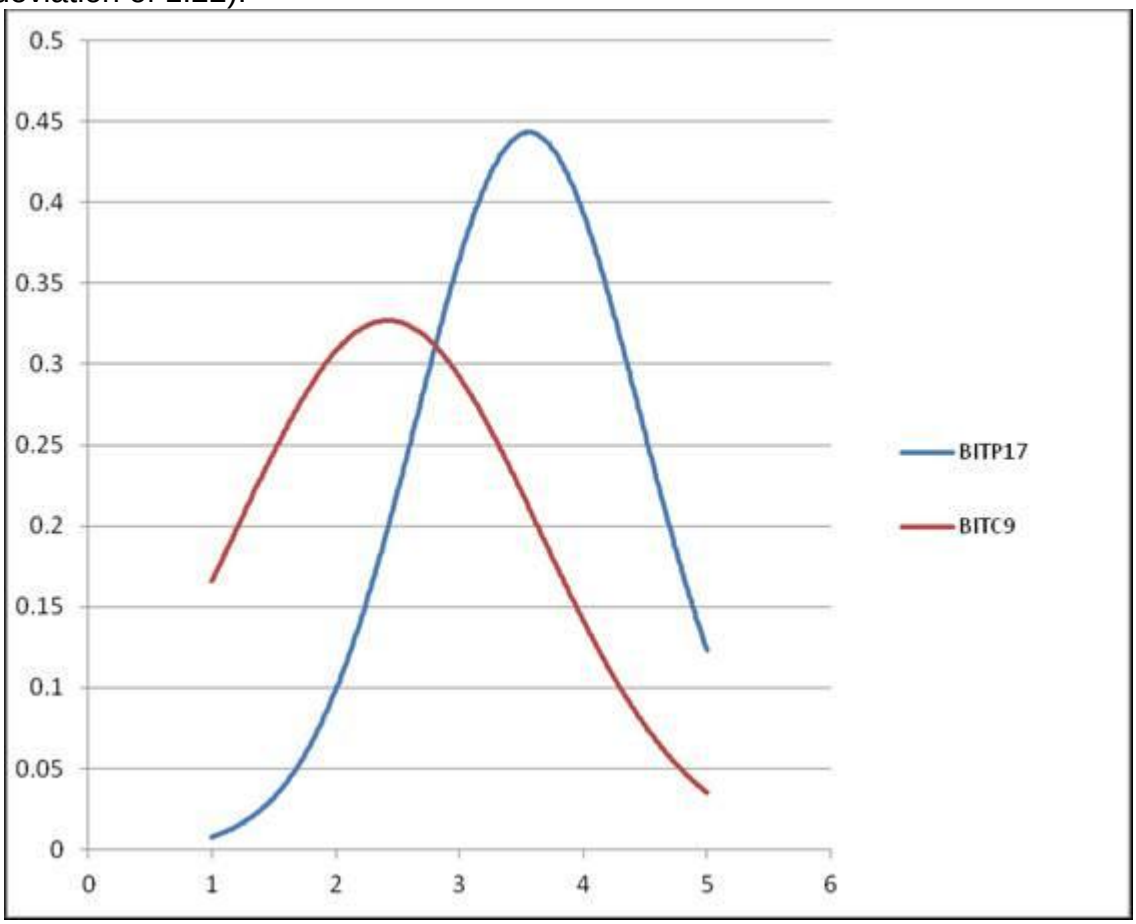

Figure 5

The graph depiction of the two sets of response (Figure 5) reveals the crest of BITP17 is approximately 45% and the ratings are closely tied to positive responses with a negligible score on the lower half of the scale. Understanding for IT's strategies has a broader range and crests at approximately 32.5% on the lower half of the scale.

	Correlation	Lower limit	Upper limit
BITP17 - BITC9	0.471	0.423	0.516

This is one of the strongest correlations between the two studies. The explicit question regarding how Business views IT's importance provides considerable insight into the type of value they have for IT. Although there are positive scores indicating that some in Business do see IT's worth the negative score regarding IT strategies would indicate the value might be

misplaced. Further to these findings on value and understanding of IT function the next set of data involves the use of senior IT employees in Business strategies and Business involvement in the creation of IT's vision and strategies.

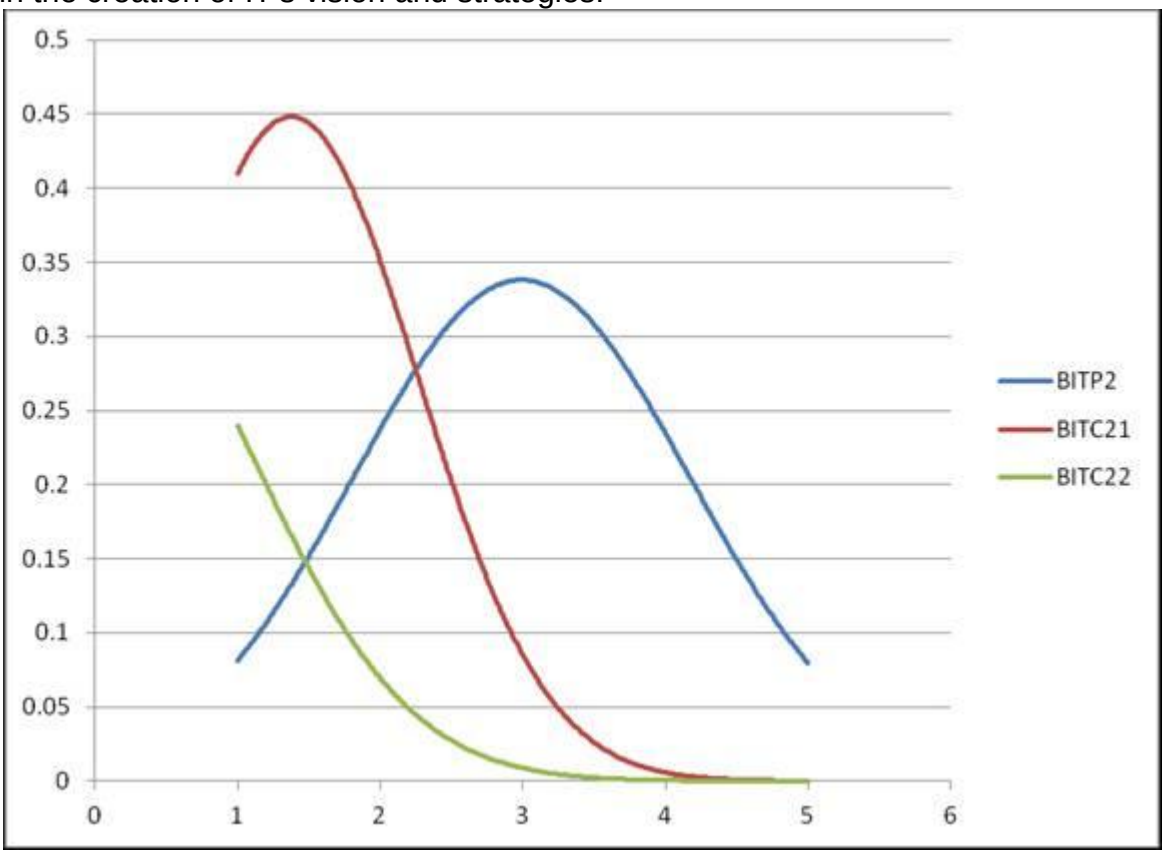

Figure 6

The graph in Figure 6 provides an illustration of the Business belief that involving senior IT contacts in business strategies absolves them from participating in IT strategies and visions. This relationship provides another example of a lack of understanding in IT's potential. As value to an organization is tied to a financial figure the responses in regards to costs effectiveness and participating in IT budgets have a strong correlation.

	Correlation	Lower limit	Upper limit
BITP15 - BITC24	0.597	0.559	0.633

With an adjusted score of 2.96 (Standard deviation of 0.99) for BTIP15, it would indicate that approximately 50 to 53% of the Business respondents feel that IT is not a cost effective service. However, most responses from Business also identified their lack of participation in creating IT's budget in their score of 1.485 (Standard deviation of 0.99). This suggests that although half of those respondents found there is value in what IT provides approximately 90% do not understand what is involved in an IT budget.

Not utilizing resources to their potential, lack of understanding of what IT is capable of doing and the associated costs with IT's function suggests that Business does not understand the value that IT (testing) brings to the organization.

4.2.2 IT responses

Analyzing IT's responses relating how they value their function within an organization is difficult, due to the expectation of biased responses. From the grouping of questions in Bassellier and Willcoxsen and Chatham's studies the correlation between the two sets of data supports this interesting dilemma.

	Correlation	Lower limit	Upper limit	Z-Value
IT to Business	0.050	-0.020	0.121	1.4

With such a low correlation and low Z-Value there seems to be little that can be related to overall perception and knowledge with regards to self-value. The average from the adjusted scores from Willcoxsen and Chatham's data resulted in 3.244 (Standard deviation of 0.986). The average score from Bassellier's research was 3.383 (Standard deviation of 0.813). The following graph (Figure 7) compares these scores.

