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## The Impact of Human Capital and Organizational Characteristics on the Business Value of Information Technology

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Graduate Program in Business

A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

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**The Impact of Human Capital and Organizational Characteristics  
on the Business Value of Information Technology**

Spine Title: Impact of Human Capital and Organizational Characteristics on IT

Business Value

Thesis Format: Monograph

By

Shady Fraiha

Graduate Program in Business Administration

A thesis submitted in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy

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entitled:

**The Impact of Human Capital and Organizational Characteristics on the  
Business Value of Information Technology**

is accepted in partial fulfillment of the  
requirements for the degree of  
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## **Abstract**

In order for a company to operate effectively within today's marketplace, an information system (IS) represents a necessary business asset in terms of efficiency and productivity. Still, despite the ongoing advances in technology, an IS stands out as an expensive asset due to the amount of change that it brings to organizational life. Its real value, however, must be examined in terms of its interaction with other resources of the firm. Hence, it is necessary to understand the factors that affect the business value of information technology (BVIT). This research addresses the human capital characteristics and organizational characteristics of a firm, resources that are potentially complementary with IT, and their impact on BVIT. The employees' diversity and knowledge and the company's organizational climate and structure represent variables that are expected to affect BVIT. This research uses the resource-based view of the firm as a framework for examining IS, while modeling human capital and organizational characteristics as resources of the firm. It also utilizes concepts from the literature on employee diversity and shared knowledge in order to develop theories and hypotheses about the phenomenon. The resulting hypotheses are built into a research model that is tested using Partial Least Squares, with the relevant data deriving from a large database of Canadian firms that was collected by Statistics Canada in 2005 using the Workplace and Employee Survey. The results show that both resources – human capital and organizational characteristics – impact the business value of IT. These findings have many implications for research and practice, and they contribute to the advancement of knowledge within the field of information systems.

**Keywords:** Impact of Human Capital, Impact of Organizational Characteristics, IT Outcomes, Organizational Diversity, Workplace and Employee Survey (WES), IT Business Value

## **Dedications**

To the future me – Make the best of it!

To those who encouraged me – Thanks!

To PhD students reading this thesis – You can do it too!

## **Acknowledgements**

I have finally reached this step – one that I expect to be an important milestone in my life. But I know I could not have gone this far without the support of a few persons.

First, I want to thank a couple of friends. I want to thank Elodie for her continuous encouragement. I don't know how she managed to pick me up every time I felt down. I feel that I could not have kept going without her wise words. I also want to thank Natalie for the infinite talks we had – they were helpful.

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## Table of Contents

Certificate of Examination.....	ii
Abstract.....	iii
Dedications .....	iv
Acknowledgements.....	v
Table of Contents.....	vi
Chapter 1.....	1
Introduction.....	1
1.1 Theoretical Direction .....	4
1.2 Research Questions .....	6
1.3 Nature of the Study .....	9
1.4 Research Methodology .....	11
1.5 Contributions of this study.....	12
1.6 Thesis Structure .....	13
Chapter 2.....	14
Theory, Literature Review and Concept Exploration .....	14
2.1 The Dependent Variable: Business Value of IT .....	14
2.2 The Resource-Based View of the Firm.....	19
2.2.1 RBV in IS research .....	23
2.3 Independent Variables .....	27
2.3.1 Human Resources Characteristics.....	30
2.3.2 Employee Diversity .....	34
2.3.2.1 Effects of Diversity .....	36
2.3.2.2 Educational Diversity.....	38
2.3.2.3 Age Diversity .....	39
2.3.2.4 Cultural Diversity.....	41
2.3.3 Cross-Domain Knowledge.....	43
2.3.3.1 What is Cross-Domain Knowledge?.....	44

2.3.3.2 The importance of cross-domain knowledge .....	48
2.3.3.3 Sources of Cross-Domain Knowledge .....	50
2.3.3.4 Summary .....	53
2.3.4 Organizational Characteristics .....	54
2.3.4.1 Organizational Climate .....	55
2.3.4.1.1 How does Organizational Climate affect IS?.....	55
2.3.4.1.2 Elements of Organizational Climate Measured .....	57
2.3.4.2 Organizational Structure and Relation to IS .....	62
2.3.4.2.1 Structural Elements Measured .....	64
2.4 Interaction of Concepts .....	66
2.5 Detailed Research Model .....	68
2.6 Conclusion .....	70
Chapter 3.....	71
Methodology .....	71
3.1 The Workplace and Employee Survey (WES).....	71
3.1.1 Benefits of Statistics Canada Data .....	74
3.2 Control Variables .....	76
3.3 Human Capital .....	79
3.3.1 Human Capital Diversity .....	80
3.3.2 Human Capital’s Cross-Domain Knowledge.....	83
3.4 Organizational Characteristics .....	85
3.4.1 Organizational Climate .....	85
3.4.2 Organizational Structure .....	88
3.5 The Dependent Variable: Business Value of IT .....	89
3.6 Data Cleaning and Data Reduction.....	93
3.7 Overview of Partial Least Squares.....	96
3.8 Data Processing before Analysis.....	97
3.9 Data Descriptives .....	99
3.10 Modeling BVIT.....	100



3.11 Conclusion .....	101
Chapter 4.....	102
Results and Discussion .....	102
4.1 General Descriptives.....	102
4.1.1 Factors of the Dependent Variable.....	104
4.2 Partial Least Squares Model .....	107
4.2.1 Testing the Model .....	108
4.2.2 Assessing the Model .....	110
4.2.3 Explaining the results.....	112
4.3 Discussion of Hypothesis-Testing Results.....	118
4.4 Conclusion .....	120
Chapter 5.....	121
Discussion and Conclusions .....	121
5.1 Contributions.....	122
5.1.1 Contributions Related to Human Capital .....	123
5.1.2 Contributions Related to Organizational Characteristics .....	125
5.1.3 General Study Contributions.....	126
5.2 Limitations .....	128
5.3 Implications for Research, Future Directions .....	130
5.4 Implications for Practice .....	133
5.5 Conclusion .....	134
References.....	135
Appendix A.....	147
Effects of Incentive Plans .....	147
Appendix B .....	149
Measuring Interaction Effects.....	149
Curriculum Vitea .....	151

## **Tables**

Table 2.1 The dependent variable in previous IS business value research	15
Table 2.2 Example of Separate Effects and Confounded Effects	18
Table 2.3 The different definitions and operationalizations of shared knowledge	46-47
Table 3.1 Descriptives of independent variables	99
Table 4.1 Comparison of Means of groups reporting/ not reporting effects	103
Table 4.2 Factor analysis of the items in the dependent variable scale	107
Table 4.3 Correlations and Loading of Formative Indicators	111

## **Figures**

Figure 2.1 Research Model	32
Figure 2.2 Detailed Research Model	69
Figure 3.1 The Data Cleaning Process	95
Figure 4.1 The Research Model	109

## Appendices

<b>Appendix A:</b> Effects of Incentive Plans	147
<b>Appendix B:</b> Measuring Interaction Effects	149

# Chapter 1

## Introduction

An information system represents an invaluable resource for a company. It can speed up operations, it can support processing, and it can increase control. Furthermore, in achieving these purposes, an IS can lead a company forward to reach its desired outcomes, such as lower costs, increased productivity, improved quality and increased market value. At the organizational level, an IS exerts a powerful influence on a wide array of economic factors and competitive results. In this study, I will explore the impact of potentially IT-complementary resources on a subset of these factors that represent organizational inputs and outcomes (including market share) and influence efficiency and effectiveness (Melville, Kraemer, &Gurbaxani, 2004). The impacts explored in this research are those of new IT implementations on organizational costs and performance, which have been addressed in the literature as the “business value of IT” (BVIT) (Nevo& Wade, 2010) or IT business value (Melville et al., 2004).

