ORGANIZATIONAL FACTORS CONTRIBUTING TO AN EFFECTIVE INFORMATION TECHNOLOGY INTELLIGENCE SYSTEM

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The purpose of this dissertation is to investigate the organizational factors that contribute to effective emerging information technology intelligence processes and products. Emerging information technology is defined as a technology which is little commercialized and is currently adopted by not more than twenty percent of the companies within a given industry. By definition, information technology intelligence is a subdivision of competitive intelligence and business intelligence.

I discovered evidence that the information technology intelligence process includes assessment of information technology intelligence needs of consumers, collection of data from internal and external sources, analysis of the collected data and distribution of the analyzed data to the consumers. Exploratory factor analysis confirmed the existence of all the variables in the proposed research model. I found empirical evidence that the final technology intelligence product contributes to better decisions made by consumers, their better environmental scanning, and more funding to information technology departments in organizations from different industries and of different sizes.

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CHAPTER 1

INTRODUCTION

In his book *The Art of War* (1520), Machiavelli emphasized the importance of the continuous quest for uncovering opponents' secrets. Today**,** business intelligence *(*BI*)* enables organizations to scan and monitor continuously external and internal environments for threats and opportunities posed by emerging technologies, competitors, markets, suppliers, distributors, customers and legal issues (Cavalcanti 2005). Globalization has increased the quantity and diversity of products in the market, as well as the challenges faced by information technology (Cavalcanti 2005). The pace and nature of change has accelerated competitiveness on a global scale (Gibson, 1998). That acceleration makes the world of business a battlefield**,** in which the stronger, the more agile and more intelligent companies will prevail (Cavalcanti and Oliveira 2002).

The importance of proactiveness is emphasized by a study conducted with the fifty oldest companies in the US to discover reasons for their long existence. One of the reasons found was proactiveness towards environmental signals (D'Aveni 1995). This study investigates the importance of technology intelligence (Savioz 2004, Lichtenthaler 2003) for the ability of organizations to attain a high level of proactiveness towards technology environmental signals.

1.1. Working Definitions

Porter (1986) defines intelligence as the analytic process that transforms information about the business environment into strategic organizational knowledge.

Porter claimed that the objective of intelligence is to provide actionable information of the external business environment**.** Unfortunately, past scholarship on the use of intelligence activities within business has identified various intelligence subdivisions by different names. The following discussion presents a view of these subdivisions that the author found most useful for conducting his research.

1.1.1 Business intelligence

Cavalcanti (2005) defined business intelligence (BI) as both a process and a product. The Society of Competitive Intelligence Professionals (SCIP 1999) used the following definition of business intelligence as a process:

> [I]t is the process of ethically collecting, analyzing and disseminating necessary information, which is pertinent, specific, opportunistic and predictive of the business environment and the organization itself.

This definition treats intelligence as a process that is supposed to deliver an accurate, opportunistic, predictable and actionable information as the final product. Cavalcanti claimed that information is simultaneously part of the intelligence process and its final product. The author differentiated between information and intelligence. Intelligence is a result of a refined analysis of information.

The activity of business intelligence involves organizational members as well as connected organizational departments to collect, analyze and disseminate it in the organization (Cavalcanti and Oliveira 2002). The process of business intelligence, according to Tudor-Silovic (1992), Miller (2000) and Shaker and Gembicki (1998), involves collecting and capturing data, its compilation and transformation into information, the analysis which transforms that information into knowledge, and the

communication and interpretation by organizational participants of the accumulated knowledge to yield actionable results.

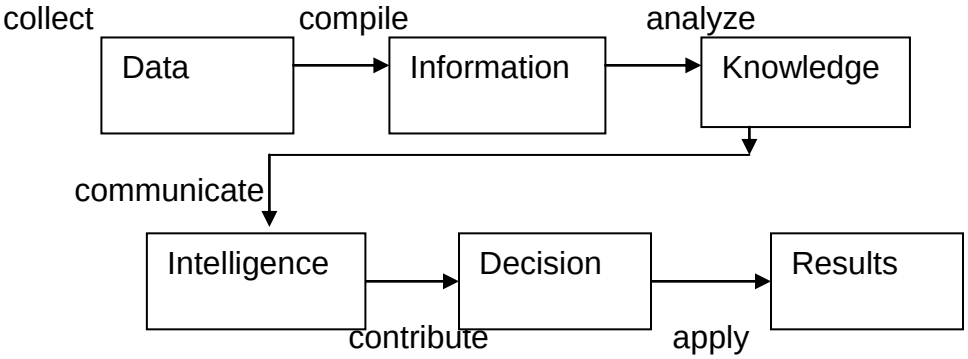


Figure 1.1. The Process of Business intelligence (SCIP 2000)

Liebowitz (2006) believes that the process of business intelligence has a more internal focus than competitive intelligence. The Knowledge Management and Business intelligence Workshop defines business intelligence as an ”active, model-based, and prospective approach to discover and explain hidden, decision-relevant aspects in large amounts of business data to better inform business decision processes” (KMBI 2005).

1.1.2 Importance of Business intelligence (BI)

Levinson (2005) believed that the three greatest obstacles to business success are large amounts of irrelevant data, poor data quality, and user resistance. He described how Wendy’s, Ruby Tuesday’s, Carlson Restaurants Worldwide, and CKE were able to utilize their business intelligence systems in a way that allowed them to realize cost efficiencies, improve process efficiency and improve gross sales revenues and profits. Levinson cited evidence from the CIO of Wendy’s that the return on investment on a business intelligence project can be as high as 430 % over a five year

period: “that of all projects that one attempts to do as a CIO, business intelligence, if well managed (and it’s not always well managed) contributes far, far more than it costs” (p.10).

Kelly (1993) analyzed empirical evidence about the value of BI as estimated by practitioners. According to his analysis, the estimated average payback of all BI projects is 310% of cost. A Gartner survey (2005) of 1300 international CIOs reported that spending for business intelligence activities was expected to increase by 6% in 2005.

Business intelligence was initially adopted by large corporations to assist them in their strategic planning in the early 1980s (Woodlawn Marketing Services 1999). During the 1990s, smaller companies started to become aware of the benefits which business intelligence can bring to their strategic planning methodologies.

1.1.3 Competitive Intelligence (CI)

Vedder et al. (1999) defined competitive intelligence as the set of legal and ethical methods, which a company uses to collect, analyze and disseminate information. As a product, the authors defined competitive intelligence as information about competitors from private and public sources. Vedder and Guynes (2002) claimed that CI has become an important source of information for business planning because it provides information about the present and future behavior of suppliers, customers, technologies, acquisitions and markets.

Liebowitz (2006) asserted that CI has both internal and external components and BI can be thus considered as the internal component of CI. From the definitions provided by Cavalcanti (2005), Vedder et al. (1999), Lonnqvist and Pirttimaki (2006) and

Liebowitz (2006) we can conclude that BI and CI overlap to a certain extent but that CI is more externally focused.

1.1.4 Importance of Competitive Intelligence (CI)

Liebowitz (2006) claimed that CI is the most comprehensive intelligence area and that it includes CI and technology intelligence (TI) as its subdivisions. Since it is more externally focused, Competitive Intelligence contributes more value to the tactical and strategic goals of a company (Savioz 2004, Liebowitz 2006). Rothberg and Erickson (2005) stressed the importance of CI. They claimed that an informative or actionable CI product fills the following gaps in an organization:

a) Knowledge gaps
b) Where to find what needs to be known
c) How to act with the information once it is provided

Liebowitz (2006) believed that the CI product is used to solve both short-term and long-term problems whereas BI is used to solve more short-term problems.

1.1.5 Technology Intelligence (TI)

Technology intelligence (TI) is one of the sub-divisions of CI (Savioz 2004, Liebowitz 2006) and as such can be studied both as a process and a product.

From Savioz (2004) and Liebowitz (2006), the following diagram to distinguish between various forms of intelligence can be derived:

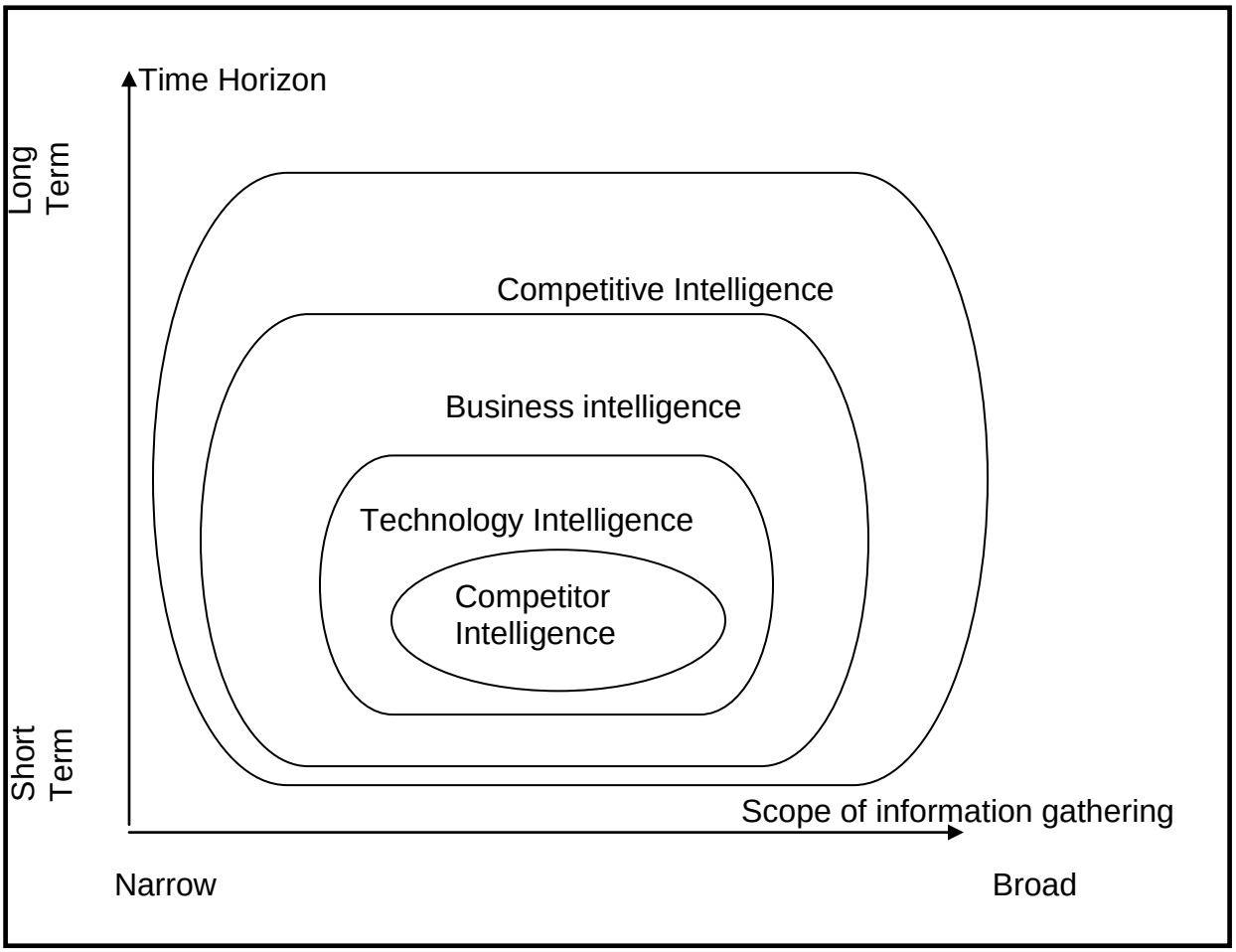


Figure 1.2 Forms of Organizational External Information Gathering (Savioz 2004, Liebowitz 2006, modified)

Liebowitz (2006) classified CI as having a broader scope than BI, more external focus and longer-term time horizon.

Savioz (2004) defined TI as activities that support technological and general management decision making by taking advantage of timely information on technological trends and facts in the organizational environment via the TI process of collection, analysis, dissemination and application. He also classified BI as having a broader scope of information gathering and longer term time horizon than TI. Lichtenthaler (2003) defined Tl as the systematic approaches used by companies for

observation and evaluation of emerging technology that may be of interest to them. Vedder and Vanecek (1998) believed that TI can be very useful to organizations if it clarifies the relative strengths and weaknesses of their information technology infrastructure when it is compared to that of other firms. The authors stated that TI can identify threats and opportunities posed by emerging information technologies.

1.1.6 Importance of Technology Intelligence (TI)

Lichtenthaler (2003) asserted that in the 1970s and 1980s there were no systematic approaches to the process of technology intelligence. Lindquist (2005) claimed that emerging information technologies can provide competitive advantage to companies that are willing to take the risk of being early adopters- defined as organizations that adapt new technologies prior to other organizations. New technologies can provide cost reductions, decision making and process efficiencies and increased revenues to organizations. Lindquist believed that early adopters can realize the opportunities provided by emerging technologies.

Lindquist claimed that these TI efforts allow organizations from different industries to maximize the benefits and minimize the risks of detecting and implementing emerging information technologies. He also stated that the keys to using a technology boldly and successfully are risk management, change management and gaining the trust of users. When these three factors are taken into consideration by organizations then emerging technologies can bring significant business benefits. Savioz (2004) recommended that companies of any size should engage in TI in order to

take advantage of relevant information about facts and trends in their technological environment. He listed the following key benefits of TI:

a) Small, medium sized and large companies improve decision making quality with TI

b) Opportunities from the technological environment can be detected

c) Threats from the technological environment can be avoided

Savioz stated that the rapid change in the technological environment presents a challenge faced by all technology-based companies. Farrell (2001) and Vedder and Vanecek (1998) recommended that the TI process needs to include organizational members representatives of the IT department in order for the quality of information to be of higher value.

The proposed research will study TI as it pertains to organizational IT needs. Prior research suggests that IT organizational departments have mostly not been involved with BI. Vedder and Guynes (2002) found IT support for intelligence efforts conducted by other departments such as marketing and finance. Lichtenthaler (2003, 2004, 2005) does not mention the IT department as involved in the process of technology intelligence or in the organizational technology intelligence system. He lists R&D, marketing and finance departments specifically as involved in the process of technology intelligence and management of TI systems. Yet, a survey conducted by the Futures Group in 1997 asked respondents to identify where intelligence is needed to make decisions (Farrell 2001). Emerging information technology initiatives were ranked fourth. This dichotomy shows that despite the fact that organizational decision makers perceive the importance of emerging information technologies, they do not do enough efforts to maximize the quality of emerging information technology intelligence. There is

a need to address this problem if decision makers are to take advantage of the potential that emerging information technologies offer. There is not enough evidence in academic or practitioner IT literature that reveals organizational commitment to emerging information technologies intelligence and the involvement of the IT department in such efforts.

1.2 Research Problem

1.2.1 Background

Considering the alleged importance of TI to firms, there is surprisingly little TI research reported in the academic IT literature. Previous management research contains studies primarily investigating the organization of TI systems in large organizations (Lichtenthaler 2003, 2004 and 2005). There is only one study that explored organization of TI systems in small and medium-sized enterprises and compared it vertically to large enterprises (Savioz 2002). The results of most of these studies show that organizations from different industries do not have a systematic way of conducting their TI and of designing and evaluating their TI systems on a continuous basis (Reger 2001, Lichtenthaler 2004).

Ashton et al. (1991) provided evidence that many technology-intensive organizations do not have a dedicated technology monitoring program. Lichtenthaler (2004) concluded from the results of 25 case studies of North American and European organizations from different industries that the biggest challenge to an organization is the management of technology intelligence systems. Lichtenthaler suggested that future research should concentrate on improvement of the management of technology

intelligence systems in technology-intensive organizations.

Lack of appropriate structure and continuity of the technology intelligence process leads to ineffective and delayed IT strategies (Cegielski et al. 2005) as well as loss of profits, market share and sales revenues (Kohli and Jaworski 1990). The value of technology intelligence (Lichtenthaler 2004, Kirca et al. 2005) and of systematic ways of organizing technology intelligence (Reger 2001, Savioz 2002) is empirically demonstrated by results from their studies.

Savioz (2004) lists the following benefits of systematic TI:

a) Completeness and lack of redundancies in TI

b) Consistent development of all elements in order to respond to changes

c) Involved organizational members are aware of being TI staff, which makes the system more effective and efficient

In summary, there is no evidence in academic IT literature or management literature of the existence of an organized, systematic and continuous TI system containing a TI management unit that includes the organizational IT function.

The research problem is that without the IT functional involvement in the TI system, the quality of intelligence provided by the TI system may not be sufficient for technical executives and decision makers to determine the best course of strategic action in terms of acquiring emerging information technologies that will create and sustain organizational competitive advantage in a rapidly changing and dynamic external organizational environment.

The following research questions emerge from the problems discussed by earlier practitioner and academic literature arranged from a macro to a micro perspective:

a) How can a technology-intensive organization (Lichtenthaler 2005) manage technology intelligence processes in order to generate continuous and actionable technology intelligence products?

b) Does an effective TI product lead to improved decision-making quality by CIOs and CTOs?

c) Does an effective TI system lead to increased funding of the IT department?

d) Are data from external sources a valuable input to the TI process?

e) Are data from internal sources a valuable input to the TI process?

f) Does an effective TI analysis lead to an effective TI product?

g) Does an effective TI system lead to better quality and justification of decisions by CIOs and CTOs?

h) Does and effective TI system lead to better CIOs/CTOs environmental scanning?