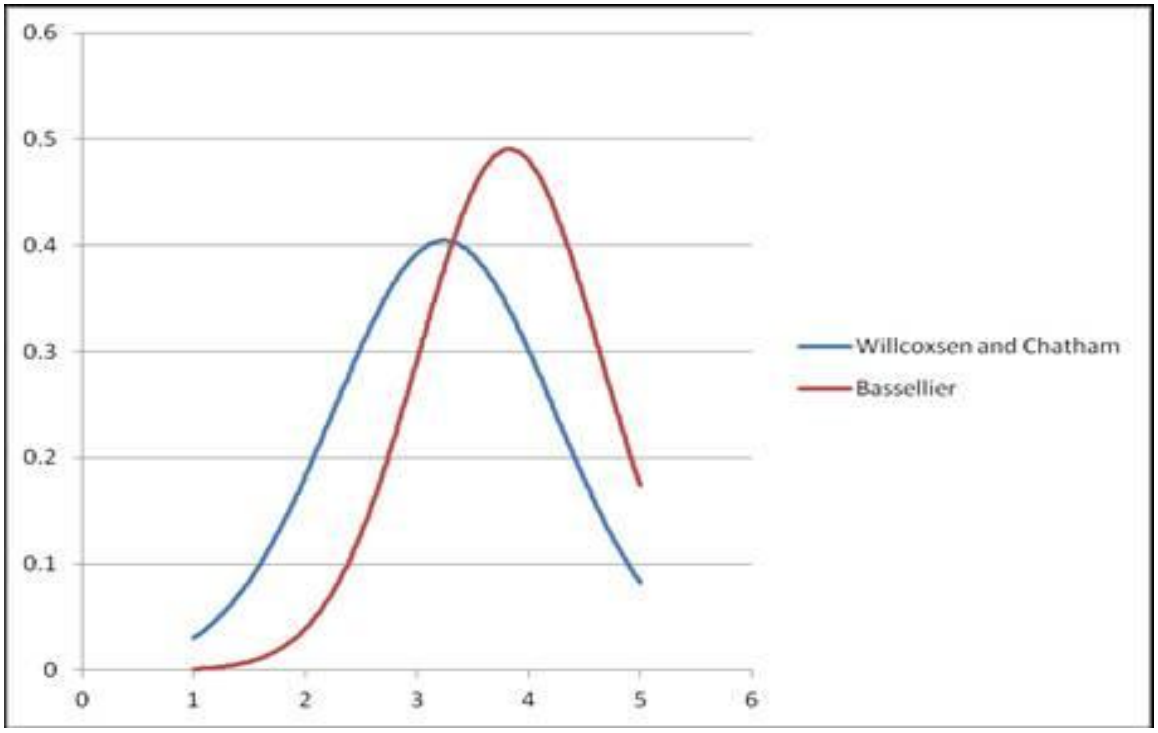

Figure 7

A more even distribution of scores occurs with Willcoxsen and Chatham's results compared to Bassellier's which is skewed to the right, indicating approximately 70% of the respondents felt they had good knowledge of their value to the organization. The overall perception could be considered midline because some of the questions do not pertain to the project environment. This will require further analysis using specific pairings of questions related to testing accomplishments. For example testing and quality assurance focuses on continuous improvement and improved quality of applications which in the end creates cost reductions within projects (Lewis, 2009).

One interesting pairing is the analysis of ITBP3 and ITBC5. In these questions IT responses to their skill set in managing their relationship ITBP3 was rated low at an adjusted score of 2.56 (Standard deviation of 0.96) and to management of relationships and interpersonal communication skills ITBC5 scored 4. Their confidence in their relationship management skill set rated low which could indicate a focus on communicating specifics within their work task but from an organizational point they do not feel they provide effective levels of communication.

One of the main components of quality assurance and testing activities is the ability to provide the data needed to improve departments. This is done throughout the organization through tasks like root cause analysis and recognizing issues (Black, 2002; Lewis, 2009). This analysis will consider the explicit questions about cost effectiveness, value added knowledge of the organization and individual units.

ITBP15 and BITP15 scored cost effectiveness as (adjusted) 3.45 (Standard deviation of 0.98). The responses to knowledge of the organization and their individual units scored 3.2 (Standard deviation of 0.80) and 2.9 (Standard deviation of 0.87) respectively. There is a slightly higher correlation to ITBP15 to ITB5 intercommunication of 4 (Standard deviation of 0.64) and little correlation to knowing who in Business they can go to for answers to their questions.

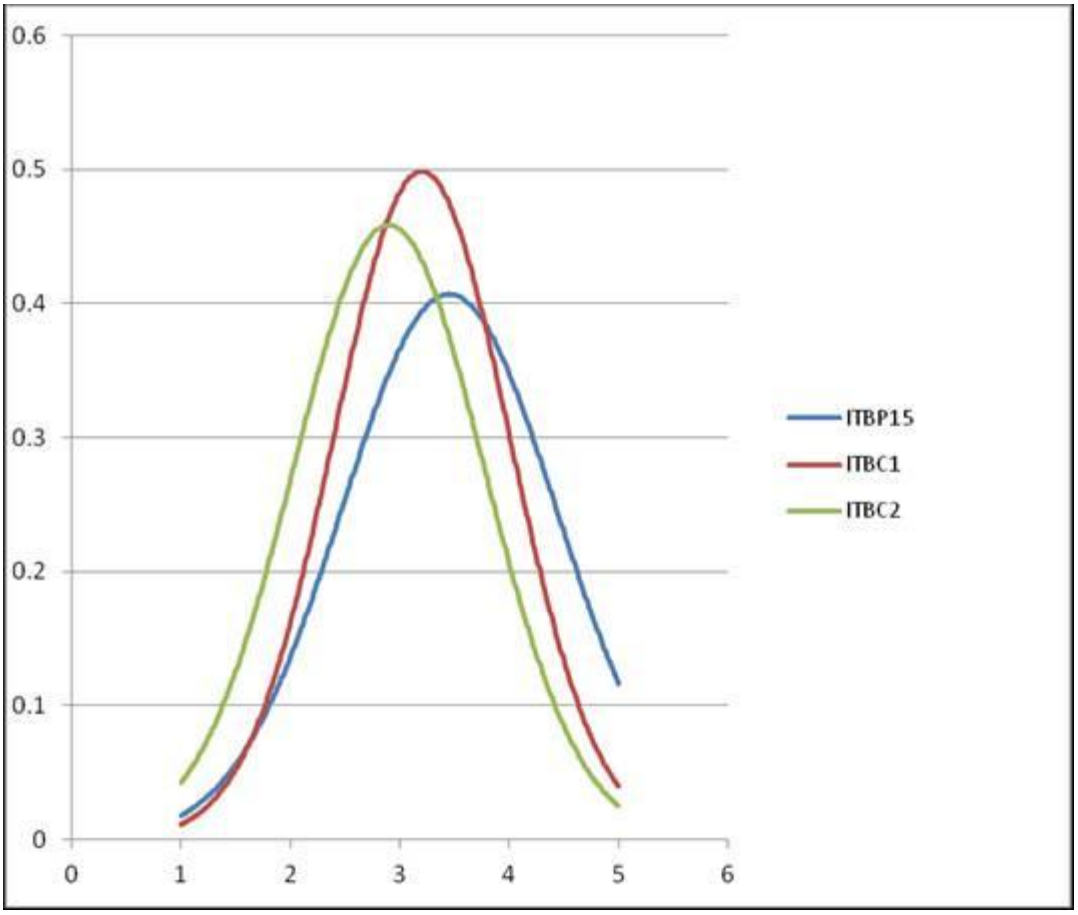

Figure 8

In Figure 8 the shape of all three graphs are similar with ITB15 slightly more on the positive side of the rating scale. This graph suggests that although IT understands *cost benefit* they may not appreciate how that benefit is realized from an organizational view. This aligns with Business' responses to question about their participation in creating the IT budget (BITC24). These responses indicated they rarely contribute with a score of 1.485.

ITB17 explicitly asked IT if they add value and their responses scored high with an adjusted result of 3.86 (Standard deviation of 0.84). The strongest correlation was with questions about knowledge of the organization and their Business units. Figure 8 provides a graphical view of those responses. If the response for ITBP17 were exchanged for those of ITBP15, as seen in Figure 9, that bell curve would shift more to the right on the positive side of the scale.

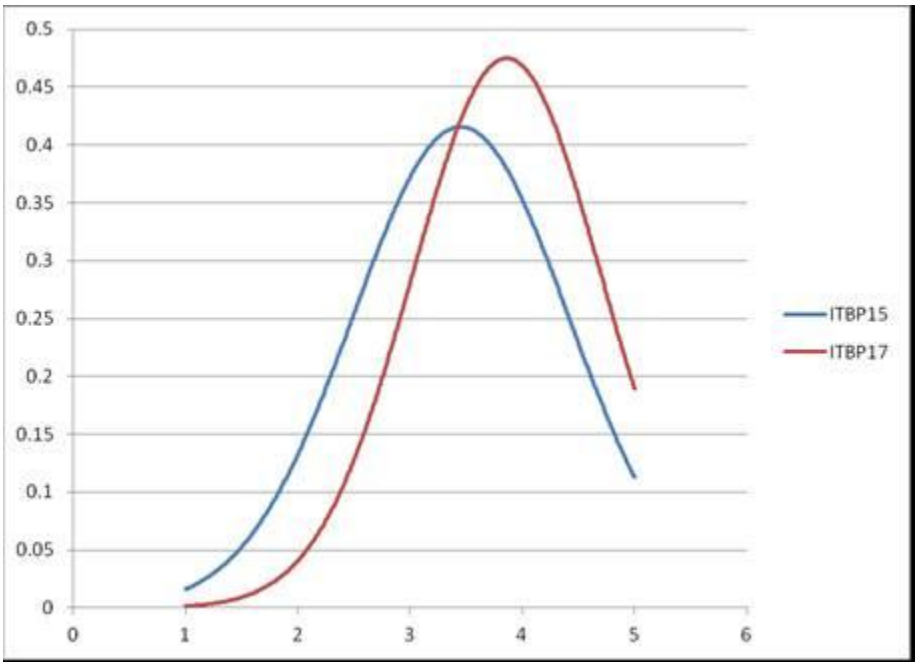

Figure 9

This indicates that IT including Testing does have an understanding of their value within technology; yet within the Business environment there might be issues. From a continuous improvement process there should be a broader understanding of all stakeholders to provide insight into the needs for improvement. It was confirmed that Business does not understand the value that a full quality assurance testing department can bring. Although there are some correlations with some middle to low scores within the IT responses this indicates they recognize their value. This suggests that although Business does not fully understand the value a full quality assurance testing department can bring to an organization, IT (Testing) does.