Understanding BVIT is important for several reasons. First among these is the extremely high capital cost of IS implementation, such as those involved in purchasing technology, training, change management, and other implementation issues. Companies spend billions of dollars on IS on an annual basis (McAfee, 2006; Pinsonneault&Rivard, 1998; Urbach, Smolnik, &Riempp, 2009) –in development, purchasing and implementation – and there is a resulting need to

understand the business value of all this spending. Second, previous research on the relationship between IT and firm performance has provided mixed and inconclusive findings (Dewett& Jones, 2001): A widely cited paper by Brynjolfsson and Yang (1996) reviewed the literature and offered mixed findings regarding the effects of IT on the company; for example, Dieweri and Smith (1994) reported large productivity gains because of IT, while Strassmann (1990) reported no correlation between IT and performance measures. Not surprisingly then, recent research reports that the organizational impacts of IT are still not clear (Dale Stoel & Muhanna, 2009). These conflicting and confusing findings indicate a need for more research on this topic in general and on this dependent variable specifically. Third, the antecedents of BVIT are not clear in the literature. Researchers have so far addressed several antecedents related to IT investment, IT infrastructure, or IT staff and management, but others must be researched if we are to acquire a more complete understanding of the role of the IS resource within an organization. Fourth, some IT failures in the workplace, as researched by many (e.g. Ewusi-mensah & Przasnyski, 1991), have been associated with a low impact from, and a low value added by, IT. A better understanding of the factors affecting BVIT may lead to a reduction in the high percentage of IT failures. Finally, if IT can affect the competitive advantage of a firm (Clemons & Row, 1991; Lado & Zhang, 1998; Powell & Dent-Micallef, 1997), either by being a rare resource or by leveraging the use of the company's existing resources, then it is important to understand how to increase IT's impact on the firm.

Previous literature has shown that the presence of information systems makes an impact on the organization in several ways. IT investments can lead to enhanced work processes, profits and market share (Brynjolfsson & Hitt, 1996), and IT human resources can lead to competitive advantage in themselves (Bharadwaj, 2000; Mata, Fuerst, & Barney, 1995). However, IT is abundant and/or easily imitable to the extent that Carr (2003) argued that “IT doesn’t matter” for competition. In a competitive environment, then, with available and imitable technology, it is not enough to simply acquire good IT. Rather, the challenge lies in creating value from the technology by integrating it with certain other resources of the firm.

Research into IT’s complementary resources is scarce (Melville et al., 2004; Nevo & Wade, 2010). In particular, the concept of complementarity is not well developed in the resource-based view of the firm (Wade & Hulland, 2004). Other than a few suggestions in the IS literature about the presence of IT complementary resources (e.g., Bharadwaj, 2000; Melville et al., 2004) the only evidence of resource complementarity with IT comes from a single work of Powell and Dent-Micallef’s (1997) research in strategy. Thus, there is a need to fill this gap in the literature by further exploring potentially IT-complementary resources with a view towards understanding how to best compile an efficient and effective information system.

## 1.1 Theoretical Direction

This exploratory study researches the business value of IT. Resources of the firm will be addressed in order to study their effects on the business value of IT. In Chapter 4, theoretical conclusions will be made from the results of this study.

One widely used theory that aids in understanding the impact of the IT resource on an organization is the resource-based view of the firm (Barney, 1991, 1999). The resource-based view (RBV) is a framework that views the company as a collection of resources working together towards a common aim. RBV is usually used to study the effect of resources on competitive advantage or the effect of resources on firm output, and one of its main assumptions proposes that heterogeneous resources lead to differentiation of a firm from others. RBV has been used before by IS researchers to understand IT-related assets and capabilities and their effects on work processes or on the firm as a whole. In that respect, IS research shows that IT management can be a differentiating factor that leads to higher competitive advantage (Mata et al., 1995). Moreover, RBV allows for researching the impact of resources within a firm. Researchers have noted that IT-complementary resources (not necessarily IT-related) are needed to enhance the IT resource's impact and the company's position. Hence, this theory is adequate for researching both BVIT and the impact of resources on the business value of IT.

Starting with the resources that were suggested by Melville et al. (2004) as being complementary to IS and with those researched by Powell and Dent-Micallef (1997), an exploration of the WES 2005 database (to find related variables) produced two categories of resources that could be examined for their complementary effects. An IS literature review provided evidence of possible impact of these two resources – human capital and organizational characteristics –on the business value of IT. Forthcoming discussions will utilize the literature findings to verify this possible impact.

One group of variables in the WES survey relates to human capital. Specifically, the survey includes measures that reflect aspects of diversity in human resources and others that reflect aspects of shared domain knowledge between business and IT, here called “cross-domain knowledge.” Human capital is the collection of skills, abilities and knowledge of the employees within an organization (Bontis, 2001; Grasenick& Law, 2004; Martensson, 2000). It enables employees to utilize their firm’s IS in more efficient ways as they work to support its business operations. Knowledgeable and skilled employees can learn from the information system by interacting with it (Hatch & Dyer, 2004), which provides them with critical knowledge to use the system effectively (King et al., 1994), and hence they are able to utilize it to achieve better outcomes. The diversity of employees corresponds to diversity in knowledge, abilities and skills, and the diversity literature has shown the effects of these differences on firms. Moreover, knowledge that is common to employees, in the form of cross-domain knowledge, is important



for communication and collaboration. Thus, these two characteristics of human resources are important when considering an interaction with the IS resource.

Despite being important characteristics of human resources, neither diversity nor cross-domain knowledge has been addressed effectively in relation to its organizational impact in IS research. Moreover, the effect of these two variables on BVIT has been largely overlooked. Another group of variables in the Workplace and Employee Survey (WES) relates to organizational characteristics. The characteristics of an organization may be important factors in determining the effectiveness of a new IT (Iivari, 1982), which is purchased, or developed, to solve organizational problems; new IT may bring change to some of these characteristics (Markus & Robey, 1988). Moreover, the effects of IT on performance are not direct, and IT moderates (interacts with) the relation between organizational characteristics and firm performance (Dewett & Jones, 2001). Specifically, WES contains variables related to organizational climate (degrees of professionalization and unionization, and incentive plans) and others related to the structural characteristics of centralization and organicity.

## **1.2 Research Questions**

Information systems are developed, acquired, and implemented to assist in the operations of a company. As the Delone and Mclean (1992, 2003) model of information system success suggests, the process of an information system's impact ends with organizational impact, part of which is BVIT. This study utilizes the knowledge accumulated in the technology adoption and

implementation areas to explore how human capital and organizational characteristics may affect BVIT, an approach that would be in line with the general belief in the IS literature that technology adoption and implementation have an impact on an organization's performance.

Implementation of IS in organizations is not a purely technical issue; it is also considered to be a social phenomenon (Alvarez, 2008; G. Marakas & S. Hornik, 1996). Hence, in order to understand the business value that results from IT implementation, we must study the human resources that interact with the system. Employees have been addressed before in IS research, but not comprehensively. The literature on IT implementation shows that users may resist information systems due to having a different set of skills and knowledge than what is required, and this resistance may lead to system failure (Kim & Kankanhalli, 2009). At the same time, employees with the right set of skills and knowledge will be able to utilize the system effectively. The collection of these sets of employee skills and knowledge constitutes the human capital, as mentioned earlier. Thus, the characteristics of this human capital may affect the business value of information systems.

The first research question addressed by this thesis is:

*RQ1: What type of impact do human capital characteristics have on BVIT?*

IS research has addressed organizational characteristics in relation to IT adoption (e.g., Thong & Yap, 1995) and IT implementation (Harper & Utley, 2001). Hong and Kim (2002) also showed the importance of a fit between organizational characteristics and IT for implementation success. Moreover, organizational characteristics are also important for achieving information system innovation success (Ji & Min, 2005; Raymond, 1985), which, at an organizational level, corresponds to performance effects (Seddon, Staples, Patnayakuni, & Bowtell, 1999). I consider similar findings to be evidence of possible impact of organizational characteristics on BVIT. Thus, it is important to research this particular relationship within the context of BVIT:

*RQ 2: What type of -impact do organizational characteristics have on BVIT?*

A successful implementation, as mentioned earlier, can be measured in terms of its effects on organizational performance (Seddon et al., 1999). The study by Alavi and Joachimsthaler (1992) showed that employee-related factors, such as training and involvement, can improve the implementation success of new IT and, consequently, the impact on the organization by up to 30%. Knowing that these factors can be controlled through a set of policies and a reward system, it seems that there is an interaction between human capital and organizational characteristics. Thus, it would be interesting to know whether there is a triple-way interaction among human capital, organizational characteristics, and information systems. This brings us to the third and last question addressed in this thesis:

*RQ 3: Is there an interaction between human resources and organizational characteristics, and does that interaction affect BVIT?*

### **1.3 Nature of the Study**

The literature addressing the business value of information technology is multifaceted. This literature has developed through five phases: 1- IT affects organizations (e.g., Pfeffer & Leblebici, 1977; Whisler, 1970), 2- IT enhances performance (e.g. Floyd & Wooldridge, 1990; Parker & Benson, 1988), 3- IT does not enhance performance all the time (e.g. Brynjolfsson & Yang, 1996; Strassmann, 1990), 4- IT leverages resources and does not impact organizations independently of other resources (e.g. Bharadwaj, 2000; Sambamurthy, Bharadwaj, & Grover, 2003; van Hoek, 2002), and 5- IT interacts with complementary resources to impact organizations (e.g., Melville et al., 2004; Nevo & Wade, 2010).