These questions are of specific significance to the IT functional members and executives since answers to them may provide a guideline for the growth and financial stability of the IT department.

1.2.2 Significance

Researchers have long argued that BI activities are highly correlated with business results. Vezmar (1996) claimed that intelligence is necessary for organizational survival. Several authors argued that BI is vital for strategy in general (Pepper 1999, Hovis 2000) and IT strategy in particular (Cegielski et al. 2005). Prescott and Miller (2001) believed that intelligence is fundamental for profitable and sustained organizational growth**.** Cavalcanti (2005) empirically demonstrated that BI in large organizations results in increased sales revenue and market share for these firms. Lichtenthaler (2004) claimed that TI is vital for organizational survival. Iansiti (2000) stated that the lack of sufficient information on technological trends results in the limited

learning capability of an organization. Kirca et al. (2005) provided evidence from their meta-analysis that TI statistically correlated to overall organizational performance using the following dimensions: overall business performance, profit, sales and market share. Vedder and Vanecek (1998) claimed that TI can reveal strengths and weaknesses of an organization's own technology infrastructure and provide insights to decision makers about threats and opportunities posed by emerging technology adoption trends of competitors.

In summary, if TI needs of an organization are not adequately addressed, then the quality of decision making, the satisfaction of intelligence consumers, internal funding of TI projects and funding of the IT department will all be jeopardized.

1.2.3 Contribution of Study to Problem Solution

The proposed study explored how external and internal TI sources (Savioz 2004) and internal TI needs (Kirca et al. 2005, Savioz 2004) influence the effectiveness of a technology intelligence product as measured by the quality of decision making (Savioz) , IT departmental funding (Overby 2005) and quality of the environmental scanning of decision-makers (Hambrick 1967). The research will help close an existing gap in the academic research literature about the management of technology intelligence systems (Lang 1998, Savioz 2002, Lichtenthaler 2004) and establish a new stream of research in the information technology academic field.

The study also explored how quality of external and internal TI sources influences the TI processes and products. The TI products are dependent on the TI needs of internal organizational customers (Lichtenthaler 2004, Kirca et al. 2005).

The goal of this study is to improve academic and practitioners' understanding of the simultaneous influence of TI needs of internal organizational customers and quality of external and internal intelligence sources on the quality of the TI process and product.

1.2.4 Research Approach

This study was a qualitative, interpretive research that used grounded theory as a research method, which is a continuous process of iteration between data collection and data analysis also suggested by Prescott et al. (2003) as a research method in BI. The mode of analysis will be hermeneutics with some elements of narrative and metaphor. For readers unfamiliar with this approach, I offer the following background.

There are two major positions within qualitative research (Yin 2002, Walsham 1993):

a) Positivist – researchers believe that reality is objective and can be described by measurable properties independent of the researchers and his or her instruments.

b) Interpretive – researchers attempt to understand the context of an information system and the process by which the information system influences and is influenced by an organizational context.

I followed the interpretive position.

There are four major data-collection methods used in qualitative research.

a) Action research – participant observation dominates as a data collection technique.

b) Case study research – researchers use interviews and documentary observations rather than participant observations.

c) Ethnography – participant observation is the primary data collection method and the direct field observations and notes of the researchers are most important.

d) Grounded theory – the researcher combines questionnaires with interviews and constantly iterates between data collection and analysis to better describe a phenomenon in terms of a given organizational context and a specific organizational process.

There are three main modes of analysis in qualitative research:

a) Hermeneutics is the interpretation of the meaning of text. The major question that is to be answered is: “What is the meaning of this text?”. The ultimate goal of hermeneutics analysis is to better define the relationships between people, the organization and an information technology.

b) Semiotics is the interpretation of signs and symbols in language.

c) Narrative and metaphor is the interpretation of the meaning of the communication between systems developers and other organizational members.

The author will use the grounded theory data collection method and a mixture of hermeneutics and narrative and metaphor as the mode of analysis in this dissertation.

1.3 Chapter Conclusion

I hope that IT practitioners and researchers will acquire a better understanding of what an effective emerging information technology intelligence product is. This product is the output of specific processes within a given organizational context defined by IT and marketing departmental structures, the personal characteristics of CIOs/CTOs, technology managers and technology intelligence consumers in general.

I discussed in chapter 1 the concepts of business intelligence in general and technology intelligence in particular and how they relate to each other. Chapter 2 focuses on review of IT and management academic and practitioner literature that covers technology intelligence processes and products. The literature review will also define the role of business intelligence processes and products for our better understanding of their technology intelligence counterparts.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

In this chapter I examine prior literature on business intelligence (BI) and technology intelligence (TI) that is relevant to this research. Very few studies on the topics of TI processes and products have appeared in IT academic literature. Consequently, IT researchers in this field must look to prior BI research (conducted by marketing and management scholars), and to practitioner literature, for guidance in developing a theoretical model.

My intent was to study CIOs/CTOs' use of technology intelligence and to learn what factors contribute to effective TI intelligence processes and products. As observed in chapter 1, TI is both a process and a product. Savioz (2004) defined that TI as a process includes collection of technology data, analysis of that data and its dissemination within the organization. He stated that the TI product is the refined output of the TI process and presents at least informative and at most actionable technology intelligence.

Business intelligence (BI) emerged in the 1980s, utilizing many of the principles of military and governmental intelligence practices (Prescott and Miller 2001, Herring 1999, Shaker and Gembicki 1999, Barclay and Kaye 2000, McGonagle and Vella 1999). Increased global competitiveness pressured companies to develop a well thought-out business intelligence processes that supported organizational flexibility and agility, and were proactive to external opportunities and threats rather than being reactive (Vedder and Vanecek, 1998).

Farrell (2001) estimated that 82% of US companies with annual revenues over $10 billion have an organized business intelligence system. He wrote that the companies best utilizing business intelligence were Microsoft, Motorola, IBM, Proctor and Gamble, GE, HP, Coca-Cola, and Intel. A survey of InfoWorld readers (2005) found that respondents placed highest value on quality of the data and predictive ability provided by business intelligence software tools.

The detailed discussion below of relevant literature reports first on TI as a process, and then on TI as a product or outcome of the process. In this discussion, the reader will often encounter the terms TI provider and TI consumer. A TI provider is a person or group of people who supplies technology intelligence on predefined topics to TI consumers (Savioz 2004). A TI consumer is the CIO or CTO of a company who demands technology intelligence to make decisions concerning product development, new technology acquisition, IT strategy or to support decisions already taken (Savioz 2004, Cegielski et al.2005, Vedder and Vanecek 1998).

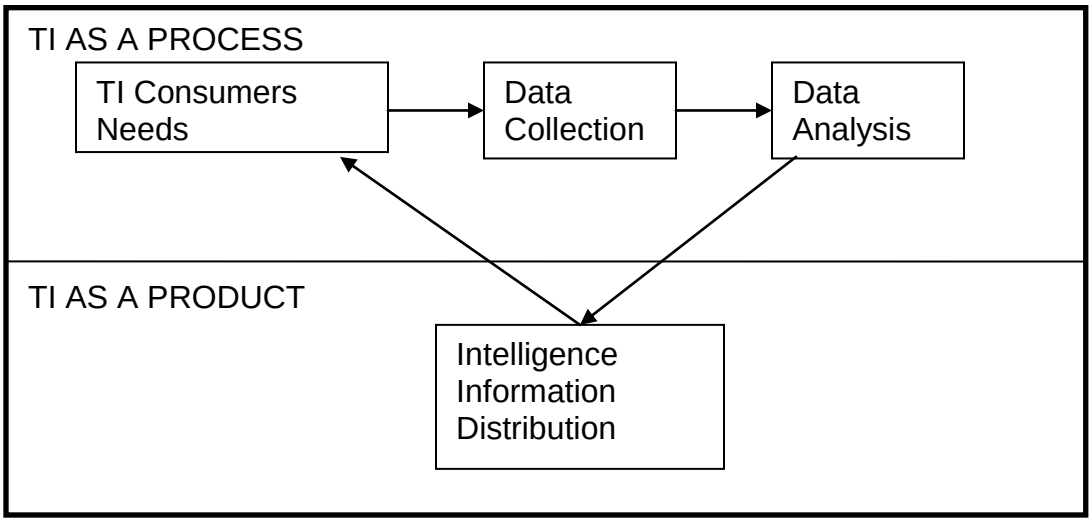


Figure 2.1 Managerial Structure of the Technology intelligence Cycle

2.2 Technology intelligence as a Process

Prior researchers have presented similar phases for both the BI process and the TI process. According to Vedder and Vanecek (1998) descriptions of the actual BI process vary, but all reflect the steps noted by Michael Porter: (1) identify what needs to be known; (2) collect external and internal data; (3) compile the data; (4) catalogue the data; (5) analyze the data; and (6) communicate the data.

The TI process is defined by Savioz (2004) as all organizational activities involved in the formulation of TI needs of internal customers, information collection, information analysis, information dissemination and information application. Savioz stated that the ideal TI process contains all these activities but observed that not all organizations implement it to such an extent.

He described each of the activities of the TI process in detail:

a) Formulation of information needs -- the TI staff defines observation areas that are most relevant to the internal technology intelligence needs of the consumers in order to prevent information overload and minimize organizational resources used.

b) Information collection -- employees from various departments collect information from external and internal sources depending on their expertise and available time. Data collectors are chosen based on the observation area so that the collectors possess the necessary subject knowledge and expertise to identify the best information sources. In cases where knowledge or expertise is missing, the firm retains outside experts to fill in the gaps.

c) Information dissemination -- the TI product reaches consumers via different communication media. The more people use TI products, the more valuable they become.

d) Information application -- during this phase the TI product is utilized by internal TI consumers. Savioz believed that the value of the TI product is measured by enhanced decision making quality of TI consumers, improved selection process of TI projects and resource allocation to them and increased awareness of technological threats from competitors.

2.2.1 Managerial Structures for TI Activities

Prior BI research (Lang 1998, Lichtenthaler 2003, 2004, 2005) suggests that companies have used one or more of three organizational schemes for intelligence gathering and analysis: a formal intelligence unit, one or more persons specifically tasked with intelligence duties, or a completely ad-hoc approach.

Lichtenthaler (2004) conducted case studies of twenty-six leading European and North American companies from the pharmaceutical, automotive and telecommunications industry. He described three forms of managing the TI process:

a) Structural coordination - tasks are attributed through a strict hierarchical order of positions and departments. Full-time technology intelligence professionals track competitors, universities and start-up companies to detect new technology trends. Savioz (2004) defined a TI professional as a person who is trained in technology data collection and analysis and whose job duties are dedicated only to TI activities.

b) Hybrid coordination - usually uses projects of limited duration tailored to specific technology intelligence problems. Non-technology intelligence professionals participate in these projects in the technology intelligence unit. Often, technology teams are created as part of the technology planning and resource allocation process. Under this scenario, participants in the planning process also form intelligence project teams. Lichtenthaler provided as an example the integration of technology intelligence into R&D projects. In this case, the intelligence professional is trained in non-technology intelligence activities and his job duties are not dedicated only to TI activities.

c) Informal coordination - promotes autonomous information gathering behavior. Innovation need serves as an information need. The most efficient way to communicate strategies is through participatory planning processes. Informal communication can be intensified through job rotation and clearly established routines of communicating new trends. Intranet has become a major communication tool under this type of technology intelligence coordination. This organizational scheme for technology collection and analysis involves people who may not be intelligence professionals at all and not trained in any type of intelligence activities.

Lichtenthaler stated that all of these approaches should be managed by a central technology intelligence unit. Further, he argued that tracking technologies which are

within the competencies of the company should be done by technology experts from the company's R&D group. Lichtenthaler recommended that monitoring emerging technologies should be delegated to TI professionals. The researcher also recommended that future research should take a holistic view of technology intelligence and investigate the interaction among the three forms of managing the TI process in a given organization.

If there is a dedicated TI unit that plans, implements, evaluates and enhances the TI process on a continuous basis**,** and the organizations**'** IT unit is a consumer of TI, then the quality of the final TI product can be enhanced (Savioz 2004, Vedder and Vanecek 1998).

2.2.2 Assessing Technology Intelligence Needs

Savioz (2004) believed that firms had to be proactive in the needs assessment of their TI consumers. He stated that TI consumers have difficulties in formulating their information needs. He recommended that TI providers and consumers need to educate each other to determine what data are informative or actionable from the point of view of TI consumers

Brenner (2005) stated that TI professionals need to be proactive in identifying intelligence needs of TI consumers. He asserted that instead of just reactively supplying reports to TI consumers, TI providers must identify consumer needs on a continuous basis to enhance the quality of the final TI product.

Savioz (2004) identified two types of formulation of an information need by TI consumers:

a) Explicit formulation -- it is a top-down initiative which defines specific demands or general declaration of requirements by TI consumers. Savioz claimed that in this case TI activities would be reactive to the explicit TI consumer needs.

b) Implicit formulation -- it is based on implicit signals coming from the changing organizational strategy. Environmental scanning may generate such an implicit signal. In this case TI activities would be proactive to potential needs of internal TI consumers.

Organizational IT departments have tended to support the intelligence needs of other departments (such as marketing) rather than pursue their own TI needs (Vedder and Guynes 2002). However, Cegielski et al. (2005) reported that CIOs and CTOs think their functional IT strategy could be much more effective and efficient if they were provided with an evaluation of an emerging information technology before they adopted it. The present research investigated this discrepancy in reported behaviors of IT departments.

2.2.3 Gathering Intelligence Data from External Sources

Shaker and Gembicki (1999) claimed that the goal of BI was to detect relevant environmental changes, so that an organization could identify and react quickly seizing opportunities and addressing threats. BI should also forecast competitors' strategies and provide insight for the reasons behind their actions (Sandman 2000, Stoner 1986, Ryan 2006).

Prior research has shown that there is a great variety of external resources. Savioz (2004), Lichtenthaler (2004) and Vedder and Vanecek (1998), stated that an organization needed to utilize all of the available external intelligence sources in order to improve the quality of the final TI product delivered to decision makers. They identified the following external intelligence sources:

a) Suppliers, customers, post docs in universities, external expert networks

b) External venture capital funds, listening posts and science and technology alliances between universities and companies from the industry

c) Journals, books, newspapers, proceedings, vendor literature, and government documents**;** and

d) Conferences, fairs, seminars and events, business and trade publications, technical journals, annual reports, speeches and press releases, online databases, and the Internet al..so identified by Farrel (2001).

Recognizing this diversity, Cavalcanti and Oliveira (2002) divided business intelligence into three environmental segments (Fig. 2.2)**:**

a) Environmental Intelligence -- this type of intelligence includes technology intelligence, legal intelligence and economic intelligence. The goal of environmental intelligence is to provide an organization with enough information about the external environment.

b) Customer Intelligence -- this type of intelligence includes attitudes, needs and characteristics of customers.

c) Market Intelligence -- this type of intelligence includes competitors' intelligence, suppliers' intelligence and distributors' intelligence. The purpose of market intelligence is to define the level of competition faced by an organization.

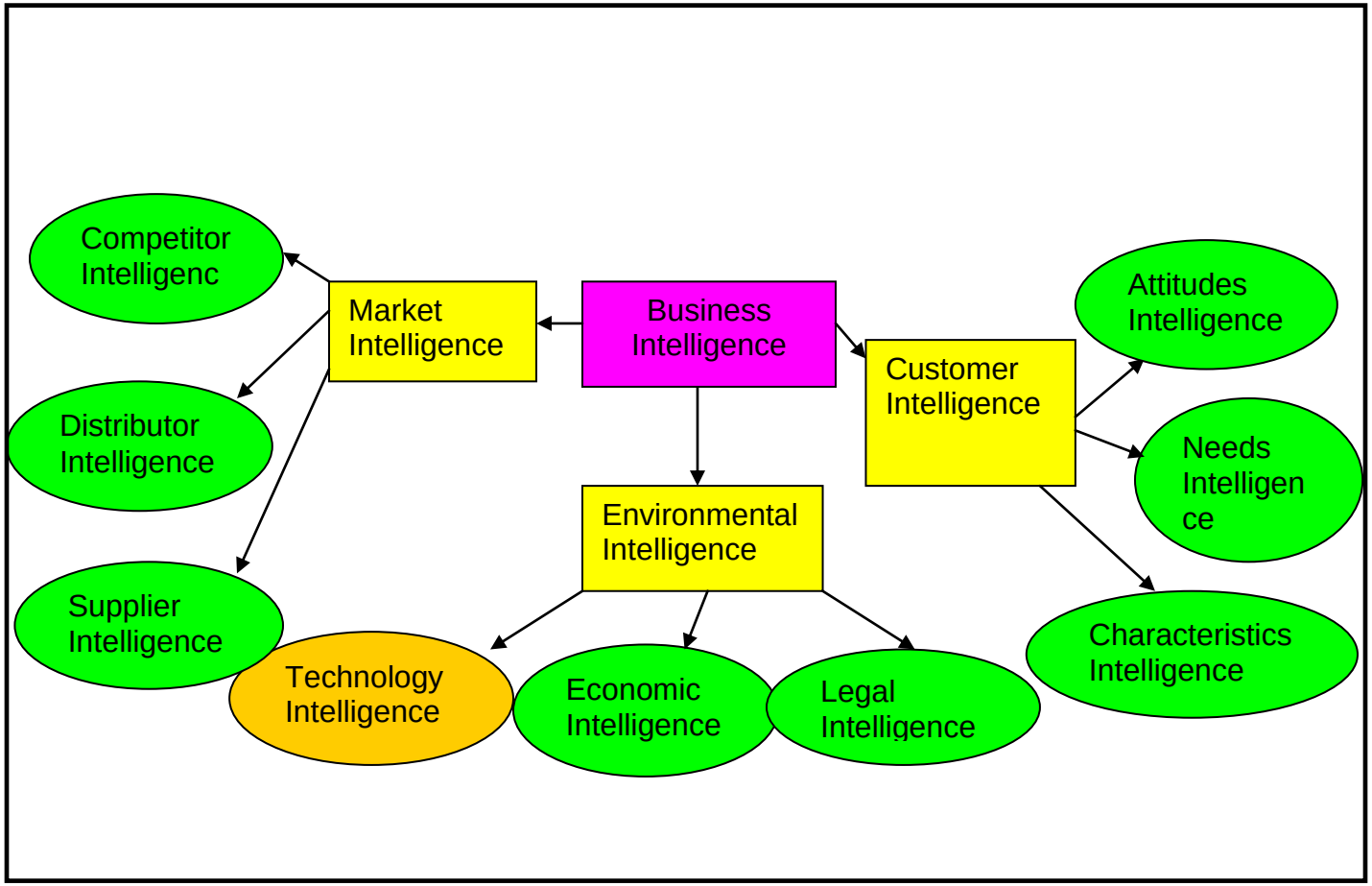


Figure 2.2: Business intelligence Subdivisions (Cavalcanti and Oliveira 2002, modified)

Since the external intelligence sources identified by Vedder and Vanecek, Cavalcanti and Oliveira and Savioz for BI and TI overlap, this supports belief that the TI process can benefit from using external BI sources.