4.2.3 Recap

Responses regarding value had one of the highest correlations between knowledge and perception of IT from Business. Yet there was little correlation of IT responses to the rating of value despite explicit questions. Within a project team environment, Business did not fully understand the processes and strategies a Testing group can bring. The general feeling from

Business suggests there is little cost effectiveness and little knowledge of the value of Testing's output in relation to the organization (van Den Hooff & De Winter, 2011; Martin, Hatzakis, Lycett, & Macredie, 2004). Business relates there is a lack of involvement and knowledge of the strategies and vision that Testing groups provide to the organization. This affects the usefulness of continuous improvement for all stakeholders (Slack, Chambers, & Johnston, 2010).

Testing indicates they do have understanding of what they can do and are effective in their strategies. Their responses indicate they realize the value they could provide to their stakeholders (Daft & Armstrong, 2009; Kotler & Keller, 2009; Grant, 2008). More detail is needed to determine the value knowledge of a Test team to an organization. Responses suggest there are missing components that are not identified by those individuals (Berriault, 2011; Berriault, 2012).

4.3 Knowledge Gap

4.4 Business responses

Unlike the previous two sets of analysis that focused on specific questions with Bassellier and Willcoxsen and Chatham's research results this section will be considering all responses. The following correlation scores include all Business responses from both studies when averaged and applied to CMAv2.

The correlation score 0.319 indicates that the general knowledge and experiences that Business has of IT creates their general perception of IT. Although not a strong correlation, similar to the previous sections, further analysis into specific responses will provide more details.

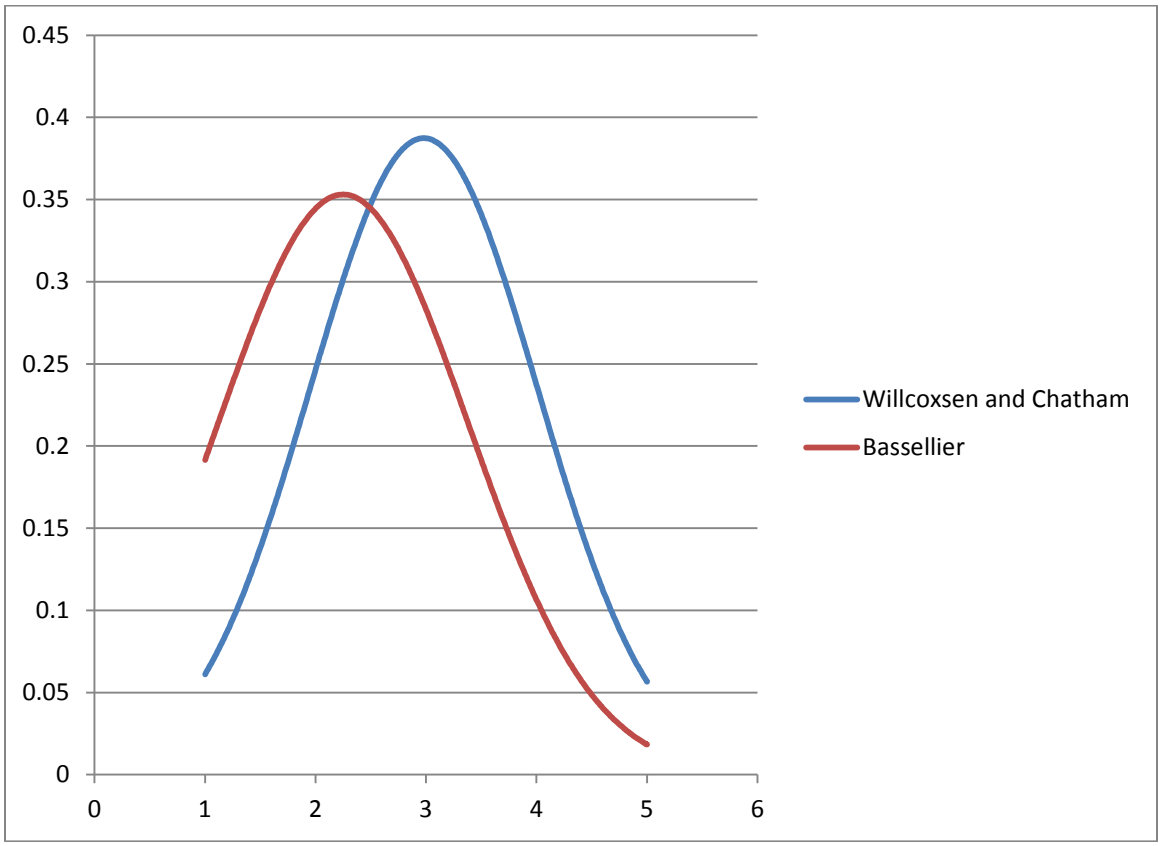

Figure 10

Figure 10 illustrates the responses to Willcoxsen and Chatham's questions pertaining to the perception of IT by Business. The data lies in an even distribution slightly shifted to the left signifying to some extent more than 50% of the respondents have negative views of IT. Bassellier's graphed responses indicate a large number of negative responses with regards to general knowledge and experiences with IT. The graph shifts to the left of the 3 rating which indicates that approximately 40% of the respondents are neutral or have good knowledge of how IT works.

These results provide the overall knowledge and perception of IT by Business indicating potential issues within a project environment where Testing groups conduct most of their work. Considering findings from hypothesis 1 and 2 which revealed a lack of effective communication between Business and IT, this could explain the knowledge curve's shift to the left. The responses to BITP16 (i.e. Business and IT speaking the same language) provides the best example that knowledge management is an issue between the two groups. The Business score of 2.68 and their scores regarding project work (i.e. BITC16 through 20) graphed below the mean indicating negative responses which suggest poor communication and knowledge management (van Den Hooff & De Winter, 2011). Reviewing IT responses for this area will further investigate the knowledge management issue.

4.4.1 IT responses

There is a weak correlation of 0.267 to questions about IT's perception of Business and how much they know and understand their environment. This may indicate how they felt about working with Business groups and may not be related to the amount of knowledge IT has for the process and procedures of Business.

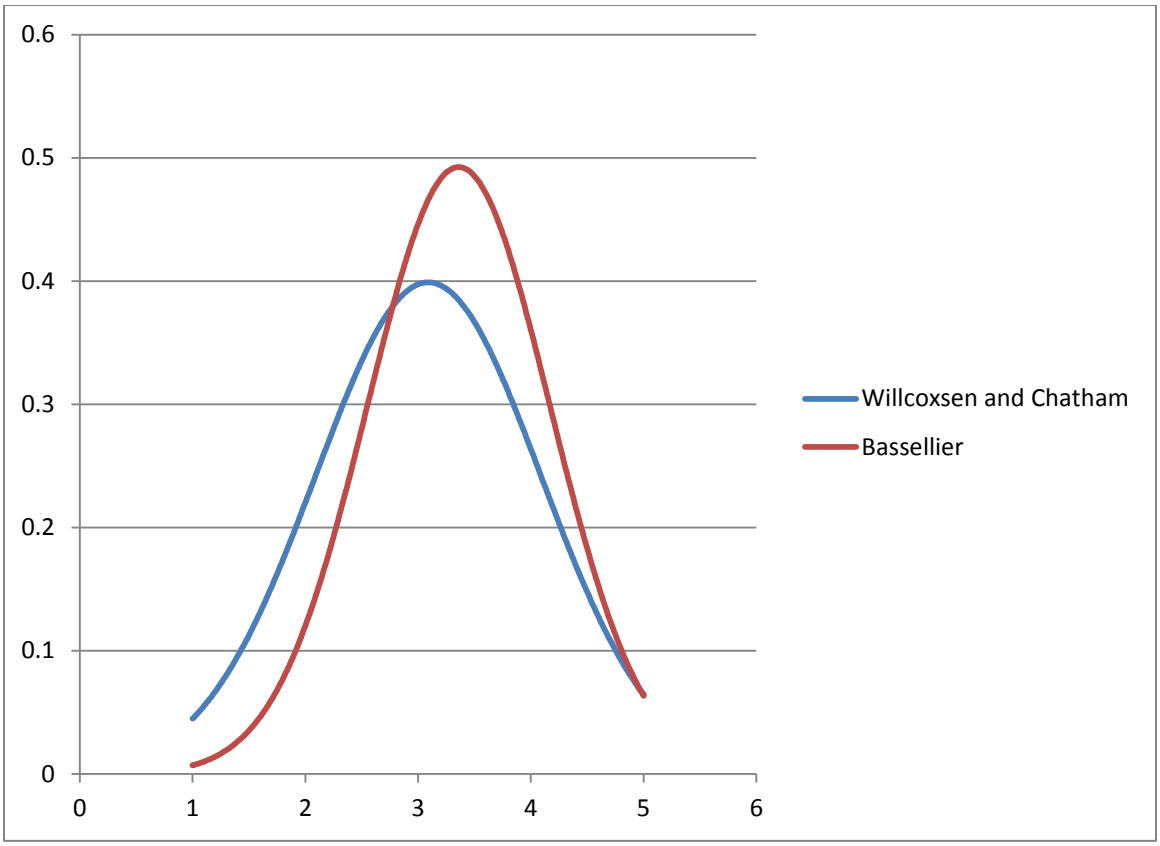

Figure 11

In Figure 11, there is an even distribution of data relating to IT's perception of Business with a slightly positive distribution of Business knowledge from both studies. This slightly positive distribution would indicate that IT may have some understanding of how to communicate with Business. Within a work team environment there should be a positive experience in production between the team members, yet in the Business results it shows a negative shift in the knowledge graph (Figure 10) indicating a lack of knowledge transfer. The IT group is not providing enough correct information to explain their role and purpose in providing a positive effect on the organization (Sinek, 2009). This can be seen with Business responses to the following questions: specific questions relating to effective communication, meeting needs, promised delivery, acting on priorities, cost effectiveness and not a constraint had an average score of 2.82. This negative response to perception of IT in those questions suggests that IT is not assisting Business to understand.