As the five phases show, the current literature on IS business value is heading towards researching complementary resources and has conceptually targeted that area. In that light, this study seeks to deliver a deeper exploration of the impact of human resources and organizational characteristics on BVIT.

The data used for analysis come from the Workplace and Employee Survey (WES) conducted by Statistics Canada in 2005. WES was developed in consultation with experts such as the EKOS Group, Human Resources Development Canada, and a Subject Matter Advisory Group. The purpose of the survey was “to explore a broad range of issues relating to employers and their employees” and “shed light on the relationships among competitiveness, innovation, technology use and human resource management on the employer side and technology use, training, job stability and earnings on the employee side”(WES, 2005). The purpose of the survey and the relationships on which it was designed to shed some light fit nicely into my exploration-oriented thesis work.

This work is neither totally theory driven, nor totally data driven. While it depends on data to verify the relationships between concepts, at the same time, in order to guide the analysis, it relies on previous advancements in theory regarding the role of IT in organizations. Given the survey data that represent the status-quo of organizations, developments in theory guide the analysis in terms of *where to search* and *what to search for*. Based on that frame of reference, it can neither be claimed that this work is top-down nor that it is bottom-up research. For example, the next chapter will rely on a theoretical perspective to show how resources may impact organizational outcomes and will utilize previous research findings to clarify the viability of the chosen resources for this research.

## 1.4 Research Methodology

To answer the three research questions, this study will analyze human capital variables and organizational characteristics variables as they relate to BVIT. The study will also address the interaction between these two resources in order to assess its impact on BVIT.

This study relies on two separate sources of data from The Workplace and Employee Survey:— the workplace questionnaire and the employee questionnaire. This survey is administered by Statistics Canada and the sample is collected from the population of Canadian companies. This use of a large sample with organizations from different industries, from different parts of the country, and having different sizes provides external validity to the research. This study investigates firms that have implemented new IT within the past year. The dependent variable in this work is BVIT, which has three factors: *Overall IS Effects* (quality of products or services, technological capabilities, working conditions, lead times, and range of products or services), *Inputs* (energy requirements, capital requirements, material requirements, and design costs), and *Market Share* (shares in local market, shares in regional or national markets, and shares in foreign markets), all collected from the workplace questionnaire. The independent variables are collected from the workplace questionnaire and from the employee questionnaire.

This analysis addresses the research interests in two parts. The first part aims at understanding the sample and the composition of the population and will provide descriptives related to IT and associated variables.

The second part proceeds by developing and testing a structured equation model using XLSTAT, which is a Windows-based program that performs Partial Least Squares analysis. Chapter 3 will provide a detailed explanation of the advantages and characteristics of this method. This second part of the study will answer the research questions.

### **1.5 Contributions of this study**

This research makes several contributions to the field of information systems. It identifies organizational resources that are complementary to IS and that affect BVIT. It also investigates multiple organizational characteristics and human capital characteristics that impact BVIT. The findings of this work will help researchers and managers focus on the elements that are more effective in increasing BVIT. Moreover, further interaction of resources is researched. For example, incentives motivate employees to work harder and to collaborate. If employees are not motivated to work harder and collaborate, then BVIT might be negatively affected, thereby revealing an interaction between human resources and organizational characteristics. By testing for the interaction of organizational characteristics and human resources, we are likely to find certain organizational characteristics that enhance the effect of human resources characteristics on the business value of IT. In other words, having those certain characteristics together in the same organization will lead to organizations reaping the benefits of IT more than in the case of having a different set of characteristics. Awareness of this enhanced effect is especially helpful for managers and more so if the organizational and human resources characteristics can be

controlled. By gaining an understanding of the relationships between these workplace resources, managers would be able to change these variables to enhance BVIT.

By way of a further contribution, this work conceptually develops existing concepts in technology adoption and implementation literatures and applies them to support hypothesis development and testing on the business value of IT, thus enriching the IS literature in terms of this concept. The results of this research stress the importance of human resources in seeking benefits from IT and show the considerable effect that this concept can have on IT's organizational outcomes. The same is true for the concept of organizational characteristics.

## **1.6 Thesis Structure**

Chapter 2 reviews the resource-based view of the firm and develops the concepts under study using relevant literatures, relying on established theory as well as empirical findings regarding the impact of information systems and other literatures to provide explanations of variables. This chapter also develops the relations between the concepts under study and produces some resulting hypotheses.

Chapter 3 describes the data and procedures for the various steps of the study and provides an overview of Partial Least Squares, which is a structured-equation modeling method. Chapter 4 presents the analyses and the statistical results, and offers comments on them. Finally, Chapter 5 presents a discussion of the overall body of work, its implications for research and practice, and its contributions to the field of IS.



## Chapter 2

### Theory, Literature Review and Concept Exploration

This chapter has several purposes. First, it elaborates upon the dependent variable. Second, it elaborates on a theoretical framework that frames this exploration by reviewing the resource-based view of the firm and providing evidence of its use and usefulness in IS research. Third, this chapter reviews and synthesizes the findings of the IS literature on human resources and organizational characteristics and their relation to IT. This review advises the exploration process by suggesting variables for further research. As explained earlier, a survey from Statistics Canada, WES 2005, supplies the data and variables, and the literature review comments on their viability for exploration. And fourth, this chapter further develops the proposed concepts to explore their interaction with IS and their possible effects on BVIT, in turn producing several hypotheses that will be tested later in this thesis.

#### 2.1 The Dependent Variable: Business Value of IT

The business value of IT has been one of the central topics in IS research since the 1980s, as researchers and managers alike have shown an interest in understanding what value IT brings to the organization. IS research has addressed the effects of IT on both organizational processes and organizational outcomes (Table 2.1). IS researchers have also used the term “IT business value” to refer to the effects of IT on organizational performance measures, such as profitability and cost reduction (Melville et al., 2004). To study these effects, researchers have used conceptual

development and empirical testing (e.g., case studies and surveys) to suggest and to verify links between IT and organizational impact (e.g. Cooper, Watson, Wixom, & Goodhue, 2000; Mata et al., 1995). Some researchers were interested in addressing the relationships between measures of IT investments and profit (Brynjolfsson & Hitt, 1996; Cron & Sobol, 1983; Weill, 1992), a question of whether or not IT influences outcomes. Other researchers addressed the components of IT that are related to organizational outcomes and competitiveness (Mata et al., 1995), a question of how IT adds to firm performance. These approaches led to a conceptualization of IT as a tool or regular asset (as evidenced by measuring IT in terms of monetary units or number of computers) or as a resource of the firm (e.g. Bharadwaj, 2000; Melville et al., 2004).