2.2.4 Gathering Intelligence Data from Internal Sources

Cavalcanti (2005) empirically demonstrated the value of internal BI sources such as marketing and sales, production, research and development, finance and general administration departments. He found that intelligence products originating from internal BI sources had the highest contribution to business success in large Brazilian and European firms from different industries, when compared with BI products drawn from external sources**.** The researcher found that internal intelligence had a higher contribution to business profit and market share of these firms when compared to intelligence originating from external sources.

Savioz (2004) and Scott and Rothberg (2005) identified the following internal TI sources:

a) Researchers -- employees from the R&D department have plenty to offer in terms of specific technology knowledge; engineers -- employees from technical departments who have experience and knowledge in the identified area of technology observation; TI specialists -- employees from the TI unit who execute the TI process and have knowledge of historical procedures involved in that process.

b) Archival intelligence data stored in customer relationship management and supply chain management internal database systems – these systems contain intelligence data on suppliers, distributors and customers, which may yield valuable tactical and strategic insights to TI consumers. Any entity on the value chain of a company can be valuable TI source.

2.2.5 Analysis of Technology intelligence Data

Savioz listed three different phases of the TI analysis process:

a) Filter -- reduce the quantity of data by checking its relevance and quality from the perspective of TI consumers.

b) Integrate -- interpret data using professional expertise and the firm's context, which produces information.

c) Assess -- evaluate the tactical or strategic meaning of the information for the company, which hopefully produces informative or actionable TI.

Farrell (2001) described the analysis phase of the intelligence cycle as the transformation of collected data into informative or actionable information. Data are collated and synthesized according to the intelligence targets and priorities set by TI consumers. TI providers should be able to combine relevant information pertinent to the TI consumers' needs from all external and internal data sources used. This phase involves evaluating the data for usability by considering its relevance, reliability, clarity, sufficiency, significance and timeliness.

Brenner (2005) claimed that decision makers in a technology-intensive company complained that they were provided with "data dumps" by TI providers. The lack of analysis of collected data by these providers negatively affected TI consumers' satisfaction.

A SAS survey (2005) supported belief that IT departments used business intelligence software tools from vendors such as Oracle, Hyperion and IBM to enhance the BI analysis phase for their BI customers. These software vendors intend to integrate the collection, analysis and reporting phases of their BI software products thus making them more efficient and user- friendly to BI consumers. (SAS survey 2005).

We can conclude based on the above discussion, that analysis is a critical part of the TI process and is the phase that transforms data into at least informative and at best actionable intelligence (Savioz 2004).

2.2.6 TI as an Informative and Actionable Product

So far in this chapter, I have discussed TI as a process. But as noted earlier, TI can also be a product, i.e., the outcome of an intelligence gathering and analysis. And as a product, TI (like all business intelligence) has value only if it is at least informative and at best actionable (Savioz 2004).

The IT unit can enhance the value of the final TI product for CIOs and CTOs if it assumes a more pro-active role in the overall TI process and provides needed technology support for all phases of the TI process (Savioz 2004). Fiora (2005) asserted that BI professionals who proactively communicate intelligence products to decision makers are more likely to satisfy them than BI professionals who reactively supply only basic reports. Havenstein (2005) stated that the consumer audience for BI was quickly expanding from high level executives to include lower level executives and frontline managers**.** Moreover, in the future larger numbers of employees would become BI consumers**,** which in turn would bring higher demands on the quality of intelligence products. For example**,** they would have to be broader in information scope and address longer-term time horizon to satisfy more diverse consumer needs.

Brenner (2005) discussed how the technology intelligence unit of Air Products, Inc. provided TI to support timely and effective decision making by technical executives when the company was faced with early warnings of new technology developments by

competitors. He believed that a non-existing orpoor quality TI product would lead to missed opportunities and increased probability of realized threats from the external organizational environment, and would also hurt the long term competitive potential of the entire organization.

McGonagle (2007) states that the product of TI is more comprehensive than other intelligence products and includes a variety of targets such as companies and universities as well as trends in the external technological environment. Cegielski et al. (2005) found that CIOs and CTOs believed that the lack of an informative or actionable TI product prevented them from creating effective and efficient IT strategy. These technical executives stated that an informative or actionable TI product could secure the long-term survival of their IT departments and organizations.

2.2.6.1 Distributing Technology Intelligence

Savioz (2004) defined distribution as the stage where TI reaches consumers. He asserted that the choice of communication media through which TI reaches final consumers is very important. McLeod and Jones (1987) created an office automation framework that took into consideration data collection sources, media preferences and decisional roles by executives when determining the most appropriate ways to distribute information to these executives. Distribution channels included audio conferences, computer conferences, electronic calendars, electronic mail, voice mail, videotext, videoconference, word processing and others. Information was delivered to the executives by employees tasked with specific projects. Lichtenthaler (2000) found a wide variety of communication media was used to distribute TI to consumers but that

none of these media was systematically preferred for any situation. Savioz (2004) believed that there is insufficient research on the distribution of TI in small and medium-sized firms. He stated that the questions of how communication takes place and what are the most effective channels between TI providers and TI consumers have not been answered. I investigated the communication means that make TI distribution most effective in companies. This is crucial for CIOs and CTOs who need timely and relevant intelligence on emerging information technologies in order to plan an effective IT strategy (Cegielski et al., 2005).

2.2.7 Effectiveness of the TI System

According to a Statistical Analysis Survey (SAS) in 2005, IT and non-IT respondents involved with BI software purchases cited the ability to provide an enterprise-wide BI solution as a determining factor when selecting a BI vendor. The survey also reported that most companies have between one and five business intelligence solution software tools and the most important key business factors driving implementation are (1) speeding up and improving the decision making process and (2) responding to user needs for availability of BI on a timely basis. The IT department was ranked second when respondents were asked about the sequence of implementation of BI tools in organizations (SAS report 2005).

Savioz (2004) identified improvement in decision-making of TI consumers and costs versus revenue generated from TI products as the major measurements of TI effectiveness in small and medium-sized firms that he studied.

Reger (2001) clearly stated the contributions of a structured TI process to the overall effectiveness of the TI system:

a) Time saving from duplication of search efforts such as the case of several data collectors scanning the same source for the same information;

b) A comprehensive internal and external network of good contacts can be established and used continuously; and

c) Information obtained can be stored in a central location and a combined electronic database can be established**.**

Guimaraes and Armstrong (1998) found that companies with above-average IT support of the TI process attained above-average TI effectiveness, as measured by subjective opinions of TI consumers about TI product quality.

2.3 Chapter Conclusion

Chapter 2 has provided a literature review of TI both as a process and as a product. It emphasized the significance of the TI analysis phase of the TI process and characteristics that make a TI product valuable from the perspective of CIOs and CTOs who are the most significant TI consumers in this research. Chapter 3 introduces the research model of this dissertation and the corresponding research hypotheses emerging from that model. I also discuss the proposed research methodology and operationalization of the constructs in the research model.

CHAPTER 3

PROPOSED RESEARCH MODEL AND METHODOLOGY

Chapter 3 presents the proposed research model, research questions and hypotheses and the methodology of this dissertation. The methodology of the paper and operationalization of the constructs in the research model are based on suggestions by Prescott et al., (2003), Savioz (2004), Cavalcanti and Oliveira (2002), Lichtenthaler (2004) and Vedder and Vanecek (1998). I believe that the proposed research model captures the most important constructs discussed in academic and practitioner literature on business intelligence (BI) and technology intelligence (TI).

3.1 Proposed Research Model

Based on the literature review presented in chapter 2, I offer the following model to support my investigations:

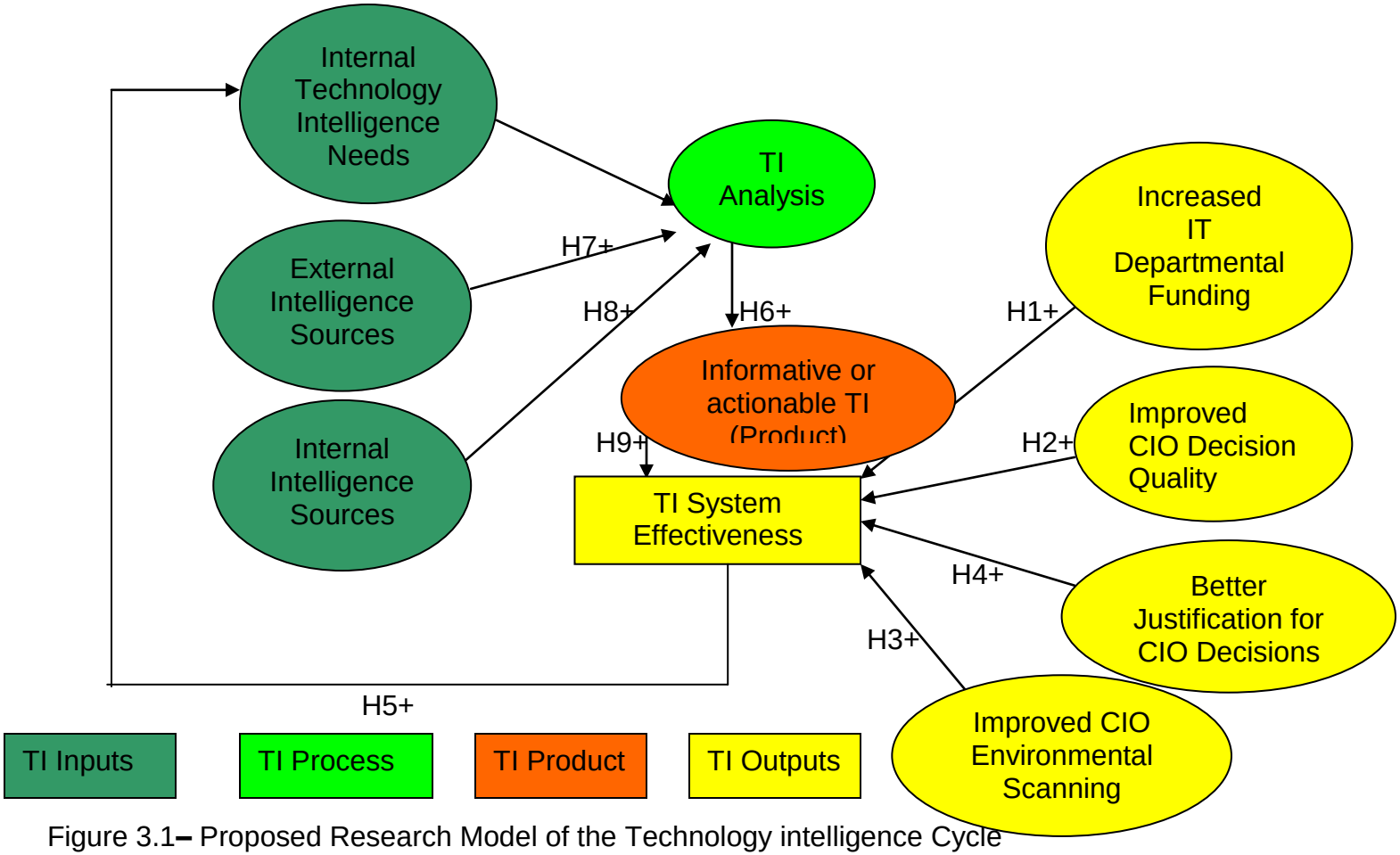


Figure 3.1– Proposed Research Model of the Technology intelligence Cycle

The research model in Figure 3.1 has four major parts:

a) Inputs to the TI analysis;

b) Analysis of TI data;

c) TI product; and

d) Effectiveness of the entire TI process**.**

Inputs to the TI analysis include external and internal technology intelligence sources and TI consumer needs identification. This needs identification guides the data collection from external and internal technology intelligence sources.

The emerging information technology data collected from external and internal technology intelligence sources provides input to the TI analysis phase (Ferrell 2001, Lichtenthaler 2003, 2004, 2005, Savioz 2004). The research model displays three links between each input and the TI data analysis part. The three links will be tested by three separate hypotheses. The collected data is then analyzed by TI providers and transformed into at least informative and at best actionable emerging technology information from the consumers' viewpoint. The research model displays a link between the TI data analysis part and the TI product part. This information is distributed to CIOs or CTOs -- the ultimate TI consumers – by varied channels. This is the stage that transitions the TI process into a TI product. The TI product is the output of the entire TI process and is evaluated by CIOs/CTOs to measure the effectiveness of this process.

The proposed research will measure the effectiveness of the entire TI process –by one objective and three subjective measures, as reported by CIOs or CTOs. The objective measure will be the actual levels of IT departmental funding. The subjective

measures will be the perceived quality of the CIOs or CTOs decision-making processes, their better justification for decisions already made and their improved environmental scanning. The proposed research model displays a link between each of these measures and the effectiveness of the entire TI process. These links will be tested by four separate hypotheses. The author believes that these measures reported by Savioz (2004), Overby (2005), Prescott et al. (2003) and Vedder and Vanecek (1998) capture the most important dimensions of the effectiveness of the entire TI process and represent an exhaustive list of such measures based on the literature review in Chapter Two.

The research model contains a link that closes the feedback loop of the TI process and makes it continuous. It is the relationship between the effectiveness of the whole TI process and future internal consumers' technology intelligence needs. Savioz (2004) and Lichtenthaler (2004) claimed that an effective TI process will lead to better-defined and more demanding future technology intelligence needs of internal consumers. The author intends to test that link with a separate hypothesis.

Finally, the proposed research model does not test each of the links between the included constructs but each link is necessary to indicate that TI is an ongoing and continuous process and does not end at a predetermined point of time. For example, the author does not test the causality between TI analysis and informative or actionable TI product constructs since by definition (Lichtenthaler 2004, Ferrell 2001) an effective TI analysis leads to an informative or actionable TI product.

3.2. Research Questions and Hypotheses

The research questions that emerge from this model include:

a) Does an increased level of IT departmental funding in companies lead to an effective (as seen by CIOs/CTOs) TI system?

H01: There is no difference in TI system effectiveness (as seen by CIOs/CTOs) between companies with less funded and companies with more funded IT departments.

b) Does an improved decision quality of CIOs or CTOs in companies lead to an effective (as seen by CIOs/CTOs) TI system?

H02: There is no difference in TI system effectiveness (as seen by CIOs/CTOs) between companies in which CIOs or CTOs have improved their decision quality, and companies in which CIOs or CTOs have not improved their decision quality.

c) Does an improved environmental scanning by CIOs or CTOs in companies lead to an effective (as seen by CIOs/CTOs) TI system?

H03: There is no difference in TI system effectiveness (as seen by CIOs/CTOs) between companies in which CIOs or CTOs have improved their environmental scanning, and companies in which CIOs or CTOs have not improved their environmental scanning.

d) Does a better justification for CIOs/CTOs decisions lead to an effective TI system (as seen by CIOs/CTOs)?

H04: There is no difference in TI system effectiveness (as seen by CIOs/CTOs) between companies in which CIOs or CTOs have better justified their decisions and companies in which CIOs or CTOs have not better justified their decisions.

e) Does internal need across organizational departments for TI products lead to a higher quality TI analysis?

H05: An internal need across organizational departments for TI products does not lead to a higher quality TI analysis.

f) Does an effective TI system lead to better-defined, future technology intelligence needs?

H06: An effective TI system does not lead to better-defined future internal technology intelligence needs.

g) Do external intelligence sources provide valuable input to the TI process?

H07: External intelligence sources do not provide valuable input to the TI process.

h) Do internal intelligence sources provide valuable input to the TI process?

H08: Internal intelligence sources do not provide valuable input to the TI process.