Although it is expected that non-technical Business individuals will not completely appreciate what is done during the software development process, a lack of high level understanding does create productivity issues (Alshawi & Al-Karaghouli, 2003). Although testing may be considered a simple process by Business such as running a program to look for errors, more is involved which can positively impact an organization (Black, 2002; Lewis, 2009). These results indicate that Testing groups (IT) do not close the knowledge gap through active knowledge transfer which could prevent communication issues.

4.4.2 Recap

Knowledge is a key component in a team environment. Each member must understand the skill sets of others and what they are accountable for, to gain team success. Business responses indicated little knowledge of IT's (Testing) effort within a project. This information effects how Business communicates with IT. Although IT (Testing) felt that they communicate well with Business the ratings from Business in project work suggest otherwise. Their lack of comprehension outside of project work impacts IT's perception that Business rarely participate in activities that would ensure effective teamwork (Martin, Hatzakis, Lycett, & Macredie, 2004; Nonaka & Konno, 1998). Testing has the ability to improve the lines of communication and flow of knowledge to help Business gain a better understanding of Testing's effort. Ensuring the message is properly received is critical to contributing to closing the gap (Sinek, 2009).

4.5 Summary

Testing (IT) is one of the last stages of software development and besides providing the last phase in quality assurance, this group also produce positive changes within an organization. It seems Business does not understand nor value this role. Although Business groups should understand Testings' purpose there is the perception that IT speaks a different language creating communication barriers. Not only does this affect productivity but it impacts the level of trust Business has for Testing (IT).

Knowledge management requires full sharing by both groups to ensure understanding; however knowledge appears to be moving in only one direction. Testing groups within IT are gaining knowledge of the business aspect of the organization but they are not sharing information with Business about their specific abilities. This is contrary to their responses indicating that they understand how to communicate with Business.

Hypothesis 2 states that neither group understands the role of IT; however, through this analysis it is evident that Testing (IT) does recognize their role and understand their purpose but Business responses support this hypothesis. Hypothesis 1 and 3 provide a basis for the strained relationship between the two groups through lack of leadership and knowledge management. The following chapter will involve discussion on where further studies would be useful, to gain a better understanding about issues between the two groups and provide some recommendations to help improve those relationships.

5 DISCUSSION

5.1 Study concerns

Although the study provided great data for identifying issues and perceptions between IT (Testing) and Business there are components that require more specific research and analysis. Responses involving more specific details to the testing discipline rather than a general set from an IT department will provide clearer results.

Hypothesis 2 relates to the determination of value for Testing. Although the Business respondents ranked this value as low, IT ranked this value high. Bias would be expected when IT is asked about their value to an organization. Questions regarding Testing's understanding of their importance within the organization and the value of their tasks are missing in the two studies. A survey requesting facts on specific tasks and documented processes such as root cause analysis and process improvements, would provide that data. These findings could be

compared to queries about cost effectiveness and "delivered as promised" questions to determine Tester understanding of that value.

The conversion of ratings from 7 to a 5 point Likert scale for Willcoxson and Chatham's results should be addressed. This aspect of the methodology provided the ability for comparison of data between the two studies; however there are benefits to a 7 point scale that allows a wider breadth in scoring and would improve the depth of information gathered. Further research is needed with primary data between the two groups to gain better analysis of their relationship.

5.2 Recommendations

The following recommendations will involve work from both disciplines to increase *maturity* and improve the flow of information to advance teamwork and productivity during the software delivery process. Previously the analysis provided data that identifies some issues causing a disconnect in the relationship between Business and Testing. The re-occurring themes throughout this analysis identified: the amount of knowledge each group has for the other and its impact on their relationship.

The investigation discovered gaps that can be contributed to both groups. The following models will provide marketing, strategic and operational management techniques that will not require large organizational changes and will assist in resolving these issues.

5.2.1 Marketing

Findings through this analysis suggest that Testing groups must develop the ability to market their discipline better to their Business partners. Although marketing is identified generally at an organizational level for growth there is an internal set of marketing between groups that is required to create an effective work team. Test groups provide a service to Business and should consider Business to be a client and provide a free flow of information in order to gain trust and understanding of their value.

There are two marketing models that will provide guidance to Testing groups in their efforts to improve their relationship with Business: *Value chain* and *holistic marketing* (Kotler & Keller, 2009).

Component 1 New-offering realization

- Test automation
- Component testing
- Identification of recurring process issues
- Quality reviews

Component 2 Customer relationship management

- Early involvement in the project process
- Provide constant feedback on consumed documents
- Involvment with budgets
- Provide training on testing practices

Component 3 Fulfillment management

- Business involvement with with test case creation
- Simplified test case creation
- Consistency in test cases

Table 1 (Kotler & Keller, 2009)

Table 1 identifies some of the values and tasks that the Testing group provides to an organization. These components are well documented in publishing about testing yet there is little knowledge about their role that is recognized by other disciplines (Black, 2002; Craig & Jaskiel, 2002; Lewis, 2009).

Literature suggests that there must be a *knowledge management program* between the two groups to ensure that value realization is achieved between the two groups (Martin, Hatzakis, Lycett, & Macredie, 2004). This program must be a collaborative environment with bi-directional communication to allow successful change management. Regular scheduled sessions with the two groups to review tasks is a main component of this atmosphere (Foster & Jonker, 2005; Gill, 2003; Ibarra & Hansen, 2011). To initiate the program Testing leadership could use the *Golden Circle*, as described by Simon Sinek (2009). This marketing model will assist in providing Business information in a manner that they can easily relate to and understand (Sinek, 2009).

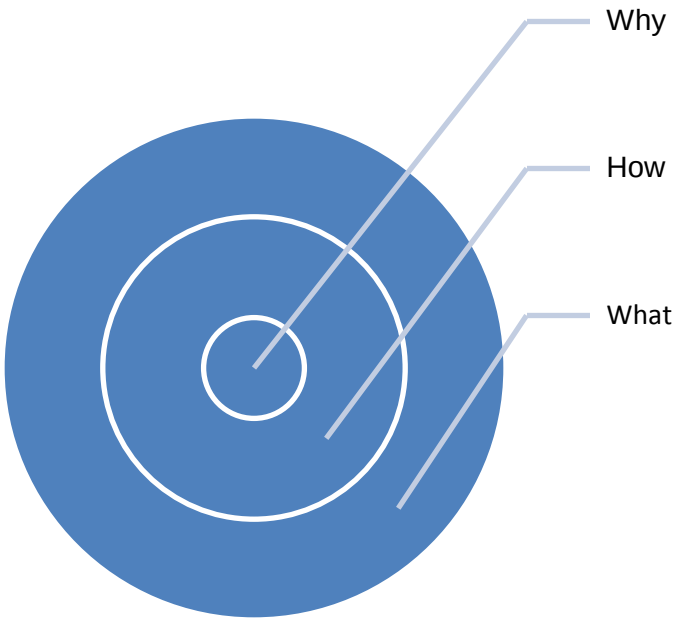

Figure 12 (Sinek, 2009)

In Figure 12 information is delivered from the center of the circle, *why* and moves outward changing the questions to provide information which will make the problem easier to understand (Sinek, 2009). Considering the analysis' findings the issues of identifying value for IT by Business is lost at the outer circles, Business understands the *what and how* but would not get to the *why.*

The Testing message that must be brought to Business is as follows:

- Why we do what we do
    - Provide consistent data and analysis that will create positive changes within the organization to improve product quality and delivery speed.
- How do we do it
    - Through the use of Testing professionals who use tools and processes to gather data and ensure quality products
- What are we
    - A group of testing professionals who are educated and experienced in testing practices.

Answers to these questions can be expanded to assist Business to gain knowledge. Because the information is *tacit* in nature this will provide better understanding of the Testing phase of a project. With the possibility of increased quality and speed to market Business will accept buy-in to Testing value (Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009; Kotler & Keller, 2009; Martin, Hatzakis, Lycett, & Macredie, 2004; Nonaka & Konno, 1998).

A final element of the program would be to re-educate both groups on needed involvement within the relationship. As described earlier, Testing is a consumer of products from other disciplines including business. The distinction of their work effort is reliant on the

quality of the documents they acquire. Their information comes from Business who is responsible for downstream work. Business has a direct effect on team efficiency and the team relies on the effort from each group (Politis, 2003; Alshawi & Al-Karaghouli, 2003).

Testing must ensure that in providing *expert power* the testers have the expertise and experience within the enterprise's testing organization to ensure collaboration and internal education programs for knowledge sharing (Kotler & Keller, 2009; Choong, 2005; Holste & Fields, 2010; Dvir, Avolio, & Shamier, 2002). In a collaboration and training program senior Testing professionals assist junior testers to understand special concepts leading them effectively in a project environment. Business member attendance in these programs can be improved through restructuring with a focus on information which will assist understanding of the process, tasks involved and the effect of testing's quality of work on the finished product.

5.2.1.1 Goals and timeline

- ✓ The Test group leadership team will complete an inventory of their processes and procedures to determine the differences between both groups in 2 months. This record would include test case, test planning, document format, and the use of test automation.
- ✓ The Test group leadership will change the defect management process to include a more robust Root Cause Analysis configuration which will provide data on re-occuring issues from project to project in 3 months.This will formalise the new process structure for the Testing group througfh information sessions to gather input from all stakeholders.
- ✓ The Test group leadership will develop internal courses for testers and Business members to provide a common language for both groups to understand and assist Business to know the *why* in testing and its importance to the organization in 6 months.
- ✓ Testing will develop and implement a plan to better market themselves to Business using one of the models identified in 6 months.
- ✓ The Test group will identify new processess to be introduced to the organization which will provide quality reviews of requirements to ensure usable quality test cases in 8 months. This action will increase Business' confidence level in their role and improve trust and value. These changes will be supported by introduction of theTest group into the SDLC process.