<b>Dependent Variable</b>	<b>Study</b>
Profit (net income, ROA, ROS)	Bharadwaj, 2000; Weil, 1992; Dos Santos and Peffers, 1995; Powell and Dent-Micallef, 1997; Cooper, Watson, Wixom, & Goodhue, 2000; Cron&Sobol, 1983
Organizational performance (quality, on-time delivery, reduced inventory); Competitive advantage	Setia, Sambamurthy, &Closs, 2008; Brynjolfsson and Hitt, 2000; Melville et al, 2004; Mata et al, 1995
Business process innovation/performance	Ray, Muhanna, & Barney, 2005; Tarafdar& Gordon, 2007; Setia, Sambamurthy, & Closs, 2008;
Market Value (stock price)	Im et al., 2001
Costs, inputs (income statement)	Cron & Sobol, 1983; Weil, 1992; Bharadwaj, 2000
Productivity (rates per hour, ROI, etc.), sales (income statement)	Powell and Dent-Micallef, 1997; Cron&Sobol, 1983; Brynjolfsson and Yang, 1996
Market share, growth (company reports)	Weil, 1992; Dos Santos and Peffers, 1995; Powell and Dent-Micallef, 1997; Cron & Sobol, 1983

Table 2.1 The dependent variable in previous IT business value research

Despite many years of attention in the literature, the relationship between IT resources and organizational performance is not clear (Kohli and Grover 2008, Melville 2004). Some researchers have found a weak relationship between IT and firm performance (Bender, 1986; Harris & Katz, 1991), while others have found a significant positive relationship between IS spending and firm performance (Brynjolfsson & Hitt, 1996) and firm market value (Brynjolfsson, Hitt, & Yang, 1998; Brynjolfsson & Hitt, 2000; Lichtenberg, 1995). This impact can be explained by the following argument: IT affects the performance of a firm positively (J. Henderson & Venkatraman, 1993; Sabherwal & King, 1991) by improving business process and enabling process integration across the organization (Melville et al., 2004). In response to such expected impacts, the stock market reacts favourably to announcements of IT investments (Im, Dow, & Graver, 2001). The negative impact may come from huge investments in IT coupled with low adoption, failed/incomplete implementation or low assimilation (Brynjolfsson & Hitt, 2000). While both arguments may be logically sound, researchers have argued that contradictory findings may be the result of the presence of complementary resources that interact with IT and impact the business value of IT (Powell & Dent-Micallef, 1997). Another cause of contradictory findings could be the choice of dependent variable.

In 1992, Delone and McLean verbalized a particular aspect of the IS field: the quest for the dependent variable. In this seminal work (Delone & McLean, 1992), the authors reviewed the state of the literature and developed an IS success model, using organizational impact as the dependent variable. In researching the business value of IT, researchers used company

performance or competitive advantage as dependent variables. But organizational performance and competitive advantage are variables that depend on numerous other variables; hence, the effects of an IS are confounded by the effects of other resources in the firm and by the effects of the environment outside the firm. In this case, (i.e., a situation where IT contributes positively to organizational outcomes whereas other resources and the environment contribute negatively), the effect of IT may be mistaken to be negative. This scenario represents a downside of using overall performance or competitive advantage as dependent variables in IS business value research since it produces a challenge not easily mitigated. This can partly explain the mixed findings in previous research. Hence, to obtain more accurate results, it is important to consider a dependent variable that measures the effects of the IT resource only, including interactive effects. The downside of this approach lies in the fact that the isolated effects of the IT resource cannot be objectively measured.

This study utilizes a dependent variable that reports the effects of the IT resource on costs, profits and market share. A similar dependent variable was used by Powell and Dent-Micallef (1997), where they collected the executives' perceptions about the impact of IT on a few measures of performance. By choosing a dependent variable closer to the resource, known as a lower-than-firm-level dependent variable (Armstrong & Shimizu, 2007), this study addresses directly the "organizational impact" of DeLone and McLean (1992) regarding profits, costs and market share, and it avoids the challenges of previous research. The benefit of using this dependent variable can be seen in the following example (Table 2.2), where the effects of three

resources are displayed separately. The resources in this example are assumed to be separate and non-interacting<sup>1</sup>.

	IS	Engineering technology	Advertising	Total effect
Quality	1%	4%	0%	5%
Sales	3%	1%	4%	8%

Table 2.2 Example of separate effects and confounded effects

Previous research has used total effects mostly (such as net income, ROA, increase in sales), and has, hence, confounded the effects of resources, as explained earlier. This approach is equivalent to using the numbers 5 and 8 (Table 2.2) as actual measurements of the effect of the IS resource, where in reality the actual effects are represented by the numbers 1 and 3. A study that utilizes the total effects of 5 and 8 would produce inaccurate results, and the researcher might draw research conclusions that are not accurate. Using the effects of only the concerned resource produces more accurate results about the relations of that particular resource.

Consequently, by researching the effect of potentially IT-complementary resources on the business value of IT, by studying the interaction of these resources, and by using a lower-than-

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<sup>1</sup>This assumption is made only for the sake of the given example. Those resources may interact in real life.

firm-level dependent variable, this study breaks into new grounds of research to discover how the role of the IT resource in a company is affected by the nature of the other resources that interact with it.

To be able to research the business value of IT and IT-complementary resources, we require a good theoretical base that is able to connect these concepts. The following sub-section provides the theoretical lens chosen for analysis, that is, the resource-based view (RBV) of the firm. RBV provides a robust framework to research how IT may interact with other resources. This particular lens allows for the choice of specific resources to study their effects on performance or competitive advantage. The ensuing subsections elaborate on human capital and organizational characteristics, which are the potentially IT-complementary resources targeted in this thesis.

## **2.2 The Resource-Based View of the Firm**

The resource based view is a widely used theory that allows for and encourages dialogue between scholars from different fields (Mahoney & Pandian, 1992). Indeed, RBV is used in different disciplines as a basis for analyzing the effects of resources on performance. RBV (Barney, 1986, 1991; Wernerfelt, 1984) is a theory about assets, capabilities and competitive advantage. Assets may be tangible (e.g., machinery, LAN, computers) or intangible (e.g., patents, relationships, goodwill), and firms use them to create and offer products or services; capabilities are processes for using the assets to add value to the products and services (Sanchez,

Heene, & Thomas, 1996), or groups of assets and processes. However, the wide use of RBV by researchers is probably the reason behind the varied terminology. Resources have been referred to as competencies, assets and stocks (Wade & Hulland, 2004).

All firms have assets and capabilities that allow them to compete in the market, but it is certain characteristics of these assets and capabilities that allow firms to achieve competitive advantage and above-average earnings, and to continue to do so for longer periods of time. Competitive advantage results when the customers of a company perceive more value in that company's services or products than in the others' (Hall, 1993), which usually happens when the product or service is either cheaper or different from what other companies are offering (Porter, 1980).

RBV emphasizes two general reasons that set companies apart: the heterogeneity of resources between companies, and the lifetime of this heterogeneity. The more specific characteristics of resources that relate to competitive advantage are split into two categories: characteristics for achieving competitive advantage, and characteristics for sustaining competitive advantage. In order to achieve competitive advantage, some of the company's resources should have value, be rare or scarce to achieve heterogeneity, and be appropriable. In order to sustain competitive advantage, resources should have low imitability, low substitutability, and low mobility, all of which cater to long-lasting differences (Barney, 1991; Newbert, 2008).

A resource has **value** if it contributes to the efficiency and effectiveness of operations in the company (Barney, 1991). This characteristic does not set companies apart from each other as all

companies tend to optimize the use of their resources. A resource is **rare** if it is not easy to find and not readily available to other firms, which sets the focal firm apart from others. If all firms have access to the same resource, then it is not rare and does not add to firm heterogeneity. And finally, a resource is **appropriable** if the company is able to accrue returns from it, that is, the returns of the resource are captured by the firm as opposed to being captured by the employees, suppliers or customers. These characteristics help a company achieve competitive advantage over a relatively short period. Competitors are very likely to catch up and provide similar products or services unless the focal firm has resources with other characteristics that can help to sustain this competitive advantage.

For sustaining competitive advantage, a resource should have low imitability, low substitutability and low transferability. Low **imitability** comes from three main sources (Barney, 1991): a unique firm history, causal ambiguity and social complexity. A unique history is something that happened in the past that affected the company or market and led to a unique situation. Causal ambiguity means that it is not clear, at least to competitors, how the firm is generating value from a given resource, or which resource it is. Examples of resources that create causal ambiguity include organizational culture, standard procedures, or decision-making mechanisms that span several levels of the organization. Finally, social complexity refers to the structure of formal and informal relations between key individuals inside and outside the firm. If this structure is not totally understood, then it cannot be duplicated.

A resource should not be easily **substitutable**, that is, competitors should not find it easy to purchase or create a resource that provides the same benefits and value as the resource of the



focal firm. A resource should also have low mobility or **transferability**, which means that it cannot be easily bought and sold on the market. Company culture stands as an example of a resource with low transferability (R. B. Grant, 1991). The characteristic of mobility also taps into the disadvantages inherent in acquiring a similar resource by rivals. If the resource obtained by the focal firm is imitable or substitutable at a very high cost such that it would put rivals at a disadvantage, then the resource has low mobility and is a cause of sustained competitive advantage.