Two apparent contradictions emerged from the literature reviewed in Chapter One and Chapter Two:

a) IT departments engage primarily in support of the BI processes of other departments such as marketing and sales (Vedder and Guynes 2002) but CIOs and CTOs state that they need TI to evaluate emerging information technologies (Cegielski et al., 2005). This dichotomy presents a discrepancy between the behavior of IT departments and their explicit needs as stated by CIOs and CTOs.

b) Lichtenthaler (2003, 2004, and 2005) listed R&D, marketing and finance departments specifically as involved in the process of technology intelligence but he did not mention the IT department. Yet, a survey conducted by the Futures Group in 1997 asked respondents who were technical and non-technical executives to identify where intelligence is needed to make decisions (Farrell 2001). Emerging information technology initiatives were ranked fourth in their list of importance. This dichotomy shows that despite the fact that organizational decision makers perceive the importance of emerging information technologies for their decision making quality, they do not do enough efforts to maximize the quality of emerging information technology intelligence.

These reported contradictions raise additional research questions:

9. How often do the intelligence requirements of other departments prevent the IT department from pursuing its own intelligence needs?

10. How do IT departments meet their need for emerging information technology intelligence if IT employees are not involved in the technology intelligence process?

3.3. Proposed Research Methodology

The author used an exploratory form of research to investigate the factors contributing to an effective TI system from the CIO/CTO viewpoint. As noted in the previous Chapter, to-date there has been very little published research on the subject of technology intelligence and none of it has been conducted by IT academics. Further, past BI researchers have identified many specific gaps in what is known.

Prescott et al., (2003) argued that academic research in the BI field lacked a solid theoretical foundation. They recommended that future research should focus on adopting systematic methodologies which would allow for replication and generalization. They also recommended that future research efforts need to focus on building theoretical models of BI processes and that researchers need to consider employing case studies and ethnographies in addition to surveys as research tools. The researchers stated that collection of qualitative data will help understand the context of organizational BI processes and create theoretical models.

Prescott et al. also asserted that very few studies have focused on the perception of BI consumers of the value that BI provides as an input to their decision making. They believed that the following measures can be employed for gauging BI effectiveness:

a) Activity based measures such as number of BI projects completed, number of BI reports written, number of BI requests handled, number of BI searches initiated and others.
b) Qualitative measures of BI effectiveness such as perceived quality and relevance of BI products by BI consumers.

Prescott et al. stated that assessments of the value BI consumers place on BI products as inputs to their decision making process are usually performed on a face-to-face basis and to a lesser extent through survey instruments. They recommended that data be collected from both BI consumers and providers to avoid mono-method bias. Questions concerning activity-based measures of BI processes should be answered by BI providers and questions concerning perceived quality and relevance of BI products should be answered by BI consumers (decision makers, managers or executives). Prescott et al. urge future research that focuses on building theoretical models of BI processes.

Lonnqvist and Pirttimaki (2006) asserted that while measurement of the value of BI had been recognized as important, it is difficult to perform. They identified only a few organizations as having metrics in place to measure BI. The authors identified two main goals of BI measurement: (1) to determine the value of BI in order to cost-justify existence of BI units and investment in BI activities; (2) to manage the BI process in order to continuously improve it. They posed two questions to be answered:

a) How much does it cost to apply BI?

b) What are the benefits of applying BI?

Lonnqvist and Pirttimaki believed that while cost is easy to calculate, benefits of intelligence are more difficult to be measured due to the fact that intelligence is processed information and the value of information is difficult to assess. Savioz (2004) recommended that measuring the effectiveness and efficiency of TI activities should be done by qualitative means. Halal et al. (1998) employed Delphi method which synthesized judgments of multiple experts to produce a more balanced estimate.

McGonagle (2007) stated that Technology intelligence providers and consumers can more easily quantify benefits of the TI product than Business intelligence providers and consumers. First, individuals involved in the process of Technology intelligence can define the amount of future costs or loss of revenues by the company if that process is terminated. Second, often TI providers are also TI consumers and can thus better appreciate the true value of the Technology intelligence product as well as apply its recommendations and turn informative TI into actionable TI. McGonagle also believes that Technology intelligence is forward looking unlike intelligence in other areas and also that it utilizes tools and techniques from other intelligence areas and distributes its final product across different organizational departments.

Given the situation discussed above, the present author believes that a field study is an appropriate approach. The author intends to include the following two stages in the field study:

a) Mailing a structured questionnaire to the subjects of the study (please see Appendix A)

b) Interviewing these subjects using an open-ended questionnaire created after review of subjects' answers to the structured questionnaire in stage one (please see Appendix A). A second interview with refined open-ended questions may follow up the first interview.

The author’s intention is to select as many companies as he can get from diverse industries and of different sizes. Each company should ideally provide a CIO/CTO (technology intelligence consumer) and a technology intelligence provider as research subjects.

Lincoln and Guba (1985) differentiated between random sampling and purposive sampling. Random sampling increases the scope or range of data exposed (and is thus likely to counteract more deviant cases). Purposive sampling includes participants who possess direct experience of the phenomenon being studied. The researcher intends to use purposive sampling, selecting Technology intelligence consumers and Technology intelligence providers.

The author has decided to implement purposive sampling because that method is suggested by Prescott et al. (2003) as an appropriate sampling procedure in the field of Business intelligence. Further, Eisenhardt (1989) argued that the goal of purposive sampling is to choose cases, which are likely to replicate or extend the emergent theory. Kerlinger (1986) also believed that purposive sampling should involve the concentrated efforts of researchers to obtain representative samples by including typical groups in the sample. Despite the increased likelihood of deviant cases, the author intends to study such deviations and find explanations for them

The author will now turn to how he intends to measure effectiveness of the TI system as seen by the CIO/CTO.

3.4. Proposed Measures of TI Effectiveness

Based on prior research, the author has selected the following measures of TI effectiveness that concentrate on the CIOs/CTOs assessments of IT departmental funding, their perceptions of the quality of the decisions they make or uphold and their ability to monitor technology opportunities and threats in the external environment.

Savioz (2004) described R&D departments as the primary consumers of the final TI products in his case studies. Lichtenthaler (2003) stated that the major contingency factor for the location of the TI function was the department that most needed TI products. Savioz (2004) proposed that TI product effectiveness be measured by the perceived satisfaction of the TI consumers. He classified this measure as subjective. From the findings of Savioz and Lichtenthaler, we can assume that if the IT department is the primary consumer of TI then TI product effectiveness can be measured by the perceived satisfaction of the most important decision maker in that department -- the CIO or the CTO.

3.4.1. IT Departmental Funding

Vedder and Vanecek (1998) described the following phases of a company's budgetary process:

a) Phase One began with a technology update concerning new IT initiatives by the firm, its competitors, and the IT environment in general

b) Phase Two consisted of a review of the strategic direction for the company's computing effort, as well as a detailed status report on current spending patterns. The outcome of this phase would be either approval or revision of the firm's strategic direction

c) Phase Three would be a company-wide review of all IT applications development and support programs. The outcome of this phase would be either approval or revision of those activities

d) Phase Four would conclude the budgetary process. This phase would develop the company-wide computing and network capacity plans and capital requirements for the upcoming fiscal year.

Kilmetz et al., (1999) presented a financial evaluation model of BI effectiveness which consisted of three steps:

a) Determining the factors(variables) that drive BI cash flows
b) Estimating these variables**;** and
c) Computing the difference between changes in sales driven by BI and the total cost of BI processes.

Dillon (2003) described how the CIO of the Technology Office of the State of New York prioritized IT projects based on length of time for ROI. He wanted projects that were able to recover up-front costs within the same budget year. Overby (2005) believed that CIOs need to be proactive in communicating the value of IT projects with effective measurement and alignment with business processes. She asserted that lack of communication between technical and non-technical executives is the primary cause for the distorted perception of the IT department as a cost center. If there is an active and continuous TI process in the organization, CIOs and CTOs will be better enabled to evaluate business and technical alignment of the TI product discussed by Cegielski et al. (2005). They could also use the financial model of Kilmetz (1999) to estimate net benefits of the TI product, present the evidence to CFOs and CEOs and secure increased IT departmental funding. The author intends to operationalize IT departmental funding as the actual funding provided to the IT department as reported by CIOs/CTOs.

3.4.2. Decision Quality of CIO/CTO

Lichtenthaler (2003) identified three generations of TI processes. The most sophisticated (third generation) TI process integrates technology and R&D strategies in decision making. Non-technical and technical executives decide together on budget and strategic direction of the R&D department. Technology planning also integrates technology and market aspects in the short, medium and long terms. Thus the technology function becomes future-oriented and can support radical innovation rather than only short-term incremental improvements of existing business processes. Savioz (2004) found that the major goal of TI at a pharmaceutical Swiss mid-size company was to lead to effective and efficient decision making of technology executives for product development of future innovative products. The researcher suggested measuring the effectiveness of TI with two objective measures (total costs of the TI process and change in sales driven by the TI product) and one subjective measurement (TI customer satisfaction).

Vedder and Vanecek (1998) conducted an exploratory study of a company from the oil and gas industry and concluded that any IT manager can benefit from using TI methods to problems in IT resource planning. The authors found that IT managers in the oil and gas company had not fully utilized available technology intelligence sources and thus the final TI product was not completely conducive to making high quality decisions. The study of Vedder and Vanecek suggested that TI products created from a full spectrum of available intelligence sources, maximized the decision making quality of IT managers in that firm.

The author intends to operationalize the decision quality of CIOs/CTOs as their perceived decision-making quality reported by them.

3.4.3. Better Justification for CIO/CTO Decisions

Vedder and Vanecek also found that the TI product was used by IT managers not only to take new decisions but also to justify decisions already taken. Savioz (2004) claimed that the TI product can be used by decision makers to justify decisions they had already made about the execution of a TI project or giving green light to the design of a future product. Davis and Olson (1985) defined level of knowledge of outcomes as one of the dimensions of the decision-making process. If the decision makers have complete and accurate knowledge of the outcome of each alternative, then they are looking for information from the external environment to confirm the optimal alternatives. The decision makers also know the optimizing criterion so they can select the optimal alternative. That criterion may be minimal cost, maximum revenue or maximum market share.

Festinger' s cognitive dissonance theory (1957) explained a behavior after a choice is made. After a decision is made and announced, the decision maker reduces cognitive dissonance by avoiding information that might be contrary to the decision and by interpreting dissonant information in a biased way. Montier (2003) described confirmation bias as decision makers seeking only information that agrees with their bias.

In either case, CIOs or CTOs would selectively filter technology intelligence provided to them to better justify decisions that they have already taken. The author intends to operationalize justification for CIO/CTO decisions as the perceived confirmatory value of the TI product reported by the CIO/CTO.

3.4.4. Quality of CIO/CTO Monitoring of the External Environment

Ansoff (1975) discussed how two major variables that affect the future of an organization are getting less favorable. The rate of environmental change has accelerated and the response of the typical organization has become slower as a result of its growth, complexity of organizational structure and diversification. As a result, decision makers need timely and relevant information about the external organizational environment more than ever. CIOs/CTOs need timely and relevant technology intelligence (Cegielski 2005) to make the IT departments strategies timely and effective and thus accelerate an organization's response to rapidly occurring external technology changes. Ansoff (1975) defined a discontinuity as a trend which significantly deviates from historic trends that an organization had faced. He listed stages of discontinuity in an organization. The stage which involves the best environmental scanning by decision makers is when they can clearly define the outcome of an environmental discontinuity. Then the profit impact and the consequences of an organizational response to a discontinuity are computable. In the case of a technological discontinuity, Tushman and Anderson (1986) believed that decision makers who scan the external organizational environment for emerging technologies are able to use a technological discontinuity to

enhance the core competencies of their firms. Hallal et al. (1998) stated that environmental scanning for emerging technologies is crucial for any company that wishes to remain competitive in the long run. The author intends to operationalize quality of CIO/CTO monitoring of the external environment as the perceived value of the emerging technology intelligence collected as a result of their monitoring of the external environment as reported by the CIO/CTO.

3.5. Research Instruments

The author will use both a survey document and open-ended interview questions as research instruments. There is so little reported in the academic literature about Business intelligence in general and Technology intelligence in particular that both of these research instruments can provide valuable measures about Business intelligence outcomes. The author hopes to confirm the validity of the proposed survey as a metric. In case the validity and reliability are not confirmed, the author anticipates that the open-ended interview questions will provide direction for to how to change the survey for future use.

3.6. Chapter Conclusion

Chapter Three discusses the proposed research model, research questions and hypotheses and the methodology of this dissertation. The operationalization of the

variables and measures is presented. The recommendations of previous researchers for an appropriate methodology in BI research were incorporated.

Chapter Four discusses how the data was collected.

CHAPTER 4

DATA COLLECTION AND ANALYSIS

Chapter Four discusses how and why the researcher collected the data, and how data was reduced, analyzed and interpreted according to the stated hypotheses in Chapter Three's research model. I also discuss how the final interpretations relate to each of the research hypotheses and whether the findings reject or confirm these hypotheses. Finally, I address the emergence of new research hypotheses or revision of current research hypotheses if findings present such evidence.

4.1. Instrument Development

The research instrument contains at least three items that measure each variable of the proposed research model. The survey consists of two separate questionnaires, one for technology intelligence consumers and one for technology intelligence providers (Savioz (2004) defined "technology intelligence consumers" as the CIOs, CTOs or technology managers in a company who demand technology intelligence to make decisions concerning product development, new technology acquisition, IT strategy or to support decisions already taken. Savioz defined "technology intelligence providers" as a person or group of people who supply technology intelligence on predefined topics to technology intelligence consumers (Savioz 2004))**.** Each instrument consisted of twenty-three items (see Appendix A). The following independent variables were measured by the items in the Technology intelligence provider questionnaire: a)

External Intelligence sources; b) Internal Intelligence sources; and c) Technology intelligence analysis.

The following dependent variables were measured by the items in the Technology intelligence consumer questionnaire: a) Technology intelligence Consumers needs; b) Improved CIO/CTO environmental scanning; c) Improved CIO/CTO decision quality; d) Better Justification for CIO/CTO decisions; and e) Increased IT departmental funding. The final version of the surveys was determined after consultation with members of the dissertation committee. Some of the items from the original proposed survey were eliminated. The major concern was to downsize the number of total questionnaire items per survey to no more than 25 in order to increase the response rate of the subjects. Also, the items that measured business intelligence and technology intelligence processes and products perceptions of the subjects were merged to provide more flexibility to each subject when answering. All of the questionnaire items in the final version of both surveys were approved by the Internal Review Board at the University of North Texas.

4.2. Data Collection

After receiving approval from the Internal Review Board at the University of North Texas, but prior to mailing the two sets of questionnaires to companies, I sent each company that presented interest for this study an initial contact letter explaining the potential benefits of the study in order to recruit the company for the study. After each company's representative indicated their consent, I mailed both the TI consumer and TI provider surveys to each designated company representative. That representative identified TI consumers and TI providers in the company. Each questionnaire packet contained also two self-addressed stamped envelopes, an explanation of benefits letter to reinforce the value of completing the surveys to each respondent, the Internal Review Board approval letter to supply contact information of the IRB to respondents in case they need it, a copy of the consent form for the respondents from each company to keep for their records, and a document explaining the concepts used in each questionnaire. I mailed these questionnaire packets to twenty-five companies in total; thirteen of them returned completed questionnaires for a response rate of 52%. The companies were from the following industry sectors: a) Electronics; b) Telecommunications; c) Travel; d) Business consulting; e) Food and Beverage; f) Defense and Intelligence.

A total of sixteen TI providers from thirteen different companies and fourteen TI consumers from thirteen different companies returned the completed surveys in sealed envelopes. Each sealed envelope was submitted to the designated company representative who forwarded these materials to the researcher. Each company had at least one Technology intelligence provider and one Technology intelligence consumer who completed questionnaires.

The TI providers held the position of business or technology intelligence analyst or technology manager at their respective company. The TI consumers held the position of CIO, CTO or Vice President of Information Technology, Marketing or Research and Development department in the respective firm. The TI consumers had more than ten years tenure with their respective organizations, had a Masters degree or higher in a technology field and had been in their current organizational positions for at least five years.

Lincoln and Guba (1985) asserted that grounded theory is inductive and theory evolves as data are collected and explored. They advised against establishing the precise sample size beforehand and suggested that 20 to 30 participants may constitute a reasonable sample size (p.93). According to Lincoln and Guba, the most important success factor of a grounded theory study was to select subjects who can contribute to an evolving theory. These subjects should possess experiential relevance. Lincoln and Guba further stated that as the study proceeds, the chief criterion for sampling becomes theoretical relevance. The researcher had already started to derive some theoretical hunches and at that point his goal was to identify examples that demonstrated the range

or variation of a concept in different situations and in relation to other constructs in the model.

Lincoln and Guba also suggested that the interview is an appropriate technique for qualitative research. They stated that its initial structure can be loose and that the researcher could modify the initial questions later if deemed appropriate as the interview progresses.

Given the above considerations, I collected data in two phases:

a) I mailed structured survey questionnaires (please see Appendix A) to TI providers and TI consumers.
b) I conducted personal interviews with TI providers and TI consumers (please see Appendix C).

4.3. Validity And Reliability of a Qualitative Study

According to Guba and Lincoln (1981) “reliability” addresses the replication of the study under similar circumstances. The researcher attains consistency through coding the raw data in ways so that another person could understand the themes and reach similar conclusions. Researchers in qualitative studies need to understand that the analysis is likely to be modified both during and after data collection.