5.2.2 Strategic

Testing groups within an organization should visualize their role as a service provider to their client (Business). The analysis section indicated some disconnect between the two groups which impacts their internal *strategic fit* (Grant, 2008; Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009). To facilitate successful marketing change recommendations for a well-executed strategic plan is necessary.

Initially there must be a clear understanding of each group's vision and goals to ensure a consensus in language. Leadership from Business and Testing should come together to create a *convergence of stakeholder interests* which will give Testing a platform to explain the full benefit their discipline is able to provide; this will assist Business to meet their goals (Grant, 2008; Foster & Jonker, 2005). These sessions will create a stronger team approach within the

two leadership groups that can filter down to other employees (Bassellier & Benbasat, 2004; Bass, 2007; Daniel & Davis, 2009).

Performance indicators must be identified and agreed upon by the leaders and are a strong component of the strategic sessions. This will ensure clear expectations, understanding of the process and improve the level of communication for stakeholder involvement (Grant, 2008).

Testing Metrics	Business Metrics
# of test cases created per day by complexity	# of Requirements per project size
# of test cases per requirement	# of identified gaps within requirements
Test case pass rate on each pass	# of change requests per # of requirements
# of cycles needed to project completion	# of defects root cause to Requirements
Actual vs estimated costs	
Daily test case execution/tester	

Table 2 – Example of metrics (Black, 2002; Lewis, 2009; Craig & Jaskiel, 2002)

The example in Table 2 can lead to knowledge sharing that will assist with improving understanding and facilitate the creation of a dialogue pipeline where strategies for improvement are formed (Grant, 2008; Dvir, Avolio, & Shamier, 2002; Khanbabaei, Lajevardi, & Kohsari, 2011; Black, 2002; Lewis, 2009). Iidentification of metrics and resulting exchange of ideas will generate a knowledge strategy to focus on processes and tasks that need attention, or are impeding the success of projects. This approach contributes to marketing changes regarding the *value chain*. The determined metrics will help to assess the resources, their capabilities and the ability to meet the identified tasks (ie Table 1) and the *Golden Circle* (Grant, 2008; Nonaka & Konno, 1998; Gill, 2003).

An important aspect of these changes is the transformation of the organizaton into a more organic and adaptive business where Testing and Business groups will learn and improve on a continuous basis (Grant, 2008; Slack, Chambers, & Johnston, 2010). Sharing knowledge and creating an equal information partnership will improve overall trust; each group will understand the role of the other and their positive contribution to the organization (Dirks & Ferrin, 2008; Holste & Fields, 2010).

5.2.2.1 Goals and timeline

- ✓ The Test group will gather all available data from the previous twelve months of projects, as per table 2 in the first 2 months.
- ✓ The leadership fo both Testing and Business will meet the to discuss the available data (Table 2) and the relationship to project success over the last year in the following month.
- ✓ Introduction of the Testing marketing message to the Business group for to increase awareness and understanding of the Tester role by the end of the fouth mongh.
- ✓ Agreement by Business and Tester leadership on realistic improvements in the identified metrics and development of metrics goals for new processes.

Operational

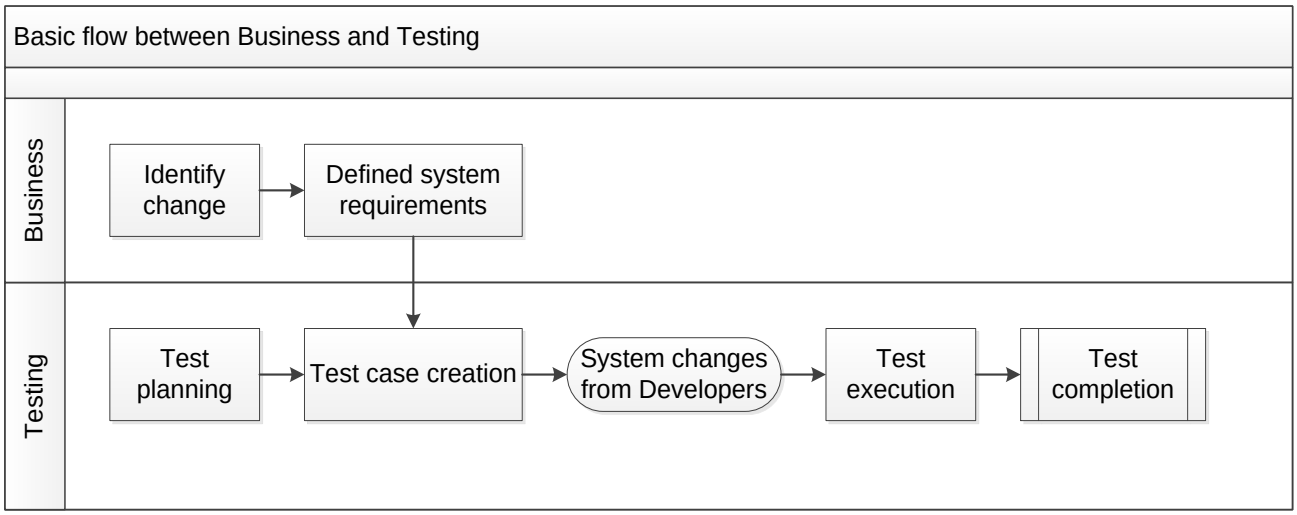

Figure 13 (Black, 2002)

The basic flow of tasks done between Business and Testing are indicated in Figure 13. This diagram outlines the flow of inputs and outputs representing a simple version of a *supply chain* where one resource is used to transform into another. The *Defined system requirements* are used to create the test cases needed to analyze the expected changes (Black, 2002; Slack, Chambers, & Johnston, 2010). The partnership between the two groups must follow basic concepts of supply chain management to improve.

Marketing and strategic changes take place when the base is set allowing forward movement with operational proposals. These recommendations will require changes from both groups using their leadership as *change agents* to ensure success (Gill, 2003).

Ensuring the system requirements used to create test cases provide sufficient information to create proper test cases is an important change. There must be a standard level of quality within the document prior to beginning the test case phase. To support this change Business must bring Testing groups into the process early to provide quality reviews of the system requirements. This will provide the “what” of the system changes and identify how they will look and behave. These changes will be used to create quality test cases and improve overall value from the beginning that will reduce costs and improve dependability of the testing process (Slack, Chambers, & Johnston, 2010; Huffman Hayes, 2002; Feldman, 2005; Alshawi & Al-Karaghouli, 2003). To complete this task the *Plan, Do, Check, Act* process is a valuable tool to review requirements prior to completion (Lewis, 2009).

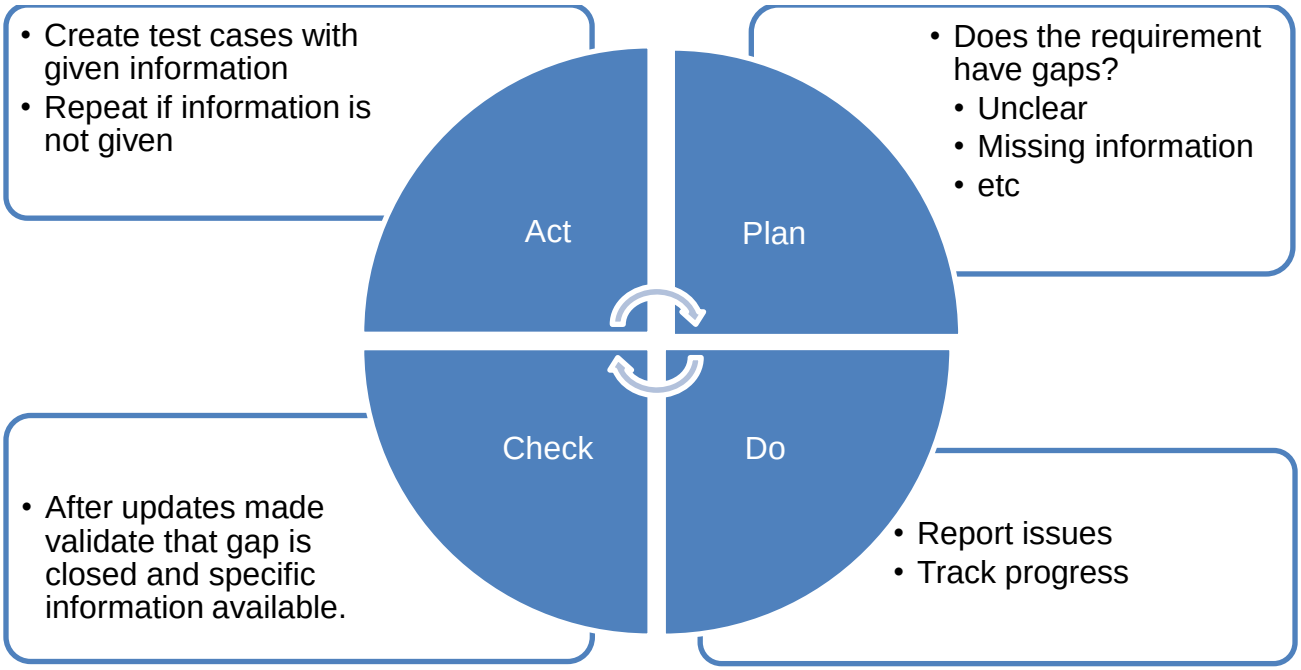

Figure 14 (Lewis, 2009)

The data that this process provides is expected to be revisited on a regular basis by Testing and Business groups to determine root causes to the any found issues. The evaluation information will improve knowledge for future projects and save time in determining Testing or Business needs (Berriault, 2012). To begin the improvement process the two groups will require the creation of a *Supply Chain Council* and employ a *Supply Chain Operations Reference* (SCOR) model using the data collected for a baseline (Slack, Chambers, & Johnston, 2010). As part of the initial process, prior to moving to test case, creation the Test team and Business must agree on the metrics for quality assurance. By identifying the limitations for product quality (i.e. unacceptable versus acceptable), re-work of the product should not create consequences allowing for al reduction in further costs to future phases of development (Lewis, 2009). Within these partnership strategy sessions halting a process although not a popular solution is more acceptable.