Barney (1991) classified resources into three categories: physical capital resources, human capital resources and organizational capital resources. Physical capital resources include the technology, plant and equipment, location, etc. Human capital resources include training, experience, intelligence, and others. Organizational capital resources include structure, planning, control and coordination systems, as well as relations with other firms. This classification provides a framework for the constructs in this research, which addresses the interaction and complementarity between technology (physical capital), diversity and knowledge (human capital), and structure and climate (organizational capital resources). An information system can also be seen as an organizational resource due to the embedding of policies and procedures into its processes.

The coming sections will show how human capital, through its complex composition, and organizational characteristics, through uniqueness and ambiguity, can be resources of value with low imitability and low mobility. First, I review the use of RBV in IS research.

### **2.2.1 RBV in IS research**

In recent years, use of the resource-based view (RBV) in IS research has been on the rise (Wade & Hulland, 2004), as demonstrated by this review, which shows the increase in the number of articles using RBV in the last five years. The reason for this increase is easy to explain: RBV is beneficial for IS research because it allows for the use of specific assets, comparison of resources, and an easy way to link IS to firm performance.

Ross et al. (1996) saw IT as a set of three different types of assets: human assets, technology assets and relationship assets. Bharadwaj (2000), on the other hand, split the IT resources differently into human resources, IT infrastructure and IT-enabled intangibles. More recently, Wade and Hulland (2004) accounted for the different IS resources addressed in the IS literature and grouped them according to Day's (1994) typology of IS resources. While the number of resources and their categorization may change, these studies attest to the usefulness of RBV as a framework for studying BVIT.

IT has a role in creating competitive advantage (Barney, 1991; Feeny & Ives, 1991), and the effects of the IT role can span across a wealth of areas, such as supply chain management, manufacturing, TQM, customer service, or decision-making, just to mention a few. Accordingly, IT can affect all the processes and operations of a firm and can optimize the use of the firm's assets and capabilities. When the relationship between IT and competitive advantage was investigated by Mata et al. (1995), the authors reviewed literature to reveal that, on its own, the IT asset is not likely to be a source of sustained competitive advantage, mainly because it is imitable and because unique IT is costly and may create disadvantages. Accordingly, if IT is widely available and is not unique, then it cannot create competitive advantage on its own. In general, assets and capabilities do not lead to competitive advantage unless the company exploits a valuable asset-capability pair (Newbert, 2008). The IT asset itself is usually either available in the market or imitable. On the other hand, the skills and knowledge of managers may be unique to a firm and may lead to a sustained competitive advantage because they are IT- and firm-specific (Mata et al., 1995).

Wade and Hulland (2004) posit that the idea of complementarity of resources is very useful for IS research but is not well developed in RBV. Complementarity of resources is very important because the role of the IS resource is seen as complementary to the other resources, and it rarely affects competitive advantage directly (Wade & Hulland, 2004). Complementarity between resources may take one of three forms: compensatory, enhancing or suppressing. "A compensatory relationship exists when a change in the level of one resource is offset by a change

in the level of another resource. An enhancing relationship exists when one resource magnifies the impact of another resource. A suppressing relationship exists when the presence of one resource diminishes the impact of another” (Wade & Hulland, 2004, p. 123).

Over the last five years, there has been much interest in RBV in the IS area. The recent works in the IS literature using RBV show the utility of this theory for IS research. My review, summarized below, shows a breadth of topics, which attests to the applicability and usefulness of RBV in IS research.

Researchers have used RBV to study the effects of IT assets and capabilities on business processes (Mishra, Konana, & Barua, 2007; Ray, Muhanna, & Barney, 2005; Tarafdar & Gordon, 2007; Zhuang & Lederer, 2006), supply chains (Dong, Xu, & Zhu, 2009), project development (Ashurst, Doherty, & Peppard, 2008), and service-oriented architecture (Mueller, Viering, Legner, & Riempp, 2010). Researchers also used RBV to explain how *IT support* and *alignment with business* can affect performance (Oh & Pinsonneault, 2007; Rivard, Raymond, & Verreault, 2006), how IS capabilities reinforce each other (Karimi, Somers, & Bhattacharjee, 2007), and how users' IT experience may increase their satisfaction (Davis et al., 2009). In addition, RBV was also useful in researching IT-outsourcing decision-making (Watjatrakul, 2005), mobile ticketing technologies (T. Li, van Heck, & Vervest, 2009) and failure of software firms (S. Li, Shang, & Slaughter, 2010).

The aforementioned literature reflects the interests of IS researchers in RBV, and it also shows the potential of RBV for future IS research. This research has addressed various attributes of IS, such as IT investments, IT staff, and IT capabilities; however, resources that interact with IT and IT-complementary resources have remained understudied (Melville et al., 2004; Nevo & Wade, 2010). Complementarity of resources means that one resource may influence others positively, with the influenced resource in turn producing more value because of the presence of the influencer resource (Zhu, 2004). Resources that impact BVIT have remained understudied as well. And according to Powell and Dent-Micallef (1997), one reason for the mixed findings in IS research in terms of the effects of IT is the presence of IT-complementary resources that impact the business value of IT. IT can have high organizational impact if it is integrated with other complementary resources of the firm (Benjamin & Levinson, 1993; Powell & Dent-Micallef, 1997). Using the complementarity argument, RBV provides a useful platform for studying the effect of other resources on BVIT. If IS does not impact the organization independently of other resources, then it is important to research those resources that impact the business value of IT. Thus, this work addresses two resources of the company that are thought to be complementary to IT and that are thought to affect the business value of IT. In doing so, I am addressing the mixed findings by researching the effect of new resources on the business value of IT.

The following sections explore the concepts of human capital and organizational characteristics. These concepts are examined from an IS perspective, citing the relevant literature, and are then

developed as resources in the RBV sense. Within these sections, I present hypotheses that relate the variables of human capital and organizational characteristics to BVIT.

### **2.3 Independent Variables**

The independent variables researched previously in relation to the impact of IS have been mostly related to IT investments, such as number of computers or IT cost (Brynjolfsson & Yang, 1996; Floyd & Wooldridge, 1990; Im et al., 2001; Ranganathan & Brown, 2006; Weill, 1992), some related to IT human resources, such as staff and managers (Mata et al., 1995), and others related to IT applications (Dos Santos & Peffers, 1995).

To explain the mixed findings concerning BVIT, however, researchers have argued that there are organizational resources that are complementary to IT and impact its business value (Powell & Dent-Micallef, 1997) and that IT effects are contingent on rare and hard-to-imitate IT capabilities (Bharadwaj, 2000; Wade & Hulland, 2004) such as shared business-IT knowledge (Jeffers, Muhanna, & Nault, 2008).

This perspective fits with an ensemble view of technology (Melville et al., 2004; Orlikowski & Iacono, 2001), which proposes that an information system is more than just the technology and those that maintain it. An information system, in a broad sense, is composed of technology and

people working together within an organization. If technology is not a factor that affects outcomes on its own and is easily imitable, then it makes sense to study the other resources of the firm that are potentially complementary to IT and affect its business value. However, only one study reviewed (Powell & Dent-Micallef, 1997) offered empirical evidence of complementarity – that between aspects of human resources (open communication, flexibility) and IS. In general, information systems will lead to competitive advantage only when they support complementary human and organizational resources (Bharadwaj, 2000; Powell & Dent-Micallef, 1997). These organizational resources include human resources and organizational characteristics (Melville et al., 2004).

Previous research shows that organizational structure affects the adoption of innovations (Moch & Morse, 1977), and the organizational structure's fit with system design affects organizational performance (Barua, Kriebel, & Mukhopadhyay, 1995). In addition, restructuring affects the contribution of IT to productivity (Bresnahan, Brynjolfsson, & Hitt, 2002), and investments in organizational structure are important for realizing value from IT (Setia, Sambamurthy, & Closs, 2008). Moreover, the composition of a firm's human resources (staff, managers, professionals) and their skill levels are broadly related to IT resources (L. Hitt & Brynjolfsson, 1997), and investments in human resources are important for realizing value from IT (Setia et al., 2008).