Guba and Lincoln defined “internal validity” in a qualitative study as the credibility or truth value ascertained through structural corroboration. Such corroboration is attained by spending sufficient time with subjects to check for deviant cases, by studying the

participants' experience in detail and by checking multiple sources of data such as other investigators, written records, diaries, field notes and others.

Guba and Lincoln defined "external validity" as the generalizability of the findings of the study. Qualitative studies offer detailed description of a relatively small number of participants within the context of a specific setting. These descriptions allow for transferability to other settings. Guba and Lincoln also believed that samples could change as the study proceeds, but generalization to other participants and situations would be always moderate and depend on the specific new context.

Rudestam and Newton (2001) defined "adequacy" in a qualitative study as the amount of data collected which is the equivalent of attaining sufficient power by involving enough number of participants in a quantitative study. Rudestam and Newton believed that adequacy is achieved when the researcher has collected enough data so that previously collected data are confirmed (a.k.a. "saturation") and understood. Lincoln and Guba (1985) defined the saturation range for qualitative studies to be 20-30 participants.

Rudestam and Newton (2001) also discussed that "appropriateness" in a qualitative study means that investigators select subjects intentionally rather than randomly to address the theoretical requirements of the study. They asserted that researchers in qualitative studies need to keep a meticulous record of the process of the study in order for other researchers to be able to reach the same conclusions. Rudestam and Newton defined this concept as an "audit trail." An audit trail includes not only the raw data but also evidence of how data were analyzed, reduced and summarized as well as researcher's notes containing information about his thoughts, intuition and reactions

during the analysis of raw data. Finally, Rudestam and Newton stated that it is common in qualitative studies for researchers to return to informants and present all their interpretations from the already obtained information, with the ultimate purpose of confirming the accuracy and credibility of their conclusions.

The internal validity in this study was measured by an exploratory factor analysis that had to confirm that there is convergent and discriminant validity between the hypothesized variables. The results from the factor analysis confirmed the convergent and discriminant validity of all of the hypothesized variables (please see Appendix B). All of the hypothesized variables had only one component after using a cut-off value of 0.5 for each dimension. The only exception was the CIO/CTO Environmental Scanning variable which had two dimensions: 1) External technological opportunities and 2) External technological threats. However, this result is consistent with Savioz (2004) and Cegielski (2005) who believed that CIO/CTO environmental scanning includes both technology intelligence opportunities and threats. Furthermore, the interviews with TI consumers and TI providers (please see Appendix C) from different firms confirmed that all of the proposed variables were present in the business intelligence/technology intelligence cycles in their respective companies. The overlap between business intelligence and technology intelligence processes was also confirmed. In addition, the chronological order of variables occurrence was also evident in the open-ended responses of the subjects: 1) TI needs assessment; 2) Collection of business intelligence/ emerging information technology intelligence from internal sources; 3) Collection of business intelligence/ emerging information technology intelligence from external sources. 4) business intelligence/ emerging information technology intelligence

data analysis; 5) Dissemination of BI/EIT intelligence among different organizational departments 6) Evaluation and application of the disseminated BI/EIT intelligence by business and technology decision- makers. 7) Reevaluation of the BI/EIT intelligence needs of each different department and each company as a whole using the final BI/EIT intelligence product.

Chapter Four discusses how data was collected, why data was collected in these specific ways, the research instruments used in this dissertation and some information on the research sample. Chapter Five discusses the results and how they relate to each of the research hypotheses from Chapter Three.

CHAPTER 5

RESULTS

Chapter Five presents and discusses the results from the Linear Regression analysis and the interviews conducted with TI providers and TI consumers. I draw conclusions from these results.

My total sample contained thirty technology intelligence consumers and technology intelligence providers. There were twelve matching pairs of a technology intelligence provider – technology intelligence consumer per company. Thirty six linear regression tests (Please see Appendix D) were performed using the SPSS software program using these matching pairs for each of the independent and dependent variables for each linear regression test. First, an exploratory factor analysis was performed to examine convergent and discriminant validity of each independent and dependent variable from the proposed research model. Second, I keyed the data from the questionnaires items that loaded on each variable into an Excel file and made sure that the data is aligned by a matching pair of a technology intelligence provider and a technology intelligence consumer from each company. Next, I computed the means for each variable within each company and used these variable means as a source for an SPSS data file. Finally, I performed thirty-six linear regression tests and evaluated the significance of the results (please see Appendix D).

5.1. Hypotheses Testing

The following section discusses the testing of each of the hypotheses about the variables of interest listed in the proposed research model in Chapter Three. The following results were based on the quantitative data collected from the TI provider and TI consumer questionnaires listed in Appendix A and the thirty six linear regression test in Appendix D

a) Hypothesis 1 from the research model in Chapter Three seeked to confirm that there is difference in TI system effectiveness between companies that provide more funding to their IT departments than companies that provide less funding. The results partially supported Hypothesis 1 based on the significance level of F values of the linear regression tests of Increased Departmental Funding on External Intelligence Sources, Increased Departmental Funding on Internal Intelligence Sources, Increased Departmental Funding on Technology intelligence Analysis and Increased Departmental Funding on Internal BI/TI Needs. The results confirmed that more funding provided to IT departments contributed to collection of higher quality technology intelligence from internal intelligence sources, to a better TI analysis and to better defined internal BI/TI needs. These results are also supported by answers of TI consumers on the open-ended interview questions:

a.1) “Now we collect, analyze and report much larger volumes of business intelligence. Now the intelligence budget is a much larger part of the total organizational budget.”

*a.2) “*Internal sources become most useful and valuable with highly emerging technologies*.”*

a.3) “Generally we have a pretty good idea of what we need.”

Table 5.1 *(*Hypothesis 1 Results *)*

Independent variable = Increased IT Departmental Funding			
Dependent Variables	R- Squared	F value	Significance Level
External Intelligence Sources	.0001	0.0001	0.988
Internal Intelligence Sources	.555	11.213	0.009
TI Analysis	.557	11.326	0.008
Internal BI/TI Needs	.457	5.884	0.046

b) Hypothesis 2 seeked to confirm that there is difference in TI system effectiveness between companies in which the decisions makers take higher quality decisions based on the final TI product provided versus companies in which the decision makers take inferior quality decisions. The results failed to reject the Null hypothesis based on the significance level of F values of the linear regression tests of Decision Quality of technology consumers on External Intelligence Sources, Decision Quality of technology consumers on Internal Intelligence Sources, Decision Quality of technology consumers on Technology

intelligence Analysis and Decision Quality of technology consumers on Internal BI/TI Needs. The only positive finding from this set of linear regression tests was that Decision Quality of technology consumers contributed to collection of higher quality technology intelligence from Internal Intelligence sources. These results are contradicted by answers of TI consumers on the open-ended interview questions:

"BI/TI which I receive is very actionable and reliable. It helps me do my job and make high-quality decisions"

Table 5.2 *(*Hypothesis 2 results*)*

Independent variable = Decision Quality of TI Consumers			
Dependent Variables	R-Squared	F-Score	Significance Level
External Intelligence Sources	.046	0.478	0.505
Internal Intelligence Sources	.345	5.264	0.045
TI Analysis	.206	2.588	0.139
Internal BI/TI Needs	.018	0.148	0.71

c) Hypothesis 3 seeked to confirm that there is difference in TI system effectiveness between companies in which the decision makers have improved their environmental scanning and companies in which decision makers have not improved their environmental scanning. The results partially support Hypothesis 3 based on the significance level of F values of the linear regression tests of Environmental Scanning of technology consumers on External Intelligence Sources, Environmental Scanning of technology consumers on Internal Intelligence Sources, Environmental Scanning of technology consumers on Technology

intelligence Analysis and Environmental Scanning of technology consumers on Internal BI/TI Needs. The results confirm that Environmental Scanning of technology consumers contributes to better TI analysis and more clearly defined Internal BI/TI needs. These results are also supported by answers of TI consumers on the open-ended interview questions:

c.1) "At our company we would like to measure the effectiveness of our current technology and evaluate the technology landscape by using the technology landscape matrix. We also would like to identify key emerging and current technologies in competitive industries."

c.2) "We try to attain an adoption level of a given technology that is consistent with our capability to utilize it".

c.3) "We use timing to adoption and business impact as the two dimensions to evaluate the quality of our technology intelligence."

Table 5.3 *(*Hypothesis 3 results*)*

Independent variable = Environmental Scanning of TI Consumers			
Dependent Variables	R-Squared	F value	Significance Level
External Intelligence Sources	.006	0.054	0.821
Internal Intelligence Sources	.192	2.145	0.177
TI Analysis	.617	14.5	0.004
Internal BI/TI Needs	.504	7.122	0.032

d) Hypothesis 4 seeked to confirm that there is difference in TI system effectiveness between companies in which decision makers have been able to justify decisions they have taken based on a TI final product and companies in which decision makers have not been able to justify decisions they have taken. The results failed to reject the Null hypothesis based on the significance level of F values of the linear regression tests of Confirmation of technology consumers' decisions on External Intelligence Sources, Confirmation of technology consumers' decisions on Internal Intelligence Sources, Confirmation of technology consumers' decisions on Technology intelligence Analysis and Confirmation of technology consumers' decisions on Internal BI/TI Needs. These results are contradicted by answers of TI consumers on the open-ended interview questions:

"I rely on the intelligence. I am satisfied with the quality of decisions it enables me to make. I have never been steered astray. It's always been trustworthy. I have made and confirmed high quality decisions."

Table 5.4 *(*Hypothesis 4 results*)*

Independent variable = Confirmation of TI Consumers' Decisions			
Dependent Variables	R-Squared	F value	Significance Level
External Intelligence Sources	.103	1.032	0.336
Internal Intelligence Sources	.300	3.85	0.081
TI Analysis	.293	3.72	0.086
Internal BI/TI Needs	.081	0.618	0.46

e) Hypothesis 5 seeked to confirm that an Effective TI system leads to better defined future Internal BI/TI needs. The results partially support Hypothesis 5 based on the significance level of F values of the linear regression tests of Internal BI/TI needs on Environmental Scanning of technology consumers, Internal BI/TI needs on Confirmation of technology consumers' decisions, Internal BI/TI needs on Decision Quality of technology consumers and Internal BI/TI needs on Increased Departmental Funding. The results confirm that better defined internal BI/TI needs contribute to higher quality Environmental Scanning of TI consumers and Increased IT departmental funding. These results are also supported by answers of TI consumers on the open-ended interview questions:

"Generally we have a pretty good idea of what we need. New competitors cause faster cycle of review of technology intelligence needs, which creates gaps between actual and perceived TI needs."

Table 5.5 (Hypothesis 5 results)

Independent variable = Internal BI/TI Needs			
Dependent Variables	R-Squared	F-value	Significance Level
Environmental Scanning of TI consumers	0.504	7.122	0.032
Confirmation of TI consumers decisions	.081	0.618	0.458
Decision Quality of TI consumers	.018	0.148	0.71
Increased Departmental Funding	.457	5.884	0.046

f) Hypothesis 6 seeked to confirm that there is difference in TI system effectiveness between companies in which TI providers perform higher quality TI analysis and companies in which TI providers perform inferior quality TI analysis. The results partially support Hypothesis 6 based on the significance level of F values of the regression tests of TI Analysis on Confirmation of technology consumers' decisions, TI analysis on Decision Quality of technology consumers, TI analysis on Environmental Scanning of TI consumers and TI analysis on Increased Departmental Funding. The results confirm that TI Analysis contributes to better Environmental Scanning of TI consumers and to Increased IT Departmental Finding. These results are also supported by answers of TI consumers on the open-ended interview questions:

f.1) "Internal analysis helps identify external data needs and collection methods. The first stage of the BI process is data collection and the second part is data analysis using automated DSS. Our company tries to automate decisions concerning emerging information technology threats."

f.2) "We use timing to adoption and business impact as the two dimensions to evaluate the quality of our technology intelligence."

Table 5.6 *(*Hypothesis 6 results*)*

Independent variable = TI Analysis			
Dependent Variables	R-Squared	F-value	Significance Level
Environmental Scanning of TI consumers	.617	14.49	0.004
Confirmation of TI consumers decisions	.293	3.72	0.086

Decision Quality of TI consumers	.206	2.588	0.139
Increased Departmental Funding	.508	11.326	0.008

g) Hypothesis 7 seeked to confirm that External Intelligence Sources contribute to an Effective TI system. The results failed to reject the Null hypothesis based on the significance level of F values of the linear regression tests of External Intelligence Sources on Confirmation of technology consumers' decisions, External Intelligence Sources on Decision Quality of technology consumers, External Intelligence Sources on Environmental Scanning of technology consumers and External Intelligence Sources on Increased Departmental Funding. These results are also supported by answers of TI consumers on the open-ended interview questions:

"We have in the past switched external vendors who provide EIT. These vendors are the primary external intelligence sources. Inaccurate or incomplete estimates have determined these switches. Most of the strategic business *and* technology intelligence is derived from these external vendors."

Table 5.7 *(*Hypothesis 7 results*)*

Independent variable = External Intelligence Sources			
Dependent Variables	R-Squared	F-value	Significance Level
Confirmation of TI consumers decisions	.103	1.03	0.336
Decision Quality of TI consumers	.046	0.478	0.505
Environmental Scanning of TI consumers	.006	0.05	0.821

Increased Departmental Funding	.0001	0.0001	0.988

h) Hypothesis 8 seeked to confirm that Internal Intelligence Sources contribute to an Effective TI system. The results partially support Hypothesis 8 based on the significance level of F values of the linear regression tests of Internal Intelligence Sources on Confirmation of technology consumers' decisions, Internal Intelligence Sources on Decision Quality of technology consumers, Internal Intelligence Sources on Environmental Scanning of technology consumers and Internal intelligence Sources on Increased Departmental Funding. The results confirm that Internal Intelligence Sources provide technology intelligence that contributes to higher Decision Quality of TI consumers and to Increased IT Departmental Funding. These results are also supported by answers of TI consumers on the open-ended interview questions:

"Manufacturing systems provide internal intelligence about available inventories and arising needs of the company to the IT group at my company. The IT group reports to me data I request"

Table 5.8 *(*Hypothesis 8 results*)*

Independent variable = Internal Intelligence Sources			
Dependent Variables	R-Squared	F-value	Significance Level
Confirmation of TI consumers decisions	.300	3.85	0.081
Decision Quality of TI consumers	.345	5.26	0.045
Environmental Scanning of TI consumers	.192	2.145	0.177
Increased Departmental Funding	.555	11.213	0.009

i) Hypothesis 9 seeked to confirm that without involvement of IT professionals in the TI process, the quality of the TI product supplied to technology consumers does not contribute to an Effective TI system. The results support Hypothesis 9 based on the significance level of F values of the linear regression tests of TI Product on Confirmation of TI consumers' decisions, TI product on Decision Quality of TI Consumers, TI Product on Environmental Scanning of TI Consumers and TI Product on Increased Departmental Funding. The results confirm that the quality of the TI product created with the involvement of IT professionals in the TI process contributes to an Effective TI system. These results are also supported by answers of TI consumers on the open-ended interview questions:

i.1) “Yes. The IT group provides internal business and technology intelligence and has its representatives in the upper level business group that is the BI/TI consumer”

i.2) “I have clearly defined technology intelligence needs. I know what I want. And the IT department helps me greatly meet those needs.”

i.3) ” Yes. They are responsible for reporting Emerging Information Technology intelligence to me. This dedicated unit consists of mostly IT people and some people with business background”

The support of Hypothesis 9 clarifies a major dichotomy in existing literature which on one hand does not state any involvement of people from IT departments in organizations’ TI processes and on the other hand emphasizes technology executives’ perception of the importance of a high quality TI product for the long term competitive advantage of their companies.

Table 5.9 *(*Hypothesis 9 results*)*

Independent variable = TI Product			
Dependent Variables	R-Squared	F-value	Significance Level
Confirmation of TI consumers decisions	.811	38.522	0.0001
Decision Quality of TI consumers	.701	21.061	0.001
Environmental Scanning of TI consumers	.436	6.965	0.027
Increased Departmental Funding	.387	5.69	0.041

Based on the above results, the confirmation or rejection of each hypothesis is summarized in the table that follows:

Table 5.10: Results

Hypotheses	Content	Reject/FTR
H010	There is no difference in TI system Effectiveness (as seen by technology intelligence consumers) between companies with less funded and companies with more funded IT departments	Partially Supported
H020	There is no difference in TI system Effectiveness (as seen by technology intelligence consumers) between companies in which technology intelligence consumers have improved their decision quality, and companies in which technology intelligence consumers have not improved their decision quality.	Fail to Reject
H030	There is no difference in TI system Effectiveness (as seen by technology intelligence consumers) between companies in which technology intelligence consumers have improved their environmental scanning, and companies in which technology intelligence consumers have not improved their environmental scanning	Partially Supported
H040	There is no difference in TI system Effectiveness	Fail to Reject

	(as seen by technology intelligence consumers) between companies in which technology intelligence consumers have better justified their decisions and companies in which technology intelligence consumers have not better justified their decisions.	
H050	An Effective TI system does not lead to better-defined future internal technology intelligence needs of technology intelligence consumers.	Partially Supported
H060	There is no difference in TI System Effectiveness between companies in which TI providers perform higher quality TI Analysis and companies in which TI providers perform inferior quality TI Analysis	Partially Supported
H070	External intelligence sources do not contribute to an Effective TI System	Fail to Reject
H080	Internal intelligence sources do not contribute to an Effective TI System.	Partially Supported
H090	The TI product does not contribute to an Effective TI System even with involvement of IT professionals in the TI process.	Reject – TI product produced with involvement of IT professionals in the TI process contributes to an Effective TI system

Analysis of the interviews with the TI providers and TI consumers confirmed the presence of all variables of the proposed research model in Chapter Three in the technology intelligence process of each company. Each participant in the interviews (please see Appendix C) stated that the quality of the TI product in each company is evaluated by one or more of the following dimensions: 1) Quality of decisions each TI consumer made; 2) Confirmation of decisions each TI consumer made; 3) Ability of each TI consumer to perceive threats and/or opportunities in the external technological environment; 4) Increased budget for technological purchases at a departmental or at an organizational level.