Within the operational end of the organization the Business Analyst role has one of the main operational functions, to create testing requirements. This position outlines the needs of the end users and the detail needed to determine function and display (Alshawi & Al-Karaghouli, 2003; Cao, Wiengarten, & Humphryes, 2011; Choong, 2005). The role is vital in the Business/Testing relationship because they have the ability to use their business knowlege and technical understanding to assist with communication between these two groups.

Testing as an organizational discipline must have the ability to meet the goals and vision identified in the strategy sessions. Although Testing's role includes managing the inputs into the testing process, they must complete any changes to ensure a quality product and reduce risk to the organization (Black, 2002; Feldman, 2005; Huffman Hayes, 2002). The Business analyst sets the goals; Testing reviews the needed requirements and Business re-assesses the test cases to ensure the expectations of the requested changes are met. A standard method for creating these cases must be created to guarantee continuity from project

to project. There is high variability and complexity in the testing cases as each required change is rarely the same (Berriault, 2011).The *Stakeholder Power-interest* grid. (Figure 15) indicates Business has high interest in the role of Testing groups to ensure a quality product and high power to control the projects.

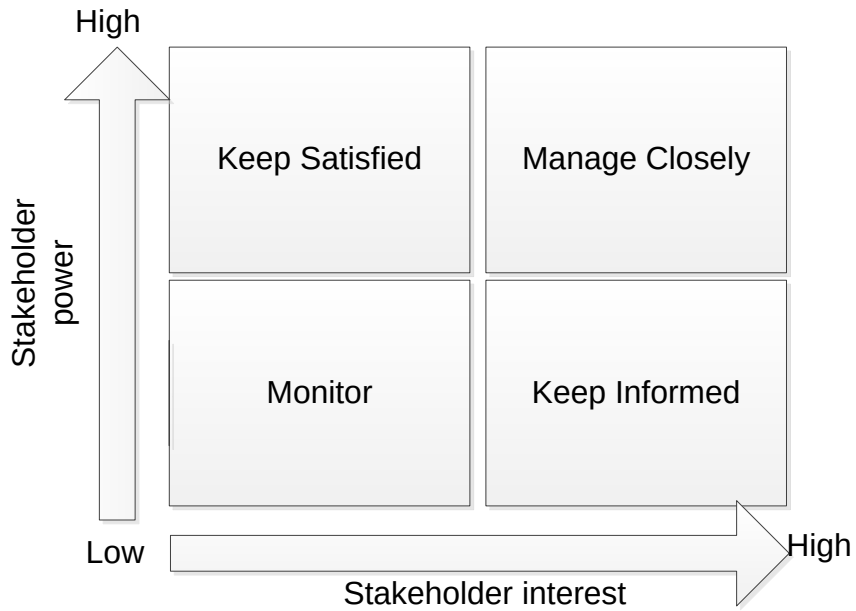

Figure 15 (Slack, Chambers, & Johnston, 2010, p. 465)

The *Customer Relationship Management* model would assist Testing to manage communication with Business. (CRM) (Slack, Chambers, & Johnston, 2010; Cao, Wiengarten, & Humphryes, 2011) By achieving a good customer relationship with Business, Testing leadership will ensure early involvment in the project stages and guarantee constant representation to provide quality assurance throughout the project (Black, 2002; Dvir, Avolio, & Shamier, 2002; Feldman, 2005).

As mentioned earlier, Testing groups must also ensure their members have the required capabilities within their resources. This involves hiring Testing professionals with the ability and appropriate training to meet the oranization's needs (Choong, 2005). Their instruction should include leadership preparation and communication skills which will assist with managing role marketing and information sharing with Business (Cao, Wiengarten, & Humphryes, 2011; Bassellier & Benbasat, 2004; Foster & Jonker, 2005; van Den Hooff & De Winter, 2011). Business confidence for Testing's function will improve the overall relationship with increased credibility and dependability of the Testing group (Dirks & Ferrin, 2008; Foster & Jonker, 2005; Golden Pryor, Pryor Singleton, Taneja, & Toombs, 2009; Slack, Chambers, & Johnston, 2010).

5.2.2.2 Goals and timing

- ✓ Testing leadership will introduce the new testing value and process changes in 9 months.
- ✓ The organization will create a Supply Chain Council with equal representation from testing and business by 9 months.
- ✓ The Council will identify monthly scheduled meetings at their first meeting. The meetings will be provide collaborative review of other metrics and discuss potential improvements that can be made during the process.
- ✓ The Council will review and identify recommended metrics as realistic or requiring further discussion prior to implementation by the 10th month.
- ✓ A collaborative site will be designated to display the monthly metrics within 2 months of the introduction of the Council to provide a forum for employees from both sides to provide their input on processes and potential improvements.

6 CONCLUSION

Testing is one of the few disciplines in a software delivery organization that can have a far reaching impact besides executing test cases. Further research is required to identify the direct value of Testing to the Business end of an organization. Of all the relationships that Testing has in a project environment, the association with Business is the most important because of the need for continuous information exchange. Without this interaction, loss of confidence in both groups occurs then leading to misunderstandings and loss of trust. Sharing knowledge can produce products that are of high quality and low costs; however organizational barriers between the two groups create a gap that impacts the successful efficient completion of a project. Shared knowledge that is bi-directional is key to improving the relationship and breaking down those barriers. Creating a common language to more appropriately communicate between the groups will help to resolve the disconnect and help both groups to understand each other`s needs.

Regardless of the delivery methodology there must be a good fit and understanding of the value provided. Testing must broaden their skills in relationship management to encourage future recognition as a role that offers more than individuals who create and execute test cases. They must push through those perceptions and improve not only themselves but the opinion of others which will help to prevent misunderstanding from arising.

The common theme throughout the analysis is knowledge management and its affect on trust and value within the relationship. The relationship between Testing and Business groups will vary from organization to organization. The recommended timing to introduce the changes may differ based on the strength of the relationship between Testing and Business. Each organization must determine their SMART goals (Specific, Measurable, Attainable, Relevant, and Timeframe) in time frames to meet their needs. Applying models such as the Golden Circle for marketing of roles, PDCA to evaluate strategic outcomes and the SCOR model for quality improvement will assist Testing and Business to resolve their disconnect issues and develop a stronger partnership for improved and efficient productivity.

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APPENDICES

Appendix A

		Business Responses *BIT				IT responses *ITB			
		Original data 7 point scale		Converted to 5 point scale		Original data 7 point scale		Converted to 5 point scale	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
*P1	Business takes full responsibility for realization of business benefits	4.65	1.56	3.32	1.11	4.07	1.51	2.91	1.08
*P 2	Most senior IT person influential in business strategy formulation	4.19	1.65	2.99	1.18	4.03	1.61	2.88	1.15
*P 3	IT Skilful in managing customer relationships and markets self-well	3.51	1.29	2.51	0.92	3.59	1.35	2.56	0.96
*P 4	IT communicates effectively with customers	3.87	1.28	2.76	0.91	3.90	1.27	2.79	0.91
*P 5	Existing information systems meet day-to-day needs of Business	3.89	1.48	2.78	1.06	4.45	1.31	3.18	0.94
*P 6	Most senior IT person a respected member of "inner sanctum"	4.52	1.71	3.23	1.22	4.22	1.62	3.01	1.16
*P 7	IT actively promotes environment of collaboration	4.14	1.34	2.96	0.96	4.58	1.25	3.27	0.89
*P 8	IT investment aligned with Business strategy and objectives	4.56	1.37	3.26	0.98	4.61	1.37	3.29	0.98
*P 9	IT actively involved in Business decision-making process	3.99	1.45	2.85	1.04	3.76	1.44	2.69	1.03
*P 10	IT delivers all it promises	3.64	1.40	2.60	1.00	3.95	1.36	2.82	0.97
*P 11	IT is a fundamental driver of future Business activity	4.89	1.72	3.49	1.23	4.93	1.73	3.52	1.24

*P 12	All IT personnel provide prompt, professional and courteous service	4.14	1.41	2.96	1.01	4.21	1.39	3.01	0.99
*P 13	IT function understands and acts upon Business priorities and issues	4.28	1.28	3.06	0.91	4.67	1.26	3.34	0.90
*P 14	Systems are reliable and responsive	4.15	1.39	2.96	0.99	4.61	1.37	3.29	0.98
*P 15	IT delivers cost-effective service	4.15	1.39	2.96	0.99	4.83	1.34	3.45	0.96
*P 16	IT and Business speak the same language	3.75	1.32	2.68	0.94	3.62	1.29	2.59	0.92
*P 17	IT adds value to the business	4.99	1.26	3.56	0.90	5.40	1.17	3.86	0.84
*P 18	IT not a constraint on the business	3.87	1.63	2.76	1.16	4.46	1.54	3.19	1.10