These findings from previous research show that there is a relationship between organizational characteristics and human resources, on one hand, and IS outcomes on the other, possibly leading to an increased impact of IS. Relying on previous research and on research in diversity and management, I here develop the concepts of human capital (diversity of employees and cross-domain knowledge) and organizational characteristics (structure and climate) from an IS perspective in order to research their impact on BVIT. Another purpose of this work is to investigate the nature and degree of interaction between the two resources – human capital and organizational characteristics, and uncover its impact on BVIT.

This section reviews prior IS literature as it relates to human resources and organizational characteristics and their effects on IT outcomes. The existing IS literature has not focused on either the human capital concepts or organizational characteristics concepts in the way I am presenting them. Accordingly, one task of this section is to synthesize the available IS literature on these two constructs. A further task of this research is to present more complete concepts with several variables, which would help to create an understanding of the effects of these variables (e.g., incentives) in the presence of others (e.g., diversity).

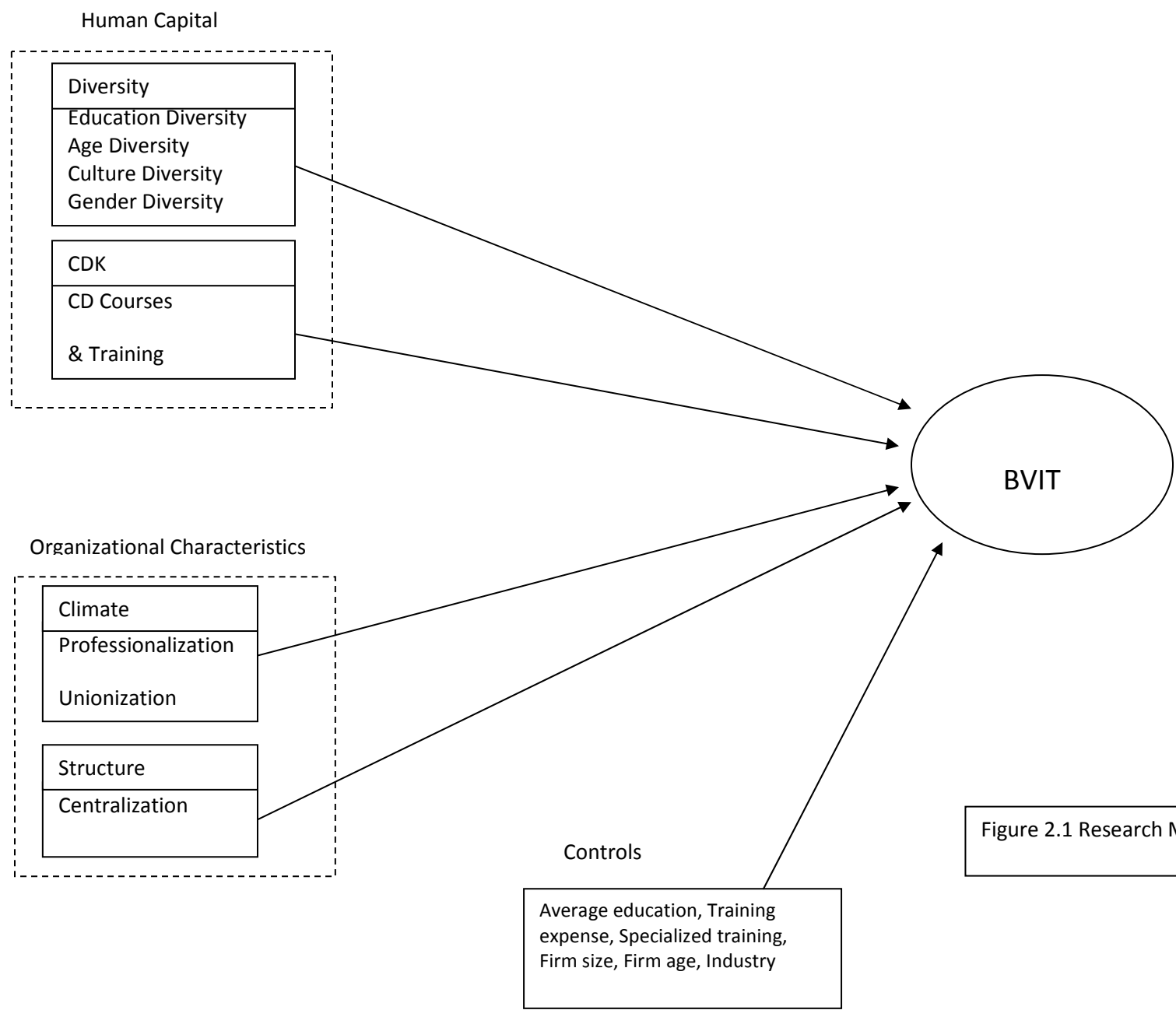
The model under study appears in Figure 2.1. The concept under investigation is the business value of IT, which is affected by the presence of the two resources, human resources and organizational characteristics, and the interaction of these two resources.



### **2.3.1 Human Resources Characteristics**

Human resources characteristics cover a wide range of knowledge-related traits (domain knowledge, education), demographics (age, gender, nationality), and others. One perspective on human resources is human capital. Human capital refers to the collection of knowledge and skills that the organization has (Bontis, 2001; Grasenick & Law, 2004), and it stands out as a characteristic that can determine the success of a firm (Wright & McMahan, 1992). Studies on human capital probably started after research on education and training showed a positive relationship with productivity. Earlier analyses were started by economists and were pioneered by Schultz in 1967 (Zula & Chermack, 2007). Research on human capital increased in the 1980s and 1990s after researchers found a correlation between human capital and firm output (e.g. M. Hitt, Bierman, Shimizu, & Kochhar, 2001). Human capital is assumed to be rare, inimitable, and unsubstitutable due to its social complexity (Hatch & Dyer, 2004), making it a unique non-tradable resource (Coff, 1997; M. Hitt et al., 2001; Mahoney & Pandian, 1992; Wright, Dunford, & Snell, 2001). Human capital adds to the flexibility of the firm (Wright & Snell, 1998) and allows for optimizing the use of technologies (Youndt, Snell, Dean, & Lepak, 1996). A high degree of human capital allows a company to effectively implement changes, including technological changes that aim to improve a company's competitive position (Kraatz & Zajac, 2001). At the same time, the RBV complementarity view maintains that an IS leads to competitive advantage only when it leverages existing resources, such as "intellectual capital" (Bharadwaj, 2000). Thus, it is expected that human capital characteristics will impact BVIT.

The aforementioned research shows that human capital is an important resource of the firm, and one that can contribute to BVIT. Yet, organizational research on human resources in IS has addressed IT staff (Bharadwaj, 2000; Ross et al., 1996) and user training only. Research on user training has shown that it leads to more acceptance of the system (Compeau & Higgins, 1995) and to implementation success (Gallivan, Spitler, & Koufaris, 2005). The current research is different in that it is not predicated on user training but on other variables representing characteristics of human capital. At the same time, the possible effects of training on BVIT are



both acknowledged and controlled for in this writing. It is believed that investments in human capital improve the performance of employees and organizations (Bishop, 1994; Black & Lynch, 1996). Moreover, humanresources indirectly affect firm performance by enhancing the effectiveness of other resources within the organization (Lado & Wilson, 1994).

Information systems are “critical to knowledge management as technologies such as groupware and multimedia systems assist in clarifying assumptions, speeding up communications, eliciting tacit knowledge, and constructing histories of insights” (Bharadwaj, 2000, p. 175). They also enhance knowledge codification (Dewett & Jones, 2001). All of these processes relate to human capital. At the same time, a more informed and knowledgeable human capital will be better equipped to make use of these services provided by IS. Thus, the human capital impacts the business value of IT.

Variables available from WES provide information about two aspects of human capital: the levels of diversity in a firm and its level of cross-domain knowledge. Research on human capital did not address cross-domain knowledge (CDK). However, research on shared-domain knowledge, which is the literature basis of cross-domain knowledge, shows the importance of CDK for successful communication and cooperation. Previous research has addressed education and training as sources of domain-related skills and knowledge and yet has overlooked diversity. While diversity can be a source of conflict in groups (Lau & Murnighan, 1998; Williams & O'Reilly, 1998), from a human capital perspective, the benefits of diversity can be seen as a

major source of value. The diversity of employees brings diversity in knowledge, abilities, and skills (Kilduff, Angelmar, & Mehra, 2000; Milliken & Martins, 1996). Thus, diversity represents a source of knowledge and skills in itself, since employees use their individual abilities to approach their work from a variety of perspectives, depending on their background, and it is this variety of perspectives that enriches a firm's human capital.