Some TI consumers were also TI providers and thus appreciated better the real quality of the TI product and its potential actionability. As McGonagle (2007) stated, TI providers used tools and techniques from other intelligence domains such as business intelligence, market intelligence, competitive intelligence and legal intelligence. Overall, the answers of the TI providers and consumers to the open-ended interview questions confirmed the need for all of the questionnaire items in the structured questionnaire.

5.2. Conclusions

The most important conclusion from the results is that all the variables in the proposed research model from Chapter Three do exist. Also I found that these variables possess convergent and discriminant validity (please see Appendix B). Each variable had only one dimension emerging after an exploratory factor analysis with the exception of Environmental Scanning of TI consumers which had two dimensions emerging but

this was consistent with the findings of Savioz (2004). I empirically confirmed one out of the nine research hypotheses. I believe that the number of variables in the research model requires a larger sample size. The rule of having at least five subjects per each questionnaire item would require data collection from about 100 TI providers and 100 TI consumers. Future research needs to replicate the same statistical analysis with more subjects and also apply different statistical techniques. The subjective answers of the respondents to the open ended interview questions provided evidence that business intelligence and technology intelligence made an important contribution to sustaining the long-term competitive potential of companies from different industries. The more competitive an industry is, the more urgent the need was for an organizational intelligence system. All of the companies that participated in the research had at least some Information Technology professionals involved in the respective technology intelligence process of each company which is indicated by the mean of 5.38 of the three questionnaire items measuring participation of IT staff in firms' TI processes. In addition, Hypothesis 9 was supported which confirmed that participation of people from IT departments in the companies studied, contributed to an effective TI system in these companies. All of the technology intelligence consumers had a technology background or an IT education. According to the subjective opinion of the participants involved in this study, the technology intelligence product did make a difference for their companies in terms of financial performance and personal job performance. Although the precise financial gain was not explicitly stated, both TI consumers and TI providers believed that without a functioning intelligence system, their firms would have been in a worse competitive position.

5.3. Implications for Further Research

The factor analysis and interview results provided evidence that all variables from the research model were present in the technology intelligence process of each company and also that the causality between the variables is the one hypothesized in the research hypotheses. I observed that with the increase in the sample size, the R-Squared values of the linear regression tests improved as well as the significance level for these values. I found support for the hypothesis that a TI product contributed to an effective TI system if IT professionals were part of the TI process. Also, five other hypotheses were partially supported which is a promising fact, given the small sample size. It is imperative that data is collected from more subjects which will allow the application of different types of statistical techniques. Different type of statistical analysis may provide more positive results in terms of confirming the research hypotheses in the model. My personal experience was that some companies initially agreed to participate in the research but later decided not to participate. Perhaps, issues with the sensitivity of their technology intelligence processes and unwillingness to reveal these to outsiders contributed to their ultimate decisions. The pool of potential companies was not large to begin with since many of the initially contacted firms did not have any business intelligence or technology intelligence processes.

I believe that it is necessary that research on the technology intelligence processes in different companies be continued. It is important that more research hypotheses are confirmed empirically so that the value of TI processes and their respective products is

proven to academic researchers as well as practitioners. An alarming trend is the continued decrease in the number of published articles on business intelligence and competitive intelligence (McGonagle, 2007) in IT and Management academic literature given their importance for organizations from different industries and of different sizes.

APPENDIX A

STRUCTURED QUESTIONNAIRE

INTRODUCTION

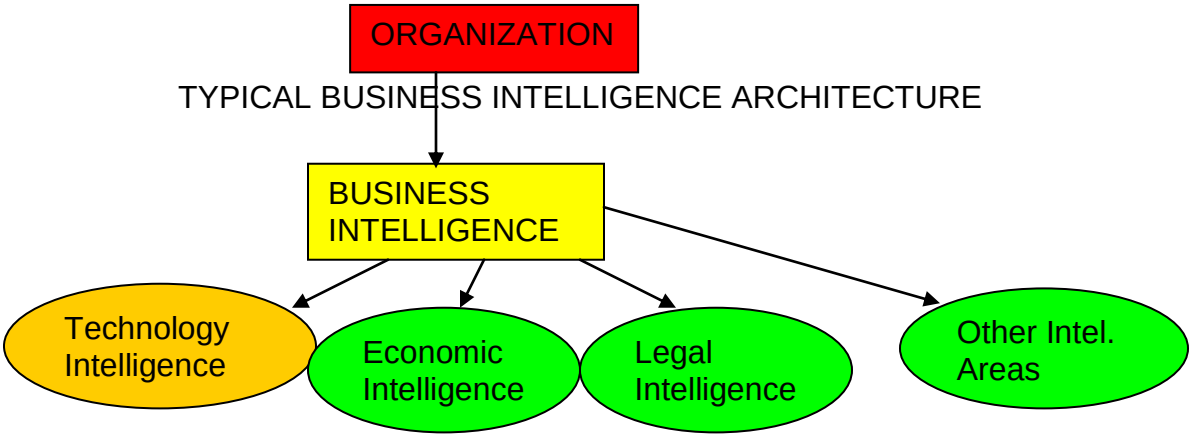
THANK YOU FOR PARTICIPATING IN THIS SURVEY. PLEASE READ THE FOLLOWING DEFINITIONS BEFORE COMPLETING THE SURVEY.

ALL FORMS OF INTELLIGENCE ARE BOTH A PROCESS AND A PRODUCT. YOUR DEFINITIONS ONLY REFER TO THE PROCESS PART.

Business intelligence is the process of ethically collecting, analyzing and distributing to management information that is pertinent, specific, opportunistic or predictive of the behavior of the business environment or of the organization itself.

Technology intelligence is the systematic approaches used by companies for observation and evaluation of emerging technologies that may be of interest to them and reveal opportunities and/or threats from the technology environment.

Emerging Technology is defined as a technology, which is little commercialized and is currently adopted by not more than twenty percent of the companies within a given industry



1. DO YOU USE BUSINESS INTELLIGENCE IN YOUR ORGANIZATION? Yes No

2. DO YOU USE TECHNOLOGY INTELLIGENCE IN YOUR ORGANIZATION? Yes No

IF YOU ANSWERED “YES” TO EITHER QUESTION (OR TO BOTH), THEN

CONTINUE WITH THE SURVEY.

IF YOU ANSWERED “NO” TO BOTH QUESTIONS, YOU ARE NOW FINISHED.

PLEASE RETURN THIS SURVEY USING THE ENCLOSED ENVELOPE. THANK

YOU FOR YOUR TIME.

Please read each question carefully and circle the number corresponding to the response that best expresses your view.

1= Strongly disagree
2= Disagree
3= Weakly disagree
4= Neutral
5= Weakly agree
6= Agree
7= Strongly Agree
NA = Not applicable or I don't know

Strongly Disagree [1] [2] [3] [4] [5] [6] [7] Strongly Agree

TI PROVIDERS ITEMS:

External Intelligence Sources

1. I use business intelligence on a continual basis.
[1] [2] [3] [4] [5] [6] [7] [NA]

2. I use external sources such as publications and conferences for acquiring business intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

3. I use technology intelligence on a continual basis to make decisions.
[1] [2] [3] [4] [5] [6] [7] [NA]

4. I use external sources such as publications and conferences for acquiring technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

5. External sources are reliable.
[1] [2] [3] [4] [5] [6] [7] [NA]

6. External sources provide actionable technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

Internal Intelligence Sources

7. I use internal sources, such as company employee's expertise and internal data warehouses, for Business intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

8. I use internal sources, such as company researchers, engineers and technology intelligence specialists for technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

9. I use internal sources, such as historical data stored in supply chain management systems and/or customer relationship management systems, for technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

10. Internal sources are reliable.
[1] [2] [3] [4] [5] [6] [7] [NA]

11. Internal sources provide actionable technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

Intelligence Analysis

12. I personally analyze business/emerging information technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

13. I use area specialists to analyze business/emerging information technology intelligence and report their results to me.
[1] [2] [3] [4] [5] [6] [7] [NA]

14. My department employs quantitative analytical tools, such as patent analysis and trend extrapolation, for analysis of business/technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

15. My department employs qualitative analytical tools, such as brainstorming or delphi methods, for analysis of business/ emerging information technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

16. My department investigates technology intelligence in an informal way. Any employee could participate in the investigation.

[1] [2] [3] [4] [5] [6] [7] [NA]

17. My department participates frequently in the data analysis phase of the business/ emerging information technology intelligence process.
[1] [2] [3] [4] [5] [6] [7] [NA]

TI CONSUMERS ITEMS:

Internal Consumer Technology intelligence Needs

18**.** My department has an urgent need for Business/ Technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

19. My department and company may gain competitive advantage through the use of Emerging Information Technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

20. My department needs Business/ Technology intelligence to justify purchases of new technology for the entire organization.
[1] [2] [3] [4] [5] [6] [7] [NA]

Informative and Actionable Technology intelligence Product

21. My department has created a number of technology intelligence reports in the last twelve months.
[1] [2] [3] [4] [5] [6] [7] [NA]

22. My department has initiated a number of technology intelligence searches in the last twelve months.
[1] [2] [3] [4] [5] [6] [7] [NA]

23. My department has replied to a number of e-mails on technology intelligence topics in the last twelve months.
[1] [2] [3] [4] [5] [6] [7] [NA]

24. Staff from our department has visited a number of web sites discussing topics on technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

Increased IT Funding

25. My department has gained more funding as a result of actionable and informative emerging information technology intelligence.

[1] [2] [3] [4] [5] [6] [7] [NA]

26. My department has been promised increased funding for future emerging information technology intelligence needs of the company.
[1] [2] [3] [4] [5] [6] [7] [NA]

27. My department uses technology intelligence as evidence for the need for new IT initiatives at a departmental and/or at an organizational level.
[1] [2] [3] [4] [5] [6] [7] [NA]

Improved CIO/CTO Decision Quality

28. The quality of the decisions I have made has improved as a result of actionable or informative technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

29. My decisions have become more efficient as a result of informative or actionable emerging information technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

30. My decisions have become more effective as a result of informative or actionable emerging information technology intelligence.
[1] [2] [3] [4] [5] [6] [7] [NA]

31. I believe that the emerging information technology intelligence I have been provided with is of high quality.
[1] [2] [3] [4] [5] [6] [7] [NA]

Better Justification for CIO/CTO Decisions

32. The quality of emerging information technology intelligence provided to me has allowed me to better justify a high percentage of the decisions I have made.
[1] [2] [3] [4] [5] [6] [7] [NA]

33. The quality of emerging information technology intelligence provided to me has allowed me to confirm decisions that I desired to implement.
[1] [2] [3] [4] [5] [6] [7] [NA]

34. I believe that the emerging information technology intelligence I have been provided with is of high relevance to decisions that I need to make.
[1] [2] [3] [4] [5] [6] [7] [NA]

Improved CIO/CTO Environmental Scanning

35. I have been able to achieve high-quality scanning of the external environment for emerging information technologies.
[1] [2] [3] [4] [5] [6] [7] [NA]

36. I have been able to detect emerging information technologies threats in the external environment.
[1] [2] [3] [4] [5] [6] [7] [NA]

37. I have been able to detect emerging information technologies opportunities in the external environment
[1] [2] [3] [4] [5] [6] [7] [NA]

Table A.1- Constructs and Measures

Name of the Constructs	Measures	Scale Sources
External Intelligence Sources	6 items	Two items adapted from Cavalcanti (2002). Four items self-developed to define external intelligence sources.
Internal Intelligence Sources	5 items	Five items self-developed to define internal intelligence sources based on Savioz (2004).
Internal Consumer Technology intelligence Needs	3 items	Self-developed. Based on Cegielski et.al (2005) and Vedder and Vanecek (1998)
Intelligence Analysis	6 items	Self-developed. Twelve items are based on Prescott et.al (2003).
Informative and Actionable TI product	8 items	Self-developed. Based on Savioz (2004) and Lichtenthaler (2004).
Effectiveness of the TI System	13 items	Self-developed. Based on Savioz (2004), Festinger (1957), Prescott et al. (2003), Vedder and Vanecek (1998)

Interview Questions:

1. Please describe what you believe is the business intelligence process.

2. Please describe what you believe is the technology intelligence process.

3. Please discuss the reliability of the emerging information technology intelligence provided to you by your technology intelligence personnel.

4. How often do you request business intelligence?

5. How often do you request emerging technology intelligence?

6. Is there a dedicated unit responsible for business or emerging technology intelligence in your company?

7. Do you think that your department has clearly defined business intelligence/ technology intelligence needs?

8. Do you encourage participation of employees from other departments in the emerging technology intelligence process addressing your departmental technology intelligence needs?

9. How do you determine the value of an emerging technology intelligence product?

10. Please describe the scope of the distribution of an emerging information technology across different departments in your company.

11. What measures do you take to improve the effectiveness of the intelligence system?

12. Is there a difference between the business intelligence/emerging technology intelligence process now and five years ago?

13. Would you like to add something to our Q&A session?

APPENDIX B

RESULTS FROM THE EXPLORATORY FACTOR ANALYSIS

Table B.1:

External Intelligence Sources Items	Loadings
External Sources are reliable providers of Business/ Emerging Information Technology intelligence	0.968
I use frequently external intelligence sources	0.887
I use external sources such as publications and conferences for acquiring Business/Emerging Information Technology intelligence	0.798
External sources provide actionable business/emerging information technology intelligence	0.78

Table B.2:

Internal Intelligence Sources Items	Loadings
I use internal sources such as company researchers, engineers and emerging information technology intelligence specialists for business/emerging information technology intelligence	0.981
I use internal sources, such as company employee's expertise and internal data warehouses, for business/emerging information technology intelligence	0.980
Internal sources provide actionable emerging information technology intelligence	0.263

Table B.3:

Business intelligence/ Technology intelligence Needs Items	Loadings
My department has handled business/emerging information technology intelligence requests on a regular basis in the last twelve months	0.959
I use business/emerging information technology intelligence on a continual basis	0.901
My department participates in number of yearly Emerging Information Technology intelligence projects	0.87
Staff from our department has made a number of presentations on business/emerging information technology intelligence topics	0.853

Table B.4:

CIO/CTO/VP Environmental Scanning	Opportunities Loadings Component	Threats Loadings Component
I have been able to detect EIT opportunities in the external environment	0.915	
I have been able to achieve high-quality scanning of the external environment for Emerging Information Technologies	0.899	
I have been able to detect threats in the external environment from Emerging Information Technologies		0.995

Table B.5:

Justification for CIO/CTO/VP Decisions Items	Loadings
I believe the emerging Information Technology provided to me is of high relevance	0.958
The quality of Emerging Information Technology intelligence provided to me has allowed me to confirm decisions that I desired to implement	0.942
The quality of Emerging Information Technology intelligence has helped me better justify decisions I have made	0.875

Table B.6:

Improved CIO/CTO/VP Decision Quality Items	Loadings
My decisions have become more effective as a result of informative or actionable Emerging Information Technology intelligence	0.897
The quality of the decisions I have made has improved as a result of actionable or informative Emerging Information Technology intelligence	0.861
I believe the provided Emerging Information Technology is of high quality	0.760
My decisions have become more efficient as a result of informative and actionable Emerging Information Technology	0.737

Table B.7:

Increased Information Technology Departmental Funding	Loadings
My department uses EITI as evidence for the need for new IT initiatives at a department or organizational level	0.963
My department has gained more funding as a result of actionable and informative Emerging Information Technology intelligence	0.895
My department has been promised increased funding for future emerging information technology intelligence needs of the company	0.871

Table B.8:

Informative or Actionable Technology intelligence Product	Loadings
My department has initiated a number of business intelligence/ emerging information technology intelligence searches in the last twelve months	0.974
My department has created a number of business intelligence/ emerging information technology intelligence reports in the last twelve months	0.938
My department has made a number of Business intelligence/ Emerging Information Technology intelligence requests in the last twelve months	0.861

Table B.9:

Emerging Information Technology intelligence Analysis	Loadings
Our department uses qualitative tools for analysis of Business intelligence/ Emerging Information Technology intelligence	0.937
My department participates in the data analysis of Business intelligence/ emerging Information Technology intelligence	0.896
Our department uses quantitative tools for analysis of Business intelligence/ Emerging Information Technology intelligence	0.818
My department analyzes in an informal way Business intelligence/ emerging Information Technology intelligence	0.736
I personally analyze Business intelligence/ Emerging Information Technology intelligence	0.518

APPENDIX C

INTERVIEW

1. Please describe what you believe is the business intelligence process.

   The Quality Assurance Department at my company uses software such as Oracle DB for collecting, analyzing and reporting data. The department also uses data mining as a statistical technique for data analysis. I personally analyze data as well. The IT department provides me with business/ technology internal intelligence. I personally collect data from publications and websites which I consider external sources of intelligence. Manufacturing systems provide internal intelligence about available inventories and arising needs of the company to the IT group at my company. The IT group reports to me data I request.