7 point scale: 1 Strongly Disagree 7 Strongly Agree

Appendix B

IT competence of Business

		Mean	Std. Dev.
Knowledge of system development			
BITC1- What is your general knowledge of traditional system development life cycle?	a	2.094	1.22
BITC2- What is your general knowledge of end-user computing?	a	2.411	1.26
BITC3- What is your general knowledge of outsourcing?	a	2.45	1.22
BITC4- What is your general knowledge of acquisition of software packages?	a	2.708	1.19
BITC5- What is your general knowledge of project management practices?	a	3.084	1.24
Knowledge of Management of IT			
BITC6- Indicate your level of knowledge about the current hardware (e.g. computers, communication, networks) assets of your business unit?	b	2.886	1.13
BITC7- Indicate your level of knowledge about the current IS applications (including software, data) assets of your business unit?	b	2.97	1.12
BITC8- How informed are you about the IT budget in your business unit?	b	1.921	1.17
BITC9- How informed are you about IT strategies in your business unit?	b	2.421	1.22
BITC10- How informed are you about the IT policies in your business unit?	b	2.137	1.14

BITC11- How informed are you about the IT vision statements in your business unit?	b	1.896	1.11
BITC12- How knowledgeable are you about your competitors' use of IT?	b	2.084	1.1
Knowledge of access to information			
BITC13- How knowledgeable are you about IT or business people to contact within your organization as a source of information about IT?	c	3.277	1.04
BITC14- How knowledgeable are you about IT or business people to contact outside your organization as a source of information about IT?	c	2.094	1.07
BITC15- How knowledgeable are you about secondary sources of knowledge as a source of information about IT?	c	2.554	1.06
Experience in IT Projects			
BITC16- How often have you participated in and/or led in initiating new IS projects?	d	2.342	1.33
BITC17- How often have you participated in and/or led in identifying the cost & benefits of IS projects before they are developed; preparation of business cases?	d	1.955	1.28
BITC18- How often have you participated in and/or led in managing information systems projects?	d	2.005	1.26
BITC19- How often have you participated in and/or led in developing information systems	d	1.733	1.18
BITC20- How often have you participated in and/or led in implementing information systems projects	d	2.089	1.27
Experience in general management of IT			
BITC21- How often have you participated in and/or led in creating an IT vision statement regarding how IT contributes to business value and strategy?	d	1.376	0.89

BITC22- How often have you participated in and/or led in developing IT strategy?	d	1.599	1.1
BITC23- How often have you participated in and/or led in creating IT policies?	d	1.485	0.98
BITC24- How often have you participated in and/or led in setting IT budgets?	d	1.485	0.99
Line leadership			
BITC25- To what extent do you intend to create or strengthen partnership/alliances with IT people within your organization?	e	3.055	1.16
BITC26- To what extent do you intend to support/promote the use of IT in your division?	e	3.945	1.06

Scale

a 1. Never hear of - 3. know about them in general - 5. understand their value to the organization

b 1. Uninformed - 5. Very well informed

c 1. Not at all knowledgeable - 5 Extremely knowledgeable

d 1. Never - 5. Many times

e 1. Very little extent - 5 Very great extent

Business Competence of IT professionals

		Mean	Standard Dev.
ITBC1-Organizational Overview	Rate your level of knowledge of the organization's external environment.	3.2	.80
	Rate you level of knowledge of the goals and objectives of the organization as a whole.		
	Rate you level of knowledge of the core capabilities of the organization.		
	Rate you level of knowledge of the key factors that must go right for the organization to succeed.		
ITBC2-Organizational Units	Rate your level of knowledge of the main challenges that different divisions in the organization face in achieving their objectives.	2.9	.87
	Rate your level of knowledge of the language of the different divisions in the organization.		
	How well do you understand the work processes of the different divisions in your organization?		
	Rate your level of knowledge of the connections and interdependencies between the various divisions in the organization.		
ITBC3-Organizational responsibility	To what extent do you take actions to stay informed about business developments not directly related to IT?	3.0	.87
	How much do you participate in business activities that are not directly related to IT?		
	To what extent are you concerned by the overall performance of your business organization?		
ITBC4-Knowledge Networking	If you have a business question or problem that you cannot solve alone, how confident are you about finding the right person to contact in your organization?	3.6	.87
	If you have a business question or problem that you cannot solve alone, how confident are you about finding the right contacts outside your organization?		
	If you have a business question or problem that you cannot solve alone, how confident are you about finding other relevant sources of business information including internet site, magazines, trade journals, and conferences?		
ITBC5-Interpersonal communication	In general, how effective do you think you are at communicating with people at different levels of the organization?	4.0	.64
	How effective are you at working in a team environment?		
	How well can you communicate about IT matters in non-technical language and within a business context to non-IT specialists?		

ITBC6-Leadership	In general, how effective do you think you are at managing projects (planning, managing resources etc…)?	3.6	.83
	In general, how effective do you think you are at acting in a leadership role?		
ITBC7-IT/Business integration	How experienced are you at recognizing potential ways to exploit new business opportunities using IT?	3.4	.76
	How experienced are you at analyzing business problems in order to identify IT-Based solutions?		
	How experienced are you at evaluating the organizational impacts of IT solutions?		
	Rate your level of knowledge of the alignment between business goals and information systems goals in the organization as a whole.		
	Rate your level of knowledge of the way IT contributes to the value of the organization.		

Appendix C

Sub problem 1					
Study name	Statistics for each study				
	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Sub problem 1 IT to Business	0.180	0.111	0.247	5.07	0.000
Sub problem 1 Business to IT	0.285	0.227	0.340	9.31	0.000
	0.240	0.196	0.283	10.35	0.000
Sub problem 2					
Study name	Statistics for each study				
	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Sub problem 2 IT to Business	0.050	-0.020	0.121	1.4	0.163
Sub problem 2 Business to IT	0.321	0.265	0.375	10.65	0.000
	0.209	0.164	0.253	8.97	0.000
Sub problem 3					
Study name	Statistics for each study				
	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Sub Problem 3 IT to Business	0.267	0.201	0.330	7.67	0.000
Sub Problem 3 Business to IT	0.319	0.263	0.373	10.58	0.000
	0.297	0.254	0.338	13.01	0.000

All sub problems					
Study name	Statistics for each study				
	Correlation	Lower limit	Upper limit	Z-Value	p-Value
Sub problem 1 IT to Business	0.180	0.111	0.247	5.070	0.000
Sub problem 2 IT to Business	0.050	-0.020	0.121	1.395	0.163
Sub Problem 3 IT to Business	0.267	0.201	0.330	7.678	0.000
Sub problem 1 Business to IT	0.285	0.227	0.340	9.312	0.000
Sub problem 2 Business to IT	0.321	0.265	0.375	10.647	0.000
Sub Problem 3 Business to IT	0.319	0.263	0.373	10.581	0.000
	0.249	0.224	0.274	18.676	0.000

Business to IT Breakdown					
Study name	Statistics for each study				
SP = Sub-Problem	Correlation	Lower limit	Upper limit	Z-Value	p-Value
SP1 BITP1-BITC19	0.459	0.411	0.505	16.345	0.000
SP1 BITP1-BITC16	0.372	0.318	0.423	12.598	0.000
SP1 BITP1-BITC18	0.487	0.440	0.530	17.632	0.000
SP1 BITP1-BITC17	0.497	0.452	0.540	18.153	0.000
SP1 BITP1-BITC4	0.258	0.200	0.315	8.368	0.000
SP1 BITP2-BITC24	0.414	0.363	0.462	14.336	0.000
SP1 BITP2-BITC22	0.231	0.171	0.289	7.414	0.000
SP1 BITP2-BITC21	0.430	0.380	0.478	15.047	0.000
SP1 BITP2-BITC13	0.128	0.066	0.189	4.012	0.000
SP1 BITP2-BITC21	0.609	0.572	0.643	24.406	0.000
SP1 BITP2-BITC22	0.520	0.476	0.561	19.293	0.000
SP2 BITP3-BITC3	0.120	0.058	0.181	3.769	0.000
SP2 BITP3-BITC7	0.220	0.160	0.278	7.037	0.000
SP2 BITP3-BITC10	0.178	0.117	0.237	5.640	0.000
SP2 BITP3-BITC13	0.364	0.310	0.416	12.309	0.000
SP2 BITP3-BITC17	0.243	0.184	0.300	7.832	0.000
SP2 BITP3-BITC18	0.224	0.164	0.282	7.194	0.000
SP2 BITP3-BITC22	0.411	0.359	0.459	14.204	0.000
SP2 BITP3-BITC24	0.473	0.426	0.518	16.978	0.000
SP2 BITP3-BITC25	0.253	0.194	0.310	8.178	0.000
SP1 BITP4-BITC3	0.143	0.081	0.204	4.514	0.000
SP1 BITP4-BITC4	0.025	-0.038	0.087	0.768	0.443
SP1 BITP4-BITC7	0.103	0.040	0.164	3.218	0.001
SP1 BITP4-BITC10	0.290	0.233	0.345	9.502	0.000
SP1 BITP4-BITC13	0.256	0.197	0.313	8.297	0.000
SP1 BITP4-BITC18	0.326	0.271	0.380	10.843	0.000
SP1 BITP5-BITC19	0.480	0.433	0.524	17.300	0.000
SP1 BITP5-BITC23	0.535	0.492	0.575	20.081	0.000
SP1 BITP5-BITC24	0.533	0.490	0.574	19.989	0.000
SP1 BITP7-BITC3	0.227	0.167	0.285	7.292	0.000
SP1 BITP7-BITC7	0.005	-0.058	0.068	0.150	0.881
SP1 BITP7-BITC8	0.438	0.388	0.485	15.376	0.000
SP1 BITP7-BITC10	0.365	0.311	0.416	12.316	0.000
SP1 BITP7-BITC11	0.457	0.409	0.503	16.239	0.000
SP1 BITP7-BITC13	0.157	0.095	0.217	4.946	0.000
SP1 BITP7-BITC18	0.394	0.341	0.443	13.490	0.000
SP1 BITP7-BITC22	0.551	0.509	0.590	20.964	0.000
SP1 BITP7-BITC23	0.605	0.568	0.640	24.161	0.000