This previous research suggests that these two characteristics of human capital may be important for researching the business value of IT. My own work adds to the literature on human capital and the business value of IT by addressing two more sources of knowledge and skill: diversity and cross-domain knowledge. The following two sections will review literature on employee diversity and CDK and suggest certain hypotheses for testing.

### **2.3.2 Employee Diversity**

One important aspect of human capital is its diversity. Diversity has been described as a difference between members, heterogeneity, and variation in characteristics (Hambrick, Cho, & Chen, 1996; Jehn, Neale, & Northcraft, 1999; L. H. Pelled, 1996). The diversity of employees in organizations is increasing due to immigration, globalization and use of virtual organizations, to name but a few examples. Diversity can be seen in terms of age, education, gender, nationality and other characteristics.

Diversity occurs in many ways and can generally be divided into observable or surface-level diversity and latent or deep-level diversity (Carte & Chidambaram, 2004; Janssens & Steyaert, 2002). Observable diversity refers to attributes that are discernable to the naked eye or easy to discover on first encounter; for example, age, gender, and race are all observable. Latent diversity, on the other hand, refers to attributes that are not observable; for example, values, experience, and knowledge are not readily observable.

Diversity, which is seldom defined explicitly, is a characteristic of a group and not an individual, because it refers to the distribution of an attribute or characteristic of individuals within an organization (Harrison & Klein, 2007). Harrison and Klein (2007) studied diversity as separation, variety and disparity, where each type represents different characteristics and outcomes:

Separation thus reflects stand point or *position*: the distribution of where members stand on a value, belief, attitude, or orientation. Variety reflects *information*: the distribution of what each unit member knows that is unique from other members, as a function of the distinct content of his or her education, training, or experience. Disparity reflects *possession*: the distribution of how much of a socially valued commodity each unit member has. (p. 1207).

Those three types can each be considered dimensions of diversity and may simultaneously exist in an organization. Employee diversity may bring differences in values and beliefs, and employees may possess different information or perspectives because of their backgrounds.

The diversity variables of culture (or nationality), education, age and gender are of relevance to this study, and WES provides data on each one. These variables have two main characteristics. First, they are the most studied in diversity research, which attests to their importance, and second, these variables have been addressed in IS research before, albeit not from a diversity perspective. Thus, they are the most likely to affect BVIT, based on the results of previous research. This work researches cultural, educational and gender diversity as “variety,” because, in this work, these variables reflect the variety of the groups to which the employees belong. Age diversity, on the other hand, is a variable that changes along a continuum and that change brings with it certain inevitable differences in the individual’s knowledge, skills, and perspectives. Hence, this variable is researched as “separation.” Those types of diversity will likely cause affective, cognitive, symbolic and communicative differences (Janssens & Steyaert, 2002) among employees. Those variables will be reviewed over the following pages after a general review of the effects of diversity.

#### 2.3.2.1 Effects of Diversity

Since the middle of the last century, researchers have sought to understand the effects of diversity in the workplace. There has been, however, no consensus in the literature on the effects of diversity on performance (Jackson, Joshi, & Erhardt, 2003). Williams and O’Reilly (1998) reported that the field had been researched for over 40 years as researchers attempt to understand the effects of diversity, whether at the group or organizational levels. According to Janssens and Steyaert (2002) there are four main types of effects of diversity: affective, cognitive, symbolic

and communicative. These effects include the level of employee satisfaction, social integration, group information-processing and creativity, and communication patterns, respectively.

People who are demographically similar establish positive relations more quickly (Janssens & Steyaert, 2002; Linnehan, Chrobot-Mason, & Konrad, 2006). In a work environment, this similarity translates into better communication, more satisfaction and possibly higher productivity. Also, people tend to classify themselves– and others – based on demographic qualities that are considered important to the society in which they live, which in turn has the effect of creating barriers to social integration (Linnehan et al., 2006; Turner & Oakes, 1989).

On the other hand, diversity may also lead to more creativity, innovation and better decision-making (Ely & Thomas, 2001; Lau & Murnighan, 2005). Diverse employees bring diverse skills, perspectives, knowledge and approaches to their work, and hence, diversity may lead to better performance because people possess a variety of skills and information (Timmerman, 2000). Moreover, as diverse team members work together, they learn how to integrate their knowledge and skills, and once they achieve a certain level of integration, they are more able to benefit from the variety of perspectives inherent in their diversity (Milliken & Martins, 1996). In addition, an organization's ability to interpret and utilize external information – its absorptive capacity – depends on the individual employees' backgrounds (Cohen & Levinthal, 1990). Thus, having employees with diverse backgrounds will expand the absorptive capacity of the organization and allow it to better interpret and utilize the external environment. At the same time, “interactions



across individuals who each possess diverse and different knowledge structures will augment the organization's capacity for making novel linkages and associations - innovating" (Cohen & Levinthal, 1990, p. 133). Thus diversity enriches the human capital and strengthens its role as a resource in the organization.

Another effect of diversity is social complexity, which is difficult to understand and imitate by competitors (Richard, 2000). Sources of social complexity, together with literature support for the effects of diversity variables, will be covered in the following sections.

#### 2.3.2.2 Educational Diversity

Education makes considerable changes in an individual's cognitive abilities (Glaser, 1984), improving their understanding of what they know and do not know and allowing them to better manage their resources (Wang, Yen, Tsai, & Lin, 2008). Thus, educational diversity brings forward the issue of cognitive differences among employees. Moreover, education enables employees to absorb new knowledge and new ideas (Daghfous, 2004) and different types of education have the capacity to instil different knowledge and perspectives in the minds of individuals. These characteristics, enabled by diverse education, are important for dealing with new technology implementation and knowledge barriers and for finding solutions to the wide array of workplace problems that are bound to arise. Educational diversity is also related to successful innovation (Østergaard, Timmermans, & Kristinsson, 2010).

In general, most companies would select employees with different types of education because of diverse job requirements. Thus, a higher degree of educational diversity brings a higher number of resources to the knowledge pool and enhances the absorptive capacity in a firm (Nielsen, 2006). Although the level of education in a company might be important, it is very likely that diverse education would be more important for BVIT. Thus, educational diversity would expand the human capital's ability to deal with technology and increase its impact.

*Hypothesis 1a: Employees' educational diversity enhances the business value of IT.*

Educational diversity by itself is a characteristic that might be easy to imitate. Thus, on its own, educational diversity is not expected to be a rare and unique resource. Moreover, work experience may substitute for education at times. However, adding educational diversity on top of cultural diversity makes the mix a little more difficult to imitate or substitute.

### 2.3.2.3 Age Diversity

Age is an important characteristic because it is visible and may be used for social categorization, which might lead to lower performance (Timmerman, 2000). However, Pelled et al. (1999) found that age diversity leads to less emotional conflict because people of similar ages tend to compete for recognition. Moreover, applying policies without regard to the age diversity in an organization may lead to a crisis because employees will react differently (Murray & Syed, 2005). And as far as technology adoption is concerned, perceived behavioral control is a

characteristic that is more salient for older employees and less so for younger ones (Morris & Venkatesh, 2000), which means that age diversity may contribute to the effect of the human capital on the dependent variable.

Key life-events have the power to shape the characteristics of a generation. For this reason, while each generation has its own skills and challenges, each may also have a different level of work-life conflict (Higgins, Duxbury, & Lee, 1994) and may bring different attitudes to the workplace (Bell & Narz, 2007). For example, the millennial generation grew up with technology and uses it as a “sixth sense,” which affects the way this generation approaches work processes and communication (Hershatter & Epstein, 2010). Other research shows that older employees are more productive, while younger employees are more task-focused (Murray & Syed, 2005). In general, younger employees are more interested in getting ahead in their jobs than are older employees (FWI, 2004). Thus, age diversity contributes to enlarging the cognitive pool of employees. Furthermore, age diversity increases the perspectives, skills and interests in the organization, thus enriching the human capital. With more knowledge and a greater number of perspectives and skills, an increase in BVIT is expected.