2. Please describe what you believe is the technology intelligence process.

   Same thing as above. Engineers are also the TI consumers besides me.

3. Please discuss the reliability of the emerging information technology intelligence provided to you by technology intelligence personnel.

   BI/TI which I receive is very actionable and reliable. It helps me do my job and make high-quality decisions. I have never had an issue or a problem with data provided to me.

4. How often do you request business intelligence?

   Each quarter I gather personally data from *external sources* such as journals from our library and once *a* month from the IT group, which I consider an internal source.

5. How often do you request emerging technology intelligence?

   Each quarte*r* I gather personally data from external sources such as journals from the TI library and once a month from the IT group, which I consider an internal source.

6. Is there a dedicated unit responsible for business or emerging technology intelligence in your company?

   Yes. The primary BI/TI consumer is a business group at the upper level of the company, which has representatives from multiple departments. The IT group using the Oracle DBs is the major BI/TI provider.

7. Do employees from the IT department participate in that dedicated unit?

Yes. *The IT group provides internal business and technology intelligence* and has its *representatives* in the *upper level business* group that is the *BI/TI consumer*.

8. Do you think that your department has clearly defined business intelligence/ technology intelligence needs?

I have clearly defined *needs*. I know what I want. And the *IT department* helps me greatly meet those needs. I do not know if the *IT department* has clearly defined needs but they do have very specific *requirements* from me and the company in general on what data to collect and provide.

9. Do you encourage participation of employees from other departments in the emerging technology intelligence process addressing your departmental technology intelligence needs?

I get help from people *from other departments*. People from other departments participate in my *BI/TI analysis*. When I get overloaded with work, I encourage help from people from other departments including people from the *IT department*.

10. How do you determine the value of an emerging technology intelligence product?

I rely on the intelligence. I am satisfied with the quality of decisions it enables me to make. I have never been steered astray. It's always been trustworthy. I have made and confirmed high quality decisions. I determine the value of the intelligence provided to me by my ability to fix *a* problem. I determine the value of the intelligence product by evaluating how the change *I* am making fixes *a* problem. If it can't fix the problem I am better without the change and the intelligence required making the change.

11. Please describe the scope of the distribution of an emerging information technology across different departments in your company**.**

All departments use new technologies. Steering committees evaluate how new technologies are distributed among different departments. Some proprietary software requiring licenses is used only in restricted departments.

12. What measures do you take to improve the effectiveness of the intelligence system?

Call the direct BI/TI provider and ask him/her or them about a problem I perceive with the BI/TI intelligence that is reported to me, if I perceive such a problem.

13. Is there a difference between the business intelligence/emerging technology intelligence process now and five years ago?

Things have gotten much better during the past five years. The BI/TI system at our company is much better than it used to be. Everything gets better. TI

providers are better and I am faster in analyzing data and making decisions than 5 years ago. My productivity has improved a lot.

14. Would you like to add something to our Q&A session?

    I am very happy with all the intelligence I have been provided with. I am very happy with my mutual work with the *IT* department which is my major intelligence provider *of* internal BI/ TI intelligence.

Interview with a TI consumer from a Travel industry company:

1. Please describe what you believe is the business intelligence process.

   There are two types of BI at our company:

   a. General type or strategic, which is implemented to identify external threats and opportunities coming from competitors and emerging competitors.

b. Specific type, which analyzes transactional data such as customer intelligence, daily sales and market share position relative to competitors.

Automated decision support tools collect information both *externally* and *internally*. Internal analysis helps identify *external data needs* and collection methods. The first stage of the BI process is *data collection* and the second part is *data analysis* using automated DSS. Our company tries to automate decisions concerning emerging information technology threats.

2. Please describe what you believe is the technology intelligence process.

At our company we would like to measure the effectiveness of our current technology and evaluate the technology landscape by using the technology landscape matrix. We also would like to identify key emerging and current technologies in competitive industries. The technology landscape follows the Gartner Group Maturity Model. We try to attain an adoption level of a given technology that is consistent with our capability to utilize it. If we see a technology that is in its first ‘technology trigger ’ phase but which we’ll be able to adopt quickly, we assign to it high priority. RFID, which has a broad impact on our industry and is currently being adopted by the majority of market players has high priority from our perspective. We use *timing to adoption* and *business impact* as the two dimensions to evaluate the quality of our technology

intelligence. High values of these dimensions translate into a high priority for us to adopt the technology. Another factor when evaluating whether to adopt a specific technology is whether we would like to have the capability to develop it in-house or partner with someone. We pioneered the self check-in kiosks at airports, which were built in our labs. We may do intelligence on emerging technology*, develop* it in our research labs and then sell it to third parties if the sales revenue exceeds the benefit for us to keep the technology for internal use. If other technologies have potential for the company we'll trade technologies.

3. Please discuss the reliability of the emerging information technology intelligence provided to you by your technology intelligence personnel.

   I believe that our emerging information technology is pretty *reliable*. If the technology capabilities are correctly estimated and the *timing* and *business impact* of the technology are correctly estimated then the technology intelligence provided has *high reliability*.

   Some technologies may be overstated. An example of an overstated technology is interactive TV. It was believed that it would become the market standard by 2008 but is still not. And it did not meet up to expectations. In web services 'yellow pages' were grossly overrated. These were applications that could find other applications automatically and would order services but this never happened. I would estimate the reliability of the emerging information technology intelligence provided to

me as more than 50% but less than 90%. *Timing* is hard to predict. And sometimes impact of a new technology is also hard to predict. Usually, *timing to adoption* and *business impact* of an emerging information technology are overstated by our technology intelligence personnel.

4. How often do you request business intelligence?

   I request once *a year* business intelligence identified in Q1 that I also consider strategic intelligence. I request transactional intelligence identified in Q1 on a *daily basis*.

5. How often do you request emerging technology intelligence?

   I request strategic EIT that identifies *threats and opportunities once a year*. I request an update of the technology landscape using the *Gartner's* Hype Cycle twice a year.

6. Is there a dedicated unit responsible for business or emerging technology intelligence in your company?

   Yes. They are responsible for reporting *Emerging Information Technology intelligence to me*. This dedicated unit consists of mostly *IT people* and some people with business background. EITI is *collected, analyzed and reported by a dedicated unit of IT people*.

Teams do some of the reporting and competitiveness review. They also support intelligence systems(our automated transactional DSS) on a daily basis. These people are located both *inside and outside* the organization.

7. Do employees from the IT department participate in that dedicated unit?

Yes. They do. Most of them are *IT people* and we have some area specialists for the transactional data intelligence *gathering and analysis*.

8. Do you think that your department has clearly defined business intelligence/ technology intelligence needs?

Yes. But we have a research group, which has changing *TI needs* and although most of the time we have *well-defined TI needs*, the research group sometimes is open to *technology intelligence from multiple intelligence sources* to broaden its perspectives. We often create new models and new sources of technologies. We do research and create new techniques to uncover gaps between what a technology is believed to be and what it actually is able of performing. Generally we have a pretty good idea of what we need. New competitors cause *faster cycle of review of technology intelligence needs*, which creates gaps *between actual and perceived TI needs and requires a change of data collection techniques*. *Technology intelligence* is collected primarily electronically. We use *web crawlers* to collect data on specific topics.

We also send people to conferences to acquire TI. Their official and primary task is to present a paper but acquiring TI from competitors is also part of their responsibilities on these conferences.

9. Do you encourage participation of employees from other departments in the emerging technology intelligence process addressing your departmental technology intelligence needs?

Yes. *People outside the department* do participate in the *BI and TI processes*. Most projects are driven by *business needs*. Business units have their representatives in the *BI and TI processes* because their *technology needs* are created by business units.

10. How do you determine the value of an emerging technology intelligence product?

Timeliness and impact and whether the specific technology requires in house capability vs. business partner.

11. Please describe the scope of the distribution of an emerging information technology across different departments in your company.

Usually distribution starts *as departmental specific*. If the information is useful it is stored in an *EDW* (enterprise data warehouse) so it is accessible to all. Once it is found valuable it's spread across other departments. Departments who have urgent *need* work with the enterprise group to *adopt EIT*. By virtue of adopting a department specific application, it helps get us more information whether we want to adopt the technology more broadly. Rarely we'll go corporate-wide with a given new

technology in the beginning of its adoption. The only exception is if we have to due to competitors' pressures. For example, we definitely need an upgrade to Windows Vista currently across all departments.

12. What measures do you take to improve the effectiveness of the intelligence system?

We have in the past switched *external vendors who provide EIT*. These vendors are the primary *external intelligence sources*. *Inaccurate* or *incomplete* estimates have determined these switches. Most of the *strategic business and technology intelligence* is derived from these external vendors. *Internal sources* become most useful and valuable with *highly emerging technologies* (in the first phase of the Gartner's Hype Cycle) when they develop it. *External sources* are more reliable than *internal sources*- provide more *complete picture of the strategic intelligence defining threats and opportunities*.

13. Is there a difference between the business intelligence/emerging technology intelligence process now and five years ago?

Yes. Now it's bigger, *much bigger* and *probably better*. Now we collect, analyze and report much larger volumes of business intelligence. Now the *intelligence budget is a much larger part of the total organizational budget*. BI helps us point *problems* we were not aware of before. Some of the BI helps us identify root causes of problems. We may not how to *fix these problems*

but at least we are aware of them. *Utilizing BI and ETI*, we have developed a much *better understanding of Internet technologies now than we had five years ago.*

14. Would you like to add something to our Q&A session?

    No, I think I said enough during our one-hour interview.

APPENDIX D:

LINEAR REGRESSION TESTS RESULTS:

D.1

Independent Variable	Dependent Variable
X	*Y*
Increased IT Departmental Funding	External Intelligence Source

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.000	1	.000	.000	.988
	Residual	18.552	9	2.061		
	Total	18.552	10			

Predictors: (Constant), IncreasedITFunding

Dependent Variable: ExternalIntelSrc

Coefficients

Model		Unstandardiz Coefficients		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. Er	Beta			LB	UB
1	(Constant)	5.28	1.05		5.00	.001	2.896	7.680
	ITFunding	.004	.251	.005	.015	.988	-.563	.571

Dependent Variable: ExternalIntelSrc

D.2

Independent Variable	Dependent Variable
X	*Y*
Increased IT Departmental Funding	Internal Intelligence Sources

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.508	1	3.508	11.213	.009
	Residual	2.815	9	.313		
	Total	6.323	10			

Predictors: (Constant), IncreasedITFunding

Dependent Variable: InternalIntelSrc

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% CI for B	
		B	Std. Error	Beta			LB	UB
1	(Constant)	4.71	.412		11.437	.000	3.779	5.643
	IncreasedITFunding	.327	.09	.745	3.34	.009	.106	.548

Dependent Variable: InternalIntelSrc

D.3

Independent Variable	Dependent Variable
X	*Y*
Increased IT Departmental Funding	BI/TI Analysis

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	9.864	1	9.864	11.326	.008
	Residual	7.838	9	.871		
	Total	17.702	10			

a. Predictors: (Constant), IncreasedITFunding

b. Dependent Variable: BITIAnalysis

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% CI for B	
		B	Std. Er	Beta			LB	UB
1	(Constant)	2.36	.687		3.437	.007	.808	3.917
	ITFunding	.548	.163	.746	3.365	.008	.180	.917

a. Dependent Variable: BITI

D.4

Independent Variable	Dependent Variable
X	*Y*
Increased IT Departmental Funding	BI/TI Needs

ANOVA

Model		Sum of Squares	df	Mean Squar	F	Sig.
1	Regression	6.542	1	6.542	5.884	.046
	Residual	7.783	7	1.112		
	Total	14.326	8			

a. Predictors: (Constant), IncreasedITFunding

b. Dependent Variable: BITINeeds

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95% CI for B LB	95% CI for B UB
1	(Constant)	3.595	.826		4.353	.003	1.642	5.548
	ITFunding	.532	.219	.676	2.426	.046	.013	1.051

Dependent Variable: BITINeeds

D.5

Independent Variable	Dependent Variable
X	Y
Decision Quality of TI Consumers	External Intelligence Source

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.137	1	1.137	.478	.505[a]
	Residual	23.785	10	2.378		
	Total	24.922	11			

Predictors: (Constant), ImprovedDecisionQualityofCIOCTO

Dependent Variable: ExternalIntelSrc

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95% CI for B LB	95% CI for B UB
	(Constant)	6.64	2.30		2.884	.016	1.511	11.78
	ImpDecisionQual CIO/CTO	-.29	.420	-.214	-.691	.505	-1.225	.645

[a] Dependent Variable: ExternalIntelSrc

D.6

Independent Variable	Dependent Variable
X	Y
Decision Quality of TI Consumers	Internal Intelligence Source

ANOVA

Model		Sum of Squares	df	Mean Squar	F	Sig.
	Regression	2.309	1	2.309	5.264	.045
	Residual	4.386	10	.439		
	Total	6.694	11			

Predictors: (Constant), ImprovedDecisionQualityofCIOCTO

Dependent Variable: InternalIntelSrc

Coefficients

Model	Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	3.689	.990		3.727	.004	1.483	5.8
Decision QualCIOCTO	.413	.180	.587	2.294	.045	.012	.815

Dependent Variable: InternalIntelSrc

D.7

Independent Variable	Dependent Variable
X	Y
Decision Quality of TI Consumers	BI/TI Analysis

ANOVA

Model		Sum of Sq	df	Mean Squa	F	Sig.
	Regression	4.199	1	4.199	2.588	.139
	Residual	16.223	10	1.622		
	Total	20.422	11			

Predictors: (Constant), ImprovedDecisionQualityofCIOCTO

Dependent Variable: BITIAnalysis

Coefficients

Model		Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. E	Beta			LB	UB
1	(Constant)	1.324	1.904		.696	.503	-2.917	5.566
	ImprovedDec QualityCIOCTO	.558	.347	.453	.609	.139	-.215	1.330

Dependent Variable: BITIAnalysis

D.8

Independent Variable	Dependent Variable
X	Y
Decision Quality of TI Consumers	BI/TI Needs

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.356	1	.356	.148	.710
	Residual	19.186	8	2.398		
	Total	19.542	9			

a. Predictors: (Constant), ImprovedDecisionQualityofCIOCTO

b. Dependent Variable: BITINeeds

Coefficients

Model		Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. E	Beta			LB	UB
1	(Constant)	4.282	2.349		1.823	.106	-1.13	9.69
	ImprovedDec QualCIOCTO	.168	.436	.135	.385	.710	-.83	1.17

Dependent Variable: BITINeeds

D.9

Independent Variable	Dependent Variable
X	Y
Environmental Scanning of TI Consumers	External Intelligence Source

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
	Regression	.111	1	.111	.054	.821
	Residual	18.441	9	2.049		
	Total	18.552	10			

Predictors: (Constant), EnvironScanning

Dependent Variable: ExternalIntelSrc

Coefficients

Model	Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	4.970	1.493		3.330	.009	1.594	8.347
EnvScanning	.072	.310	.077	.233	.821	-.630	.774

Dependent Variable: ExternalIntelSrc

D.10

Independent Variable	Dependent Variable
X	Y
Environmental Scanning of TI Consumers	Internal Intelligence Sources

ANOVA

Model		Sum of Squares	df	Mean Squar	F	Sig.
1	Regression	1.217	1	1.217	2.145	.177
	Residual	5.106	9	.567		
	Total	6.323	10			

Predictors: (Constant), EnvironScanning

Dependent Variable: InternalIntelSrc

Coefficients

Model		Unstandard Coeffs		Standard Coeffs		Sig.	95% CI for B	
		B	Std Err	Beta	t		LB	UB
1	(Constant)	4.86	.785		6.199	.000	3.09	6.645
	EnvScanning	.23	.163	.439	1.465	.177	-.130	.608

Dependent Variable: InternalIntelSrc

D.11

Independent Variable	Dependent Variable
X	Y
Environmental Scanning of TI Consumers	BI/TI Analysis

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	10.920	1	10.920	14.492	.004
Residual	6.782	9	.754		
Total	17.702	10			

Predictors: (Constant), EnvironScanning

Dependent Variable: BITIAnalysis

Coefficients

Model		Unstandard Coefficients		Standard Coefficie		Sig.	95% CI for B	
		B	Std. E	Beta	t		LB	UB
1	(Constant)	1.17	.905		1.297	.227	-.87	3.222
	EnvnScan	.716	.188	.785	3.807	.004	.291	1.142

Dependent Variable: BITIAnalysis

D.12

Independent Variable	Dependent Variable
X	Y
Environmental Scanning of TI Consumers	BI/TI Needs

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	7.225	1	7.225	7.122	.032
	Residual	7.101	7	1.014		
	Total	14.326	8			

Predictors: (Constant), EnvironScanning

Dependent Variable: BITINeeds

Coefficients

Model		Unstandardi Coefficients		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. Er	Beta			LB	UB
1	(Constant)	2.72	1.06		2.56	.037	.212	5.23
	EnvrnScan	.604	.226	.710	2.66	.032	.069	1.14