SP1/2 BITP8-BITC1	0.467	0.420	0.512	16.720	0.000
SP1/2 BITP8-BITC3	0.345	0.290	0.397	11.543	0.000
SP1/2 BITP8-BITC4	0.246	0.187	0.303	7.947	0.000
SP1/2 BITP8-BITC9	0.380	0.327	0.430	12.919	0.000
SP2 BITP9-BITC13	0.201	0.141	0.260	6.410	0.000
SP2 BITP9-BITC25	0.093	0.030	0.155	2.904	0.004
SP1 BITP10-BITC1	0.222	0.162	0.280	7.114	0.000
SP1 BITP10-BITC3	0.067	0.005	0.130	2.101	0.036
SP1 BITP10-BITC8	0.298	0.241	0.353	9.806	0.000
SP1 BITP10-BITC10	0.211	0.151	0.270	6.760	0.000
SP1 BITP10-BITC17	0.273	0.215	0.329	8.899	0.000
SP1 BITP10-BITC18	0.254	0.195	0.311	8.217	0.000
SP2 BITP11-BITC9	0.400	0.348	0.449	13.741	0.000
SP2 BITP11-BITC10	0.495	0.449	0.538	18.029	0.000
SP2 BITP11-BITC19	0.588	0.550	0.625	23.130	0.000
SP2 BITP11-BITC25	0.179	0.118	0.238	5.671	0.000
SP2 BITP11-BITC26	0.196	0.135	0.255	6.237	0.000
SP1 BITP12-BITC16	0.254	0.195	0.311	8.227	0.000
SP1 BITP12-BITC17	0.401	0.349	0.450	13.788	0.000
SP1 BITP12-BITC18	0.387	0.334	0.437	13.216	0.000
SP1 BITP12-BITC19	0.488	0.442	0.532	17.724	0.000
SP2 BITP13-BITC13	0.111	0.048	0.172	3.468	0.001
SP2 BITP13-BITC10	0.410	0.358	0.458	14.159	0.000
SP2 BITP13-BITC23	0.640	0.606	0.672	26.493	0.000
SP1 BITP14-BITC1	0.364	0.310	0.416	12.301	0.000
SP1 BITP14-BITC2	0.236	0.177	0.294	7.608	0.000
SP1 BITP14-BITC4	0.115	0.052	0.176	3.599	0.000
SP1 BITP14-BITC7	0.005	-0.058	0.068	0.148	0.883
SP1 BITP14-BITC16	0.256	0.197	0.313	8.291	0.000
SP1 BITP14-BITC18	0.390	0.337	0.440	13.325	0.000
SP1 BITP14-BITC19	0.492	0.446	0.535	17.882	0.000
SP2 BITP15-BITC3	0.224	0.165	0.283	7.201	0.000
SP2 BITP15-BITC4	0.115	0.052	0.176	3.599	0.000
SP2 BITP15-BITC7	0.005	-0.058	0.068	0.148	0.883
SP2 BITP15-BITC8	0.433	0.383	0.480	15.171	0.000
SP2 BITP15-BITC17	0.403	0.352	0.453	13.900	0.000
SP2 BITP15-BITC18	0.390	0.337	0.440	13.325	0.000
SP2 BITP15-BITC24	0.597	0.559	0.633	23.662	0.000
SP1 BITP16-BITC13	0.289	0.231	0.344	9.452	0.000
SP1 BITP16-BITC19	0.407	0.355	0.456	14.044	0.000
SP1 BITP16-BITC21	0.580	0.540	0.616	22.593	0.000

SP1 BITP16-BITC22	0.468	0.420	0.513	16.746	0.000
SP2 BITP17-BITC9	0.471	0.423	0.516	16.887	0.000
SP2 BITP17-BITC25	0.237	0.178	0.295	7.640	0.000
SP2 BITP17-BITC26	0.193	0.132	0.252	6.130	0.000
SP1 BITP18-BITC9	0.141	0.079	0.202	4.443	0.000
	0.343	0.340	0.349	105.64	0

Breakdown IT to Business					
Study name	Statistics for each study				
	Correlation	Lower limit	Upper limit	Z-Value	p-Value
SP1 ITBP1-ITBC3	0.030	-0.041	0.101	0.826	0.409
SP1 ITBP1-ITBC5	0.348	0.286	0.407	10.334	0.000
SP1 ITBP1-ITBC6	0.225	0.157	0.290	6.389	0.000
SP1 ITBP2-ITBC3	0.038	-0.033	0.108	1.041	0.298
SP1 ITBP2-ITBC5	0.338	0.275	0.398	10.000	0.000
SP1 ITBP2-ITBC6	0.101	0.030	0.170	2.796	0.005
SP ITBP3-ITBC1	0.125	0.054	0.194	3.472	0.001
SP ITBP3-ITBC2	0.160	0.091	0.228	4.497	0.000
SP ITBP3-ITBC4	0.368	0.307	0.425	11.023	0.000
SP ITBP3-ITBC5	0.472	0.418	0.522	14.997	0.000
SP1 ITBP4-ITBC3	0.081	0.010	0.151	2.245	0.025
SP1 ITBP4-ITBC5	0.435	0.379	0.488	13.524	0.000
SP1 ITBP4-ITBC6	0.301	0.236	0.363	8.770	0.000
SP1 ITBP5-ITBC3	0.068	-0.003	0.138	1.871	0.061
SP1 ITBP5-ITBC5	0.303	0.239	0.364	8.836	0.000
SP1 ITBP5-ITBC6	0.157	0.087	0.225	4.396	0.000
SP1 ITBP7-ITBC3	0.106	0.036	0.175	2.944	0.003
SP1 ITBP7-ITBC5	0.285	0.220	0.348	8.267	0.000
SP1 ITBP7-ITBC6	0.130	0.060	0.199	3.622	0.000
SP1/2 ITBP8-ITBC3	0.105	0.034	0.174	2.907	0.004
SP1/2 ITBP8-ITBC5	0.256	0.190	0.320	7.345	0.000
SP1/2 ITBP8-ITBC6	0.112	0.042	0.182	3.124	0.002
SP2 ITBP9-ITBC1	0.073	0.002	0.143	2.013	0.044
SP2 ITBP9-ITBC2	0.107	0.037	0.176	2.973	0.003
SP2 ITBP9-ITBC4	0.308	0.244	0.369	9.005	0.000
SP2 ITBP9-ITBC5	0.416	0.358	0.470	12.772	0.000
SP1 ITBP10-ITBC3	0.062	-0.009	0.133	1.725	0.085
SP1 ITBP10-ITBC5	0.387	0.328	0.444	11.721	0.000
SP1 ITBP10-ITBC6	0.262	0.196	0.326	7.550	0.000
SP2 ITBP11-ITBC1	0.179	0.110	0.246	5.030	0.000
SP2 ITBP11-ITBC2	0.151	0.081	0.219	4.215	0.000
SP2 ITBP11-ITBC4	0.024	-0.047	0.095	0.659	0.510
SP2 ITBP11-ITBC5	0.140	0.070	0.208	3.903	0.000
SP1 ITBP12-ITBC3	0.004	-0.067	0.074	0.099	0.921
SP1 ITBP12-ITBC5	0.343	0.281	0.403	10.184	0.000
SP1 ITBP12-ITBC6	0.209	0.140	0.275	5.906	0.000
SP2 ITBP13-ITBC1	0.169	0.100	0.237	4.758	0.000

SP2 ITBP13-ITBC2	0.132	0.062	0.200	3.674	0.000
SP2 ITBP13-ITBC4	0.104	0.034	0.174	2.898	0.004
SP2 ITBP13-ITBC5	0.251	0.185	0.315	7.200	0.000
SP1 ITBP14-ITBC3	0.105	0.034	0.174	2.907	0.004
SP1 ITBP14-ITBC5	0.256	0.190	0.320	7.345	0.000
SP1 ITBP14-ITBC6	0.112	0.042	0.182	3.124	0.002
SP2 ITBP15-ITBC1	0.199	0.131	0.266	5.627	0.000
SP2 ITBP15-ITBC2	0.164	0.095	0.232	4.599	0.000
SP2 ITBP15-ITBC4	0.057	-0.014	0.127	1.574	0.116
SP2 ITBP15-ITBC5	0.200	0.132	0.267	5.658	0.000
SP1 ITBP16-ITBC3	0.155	0.086	0.223	4.348	0.000
SP1 ITBP16-ITBC5	0.487	0.434	0.536	15.641	0.000
SP1 ITBP16-ITBC6	0.363	0.302	0.421	10.862	0.000
SP2 ITBP17-ITBC1	0.370	0.309	0.427	11.104	0.000
SP2 ITBP17-ITBC2	0.336	0.273	0.396	9.931	0.000
SP2 ITBP17-ITBC4	0.111	0.041	0.180	3.088	0.002
SP2 ITBP17-ITBC5	0.058	-0.013	0.129	1.614	0.107
	0.209	0.199	0.218	43.574	0.000

Appendix D

Willcoxsen and Chatham				Bassellier			
Trust		Value		Trust		Value	
Business	IT	Business	IT	Business	IT	Business	IT
BITP1, 2, 4, 5, 7, 8, 10, 12, 14, 16, 18	ITPB1, 2, 4, 5, 7, 8, 10, 12, 14, 16, 18	BITP3, 8, 9, 11, 13, 15, 17	ITBP3, 8, 9, 11, 13, 15, 17	BITC19, 16, 17, 4, 24, 22, 21, 13, 3, 7, 10, 13, 18, 23, 24, 8, 11, 22, 1, 9, 2	ITBC3, 5, 6	BITC3, 7, 10, 13, 17, 18, 22, 24, 25, 1, 4, 9, 19, 26, 23, 8	ITBC1, 2, 4, 5,

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