Dependent Variable: BITINeeds

D.13

Independent Variable	Dependent Variable
X	Y
Confirmation of TI consumers decisions	External Intelligence Source

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	1.909	1	1.909	1.032	.336
	Residual	16.643	9	1.849		
	Total	18.552	10			

Predictors: (Constant), JustificationforCIOCTOdecisions

Dependent Variable: ExternalIntelSrc

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% CI for B	
		B	Std. E	Beta			LB	UB
	(Constant)	6.95	1.67		4.14	.00	3.16	10.7
	Justificationfor CIOCTOdecisions	-.31	.30	-.32	-1.01	.33	-1.0	.38

Dependent Variable: ExternalIntelSrc

D.14

Independent Variable	Dependent Variable
X	Y
Confirmation of TI consumers decisions	Internal Intelligence Sources

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	1.894	1	1.894	3.848	.081
	Residual	4.429	9	.492		
	Total	6.323	10			

Predictors: (Constant), JustificationforCIOCTOdecisions

Dependent Variable: InternalIntelSrc

Coefficients

Model		Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. E	Beta			LB	UB
1	(Constant)	4.32	.865		4.99	.00	2.36	6.28
	Justificationfor CIOCTOdecisions	.31	.158	.547	1.96	.08	-.04	.668

Dependent Variable: InternalIntelSrc

D.15

Independent Variable	Dependent Variable
X	Y
Confirmation of TI consumers decisions	BI/TI Analysis

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	5.180	1	5.180	3.723	.086
	Residual	12.522	9	1.391		
	Total	17.702	10			

Predictors: (Constant), JustificationforCIOCTOdecisions

Dependent Variable: BITIAnalysis

Coefficients

Model		Unstandardi Coefficients		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. Er	Beta			LB	UB
1	(Constant)	1.75	1.455		1.203	.260	-1.541	5.042
	Justificationfor CIOCTOdecisions	.513	.266	.541	1.930	.086	-.088	1.115

Dependent Variable: BITIAnalysis

D.16

Independent Variable	Dependent Variable

X	Y
Confirmation of TI consumers decisions	BI/TI Needs

ANOVA

Model		Sum of Squares	df	Mean Squar	F	Sig.
1	Regression	1.162	1	1.162	.618	.458
	Residual	13.163	7	1.880		
	Total	14.326	8			

Predictors: (Constant), JustificationforCIOCTOdecisions

Dependent Variable: BITINeeds

Coefficients

Model		Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. E	Beta			LB	UB
1	(Constant)	4.12	1.701		2.422	.046	.098	8.141
	Justificationfor CIOCTODec	.247	.314	.285	.786	.458	-.495	.988

Dependent Variable: BITINeeds

D.17

Independent Variable	Dependent Variable
X	Y
BI/TI Needs	Environmental Scanning of TI Consumers

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.974	1	9.974	7.122	.032
	Residual	9.803	7	1.400		
	Total	19.778	8			

Predictors: (Constant), BITINeeds

Dependent Variable: EnvironScanning

Coefficients

Model	Unstandard Coefficient B	Unstandard Coefficient St.Err	Standard Coefficie Beta	t	Sig.	95% CI for B LB	95% CI for B UB
(Const)	-.068	1.736		-.03	.97	-4.173	4.03
BITINeeds	.834	.313	.71	2.66	.03	.095	1.574

Dependent Variable: EnvironScanning

D.18

Independent Variable	Dependent Variable
X	Y
	Confirmation of TI
BI/TI Needs	consumers decisions

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	1.550	1	1.550	.618	.458
	Residual	17.561	7	2.509		
	Total	19.111	8			

Predictors: (Constant), BITINeeds

Dependent Variable: JustificationforCIOCTOdecisions

Coefficients

Model	Unstandard Coefficient B	Unstandard Coefficient Std. Er	Standard Coefficient Beta	t	Sig.	95% CI for B LB	95% CI for B UB
(Const)	3.44	2.324		1.482	.182	-2.051	8.938
BITINeeds	.329	.418	.285	.786	.458	-.661	1.319

Dependent Variable: JustificationforCIOCTOdecisions

D.19

Independent Variable	Dependent Variable
X	Y
	Decision Quality of TI
BI/TI Needs	Consumers

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.230	1	.230	.148	.710
	Residual	12.379	8	1.547		
	Total	12.608	9			

Predictors: (Constant), BITINeeds

Dependent Variable: ImprovedDecisionQualityofCIOCTO

Coefficients

Model	Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	4.707	1.506		3.125	.014	1.23	8.180
BITINeeds	.108	.281	.135	.385	.710	-.54	.757

Dependent Variable: ImprovedDecisionQualityofCIOCTO

D.20

Independent Variable	Dependent Variable
X	Y
BI/TI Needs	Increased IT Departmental Funding

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	10.557	1	10.557	5.884	.046
	Residual	12.560	7	1.794		
	Total	23.117	8			

Predictors: (Constant), BITINeeds

Dependent Variable: IncreasedITFunding

Coefficients

Model	Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Const)	-1.23	1.96		-.62	.55	-5.88	3.41
BITINeeds	.858	.354	.67	2.42	.04	.022	1.69

Dependent Variable: IncreasedITFunding

D.21

Independent Variable	Dependent Variable
X	Y
BI/TI Analysis	Environmental Scanning of TI Consumers

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	13.135	1	13.135	14.492	.004[a]
	Residual	8.158	9	.906		
	Total	21.293	10			

Predictors: (Constant), BITIAnalysis

Dependent Variable: EnvironScanning

Coefficients

Model		Unstandard Coefficient		Standard Coefficie			95% CI for B	
		B	Std. E	Beta	t	Sig.	LB	UB
1	(Const)	.753	1.052		.716	.492	-1.627	3.13
	BITIAnal	.861	.226	.785	3.807	.004	.350	1.37

Dependent Variable: EnvironScanning

D.22

Independent Variable	Dependent Variable
X	Y
BI/TI Analysis	Confirmation of TI consumers decisions

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
	Regression	5.752	1	5.752	3.723	.086
	Residual	13.904	9	1.545		
	Total	19.657	10			

Predictors: (Constant), BITIAnalysis

Dependent Variable: JustificationforCIOCTOdecisions

Coefficients

Model	Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. E	Beta			LB	UB
(Constant)	2.753	1.373		2.005	.076	-.354	5.86
BITIAnalysis	.570	.295	.541	1.930	.086	-.098	1.23

Dependent Variable: JustificationforCIOCTOdecisions

D.23

Independent Variable	Dependent Variable
X	Y
	Decision Quality of TI
BI/TI Analysis	Consumers

ANOVA

Model	Sum of Squares	df	Mean Squa	F	Sig.
Regression	2.777	1	2.777	2.588	.139
Residual	10.728	10	1.073		
Total	13.505	11			

Predictors: (Constant), BITIAnalysis

Dependent Variable: ImprovedDecisionQualityofCIOCTO

Coefficients

Model	Unstandard Coefficient		Standardiz Coefficient	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	3.793	1.036		3.660	.004	1.484	6.102
BITIAnalysis	.369	.229	.453	1.609	.139	-.142	.879

Dependent Variable: ImprovedDecisionQualityofCIOCTO

D.24

Independent Variable	Dependent Variable
X	Y
	Increased IT Departmental
BI/TI Analysis	Funding

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	18.279	1	18.279	11.326	.008
	Residual	14.524	9	1.614		
	Total	32.803	10			

Predictors: (Constant), BITIAnalysis
Dependent Variable: IncreasedITFunding

Coefficients

Model	Unstandard Coefficient		Standardi Coefficier	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	-.697	1.404		-.496	.632	-3.872	2.479
BITIAnalysis	1.016	.302	.746	3.365	.008	.333	1.699

Dependent Variable: IncreasedITFunding

D.25

Independent Variable	Dependent Variable
X	Y
	Environmental Scanning of
External Intelligence Source	TI Consumers

ANOVA

Model		Sum of Squares	df	Mean Squar	F	Sig.
1	Regression	.127	1	.127	.054	.821
	Residual	21.166	9	2.352		
	Total	21.293	10			

Predictors: (Constant), ExternalIntelSrc
Dependent Variable: EnvironScanning

Coefficients

Model	Unstandard Coefficients		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	4.16	1.944		2.144	.061	-.230	8.564
ExternalIntelSrc	.083	.356	.077	.233	.821	-.723	.888

Dependent Variable: EnvironScanning

D.26

Independent Variable	Dependent Variable
X	Y
	Confirmation of TI
External Intelligence Source	consumers decisions

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	2.023	1	2.023	1.032	.336
	Residual	17.634	9	1.959		
	Total	19.657	10			

Predictors: (Constant), ExternalIntelSrc

Dependent Variable: JustificationforCIOCTOdecisions

Coefficients

	Unstandard Coefficient		Standard Coefficie			95% CI for B	
Model	B	Std. E	Beta	t	Sig.	LB	UB
(Constant)	7.054	1.774		3.976	.003	3.040	11.068
ExternalIntelSrc	-.330	.325	-.321	-1.016	.336	-1.065	.405

Dependent Variable: JustificationforCIOCTOdecisions

D.27

Independent Variable	Dependent Variable
X	Y
	Decision Quality of TI
External Intelligence Source	Consumers

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	.616	1	.616	.478	.505[a]
	Residual	12.888	10	1.289		
	Total	13.505	11			

Predictors: (Constant), ExternalIntelSrc

Dependent Variable: ImprovedDecisionQualityofCIOCTO

Coefficients

Model	Unstandardi Coefficients		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	6.18	1.202		5.150	.000	3.511	8.865
ExternalIntelSrc	-.15	.227	-.214	-.691	.505	-.664	.349

Dependent Variable: ImprovedDecisionQualityofCIOCTO

D.28

Independent Variable	Dependent Variable
X	Y
External Intelligence Source	Increased IT Departmental Funding

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	.001	1	.001	.000	.988
	Residual	32.802	9	3.645		
	Total	32.803	10			

Predictors: (Constant), ExternalIntelSrc

Dependent Variable: IncreasedITFunding

Coefficients

Model	Unstandard Coefficient		Standard Coefficie			95% CI for B	
	B	Std. Er	Beta	t	Sig.	LB	UB
(Constant)	3.81	2.42		1.57	.149	-1.661	9.287
ExternalIntelSrc	.007	.443	.005	.015	.988	-.996	1.009

Dependent Variable: IncreasedITFunding

D.29

Independent Variable	Dependent Variable
X	Y
	Environmental Scanning of
Internal Intelligence Sources	TI Consumers

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	4.099	1	4.099	2.145	.177
	Residual	17.194	9	1.910		
	Total	21.293	10			

Predictors: (Constant), InternalIntelSrc

Dependent Variable: EnvironScanning

Coefficients

Model	Unstandard Coefficients		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	-.200	3.308		-.061	.953	-7.683	7.282
InternalIntelSrc	.805	.550	.439	1.465	.177	-.438	2.049

Dependent Variable: EnvironScanning

D.30

Independent Variable	Dependent Variable
X	Y
	Confirmation of TI
Internal Intelligence Sources	consumers decisions

ANOVA

Model	Sum of Squares	df	Mean Squa	F	Sig.
Regression	5.888	1	5.888	3.848	.081
Residual	13.769	9	1.530		
Total	19.657	10			

Predictors: (Constant), InternalIntelSrc

Dependent Variable: JustificationforCIOCTOdecisions

Coefficients

Model	Unstandard Coefficients		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. Er	Beta			LB	UB
(Constant)	-.457	2.960		-.155	.881	-7.154	6.239
InternalIntelSrc	.965	.492	.547	1.962	.081	-.148	2.078

Dependent Variable: JustificationforCIOCTOdecisions

D.31

Independent Variable	Dependent Variable
X	Y
	Decision Quality of TI
Internal Intelligence Sources	Consumers

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	4.657	1	4.657	5.264	.045
	Residual	8.848	10	.885		
	Total	13.505	11			

Predictors: (Constant), InternalIntelSrc

Dependent Variable: ImprovedDecisionQualityofCIOCTO

Coefficients

Model	Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
	B	Std. E	Beta			LB	UB
(Constant)	.454	2.168		.209	.838	-4.377	5.285
InternalIntelSrc	.834	.364	.587	2.294	.045	.024	1.644

Dependent Variable: ImprovedDecisionQualityofCIOCTO

D.32

Independent Variable	Dependent Variable
X	Y
Internal Intelligence Sources	Increased IT Departmental Funding

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	18.197	1	18.197	11.213	.009
	Residual	14.606	9	1.623		
	Total	32.803	10			

Predictors: (Constant), InternalIntelSrc

Dependent Variable: IncreasedITFunding

Coefficients

Model		Unstandard Coefficients		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. Er	Beta			LB	UB
1	(Constant)	-6.279	3.04	.745	-2.060	.070	-13.175	.618
	InternalIntelSrc	1.69	.507		3.349	.009	.550	2.842

Dependent Variable: IncreasedITFunding

D.33

Independent Variable	Dependent Variable
X	Y
Informative and Actionable TI Product	Environmental Scanning of TI Consumers

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	9.289	1	9.289	6.965	.027
	Residual	12.004	9	1.334		
	Total	21.293	10			

Predictors: (Constant), Informative and Actionable TI Product

Dependent Variable: EnvironScanning

Coefficients

Model		Unstandard Coefficients		Standard Coefficien	t	Sig.	95% CI for B	
		B	Std. Err	Beta			LB	UB
	(Constant)	1.814	1.114		1.629	.138	-.705	4.334
	Informative and Actionable TI Product	.562	.213	.661	2.639	.027	.080	1.043

Dependent Variable: EnvironScanning

D.34

Independent Variable	Dependent Variable
X	Y
Informative and Actionable TI Product	Confirmation of TI consumers decisions

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	15.934	1	15.934	38.522	.000
	Residual	3.723	9	.414		
	Total	19.657	10			

Predictors: (Constant), Informative and Actionable TI Product

Dependent Variable: JustificationforCIOCTOdecisions

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% CI for B	
		B	Std. E	Beta			LB	UB
1	(Constant)	1.64	.620		2.655	.026	.243	3.050
	Informative and Actionable TI Product	.73	.119	.900	6.207	.000	.468	1.004

Dependent Variable: JustificationforCIOCTOdecisions

D.35

Independent Variable	Dependent Variable
X	Y
Informative and Actionable TI Product	Decision Quality of TI Consumers

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	9.346	1	9.346	21.061	.001
	Residual	3.994	9	.444		
	Total	13.340	10			

Predictors: (Constant), Informative and Actionable TI Product

Dependent Variable: ImprovedDecisionQualityofCIOCTO

Coefficients

Model		Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. Err	Beta			LB	UB
	(Constant)	2.624	.642		4.084	.003	1.171	4.077
	Informative and Actionable TI Product	.563	.123	.837	4.589	.001	.286	.841

Dependent Variable: ImprovedDecisionQualityofCIOCTO

D.36

Independent Variable	Dependent Variable
X	Y
Informative and Actionable TI Product	Increased IT Departmental Funding

ANOVA

Model		Sum of Squares	df	Mean Squa	F	Sig.
1	Regression	12.705	1	12.705	5.690	.041[a]
	Residual	20.098	9	2.233		
	Total	32.803	10			

Predictors: (Constant), Informative and Actionable TI Product

Dependent Variable: IncreasedITFunding

Coefficients

Model		Unstandard Coefficient		Standard Coefficie	t	Sig.	95% CI for B	
		B	Std. E	Beta			LB	UB
	(Constant)	.583	1.44		.405	.695	-2.677	3.843
	Informative and Actionable TI Product	.657	.275	.622	2.385	.041	.034	1.280

Dependent Variable: IncreasedITFunding

APPENDIX E

INFORMED CONSENT NOTICE

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose and benefits of the study and how it will be conducted. Title of Study: Organizational Factors Contributing to an Effective Technology intelligence System. The principal investigator of this study is Konstantin Taskov, a graduate student at the University of North Texas (UNT) Department of Information Technology and Decision Sciences. You are being asked to participate in a research study which involves a survey on the affect of different factors that influence the organizational business intelligence/emerging information technology intelligence processes. You will be asked to fill out a survey that will take no more than 20 minutes of your time and subsequently an interview which should take no more than 30 minutes of your time. There are no foreseeable risks involved in this study. We expect the project to benefit you by helping you learn more about the business intelligence/emerging information technology intelligence processes in other companies and compare them to the intelligence processes in your company.

No information will be collected that can identify subjects. Disaggregate data will only reside on a single stand alone machine at the College of Business at UNT. Aggregated data at the industry level will be used for presentation and reporting. You are invited to complete the survey, but are not required to complete the survey. There will be no audio or video recordings. The confidentiality of your individual and company information will be maintained in any publications or presentations regarding this study. If you have any questions about the study, you may contact Konstantin Taskov at telephone number 214-493-6649 or Dr. Richard Vedder, UNT Department of ITDS at telephone number 940-565-3104. This research project has been reviewed and approved by the UNT Institutional Review Board (940) 565-3940. Contact the UNT IRB with any questions regarding your rights as a research subject. Your proceeding with the survey indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- Konstantin Taskov has explained the study to you and answered all of your questions. You have been told the possible benefits and the potential risks and/or discomforts of the study.

- You understand that you do not have to take part in this study, and your refusal to participate or your decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as a research participant and you voluntarily consent to participate in this study.
- You may keep this notice for your records

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