*Hypothesis 1b: Employees age diversity enhances the business value of IT.*

Age diversity by itself is a characteristic that might be easy to imitate because of the availability of employees at almost all ages. Thus, on its own, age diversity is not expected to be a rare and unique resource. It is not clear whether age diversity is substitutable; however, adding age

diversity on top of educational diversity on top of cultural diversity clearly makes the mix much more difficult to imitate or substitute.

#### 2.3.2.4 Cultural Diversity

The cultural diversity of the human capital adds to the diversity of employees. Leidner and Kayworth (2006) state that “information flows and information technologies are often closely intertwined with culture” (p. 358). So when employees bring their different cultures to the workplace, different interpretations of information flows are bound to result. Culture influences the perceptions and metaphor of its incumbents and may have subcultures, which arise when different groups have different beliefs, expectations, or values from each other (Grindley, 1992; Schein, 1992; Ward & Peppard, 1996). Moreover, the adoption of IS may be affected by differences in cultural values (Galliers, Madon, & Rashid, 1998), which means that the cultural diversity of the human capital affects the impact of IS.

In their review of the effects of culture in IS research, Leidner and Kayworth (2006) posed a question that is central to this type of research: “Will the same IT be used in similar ways across cultures and result in similar benefits, or will the same IT be used differently across cultures and result in different benefits?” (p. 367). Their review shows that cultural differences between adopting organizations or groups can lead to differences in the use and outcomes of IT. For example, DeVreede et al. (1999) argue that people in cultures with a high power distance are more likely to adopt GSS because of the anonymity it provides. This work takes culture research

one step further and considers cultural differences within an organization. If culture influences the perceptions of people and helps them develop skills and abilities, then cultural diversity increases the pool of skills and perspectives in an organization. Thus, a more culturally diverse human capital may lead to more utilization of IT, which will have a positive impact on BVIT.

*Hypothesis 1c: Employees' cultural/national diversity enhances the business value of IT.*

### 3.2.5 Gender Diversity

Gender diversity may have similar effects to other aspects of diversity (Milliken & Martins, 1996). Men and women differ in their willingness to accept jobs with more responsibility (FWI, 2004), and they also differ in their perceptions of technology (Gefen & Straub, 1997). Thus, gender should be taken into account if we want to achieve a better understanding of technology (Adam, Howcroft, & Richardson, 2004). Harrison et al. (1998) found that gender diversity decreased group cohesion, and in IS, gender has been shown to affect the adoption of information technology (Venkatesh & et al., 2003). Perceived usefulness of an application is more salient for men, while perceived ease of use is more salient for women (Venkatesh & Morris, 2000). Hence, gender diversity adds to the knowledge and skill pool of human capital. Moreover, gender diversity in employees is positively related to group effectiveness (C. Lee & Farh, 2004; Wegge, Roth, Neubach, Schmidt, & Kanfer, 2008), successful innovation (Østergaard et al., 2010), and creativity (L. R. Hoffman & Maier, 1961). These findings imply that gender diversity can affect BVIT positively.

*Hypothesis 1d: Employees' gender diversity enhances the business value of IT.*

Gender diversity by itself is a characteristic that might be easy to copy because of the availability of employees in both genders. Thus, on its own, gender diversity is not expected to be a rare and inimitable resource. However, adding gender diversity to the other diversity dimensions makes this mix very difficult to imitate or substitute.

Diversity brings differences in knowledge, perspectives and approaches. More diversity brings more differences, thus creating resources with high value, low imitability and low substitutability, and increasing the capabilities of the firm by enriching its human capital. According to Cohen and Levinthal(1990),in the ideal knowledge structure of an organization a trade-off exists between diversity and commonality of knowledge across employees. The following section addresses commonality of knowledge in the human capital of a firm.

### **2.3.3 Cross-Domain Knowledge**

Cross-domain knowledge represents another interesting characteristic of human capital that is available from WES. At an individual level, cross-domain knowledge (CDK) is the knowledge that an individual has of a domain (e.g., business, IT) other than his or her own. At an organizational level, CDK is the aggregation of such knowledge possessed by employees.

From the users' perspective, the new technology may be unknown to them, which poses technological knowledge barriers. Moreover, work processes generally have to be adapted to fit

the new technology, and that poses business knowledge barriers as employees have to learn the new processes in a short time. The purpose of this section is to know whether the aggregate IT knowledge of business employees and business knowledge of IT employees ('cross domain knowledge') could lead to higher impact of IS.

#### 2.3.3.1 What is Cross-Domain Knowledge?

According to Davenport and Prusak (2000), knowledge is a fluid mix of experience, values, contextual information and expert insight. It can be derived from books, stories or other resources, and it can be tacit or explicit (Bassellier, Benbasat, & Reich, 2003). Tacit knowledge is derived from experience and is hard to articulate or explain, while explicit knowledge is transferable and easier to codify and articulate. In an organizational context, knowledge can be derived from work experience, work policies, organizational stories, training and employee education. In that same context, however, the experiences of people in different departments may vary widely from one individual to another. Moreover, the handbooks, procedures and skills required to meet the needs of the job may be totally different. All of this leads to different domains of knowledge within an organization.

When information is shared (overlapping) between two individuals, then that information is called shared-domain knowledge. For example, if a firm's business people and its IT people both know how to use the Windows OS, then their knowledge is shared. If, however, the business people learn how to program using COBOL, and the IT people learn more advanced

programming languages (but not COBOL), then their knowledge is not shared. Rather, in this example, the business people have cross-domain knowledge of IT. While the concept of “shared” implies more than one entity or group, the concept of cross-domain knowledge may apply to a single individual. At an organizational level, the collection of such knowledge reflects the CDK of the human capital. For this work, the relevant CDK is that of business and IT employees.

There is almost no literature naming cross-domain knowledge as a concept for discovery and exploration. However, most of the literature on shared-domain knowledge (SDK) actually addresses cross-domain knowledge by measuring and testing the knowledge of one group of people in a specific domain concerning the information, processes and abilities of another domain without testing for a “shared knowledge” in the sense of “overlapping” or “same.” For example, Reich and Benbasat (2000) defined shared-domain knowledge indirectly by saying that it refers to IT-knowledgeable business managers and business-knowledgeable IT managers, while Ray et al. (2005) proposed that it refers to the knowledge of business managers about IT opportunities and abilities and the knowledge of the IT managers about business processes. Thus, this section will rely on the “shared knowledge” literature to develop hypotheses on the basis that the results of the measures and the conclusions made from these results are valid results and conclusions in term of “cross-domain knowledge.” Table 2.3 shows the different operationalizations of SDK by researchers. In this work, I use a definition similar to that of Reich and Benbasat (2000) and apply it to the organizational level. Hence, cross-domain knowledge of the human capital is the aggregation of the CDK of individual employees.



Reference	Definition/ Description	Operationalization
Reich and Benbasat, 2000	<p>“Shared domain knowledge ... refers both to IT-knowledgeable business managers and business-knowledgeable IT managers” (p. 84).</p> <p>“Shared domain knowledge is defined here as the ability of IT and business executives, at a deep level, to understand and be able to participate in the others’ key processes and to respect each other's unique contribution and challenges” (p. 86).</p>	<p>“Shared domain knowledge was operationalized as <b>work experience</b> and measured by assessing the actual amount of <b>IT experience</b> among the business executives and the actual amount of <b>business experience</b> among the IT executives.” (p. 89)</p>
Nelson and Coopridier, 1996	<p>Shared knowledge is an understanding, respect, and appreciation between groups.</p>	<p>Survey items such as: “the level of <b>appreciation</b> that the line organization has for the accomplishments of the IS organization.”</p>
Ray, Muhanna, and Barney 2005	<p>“It is the knowledge that the IT manager possesses about the customer service process, the knowledge that the customer service manager possesses about the potential opportunities to apply IT to improve customer service, and the common <i>understanding</i> between the IT and the line manager <b>regarding how IT can be used</b> to improve customer service process performance that constitute the construct we refer to as shared knowledge” (p. 630).</p>	<p>Survey items such as:</p> <p>“Managers in the information systems unit <b>understand</b> the business operations of the customer service unit.”</p>
Kearns and Sabherwal, 2007	<p>Same as Reich and Benbasat (2000).</p> <p>Recognize business executives’ knowledge of IT as more valuable.</p>	<p>Survey items that measure the extent to which business managers recognize IT as a competitive weapon and as a tool, and their beliefs about <b>IT’s value</b> in general.</p>

Hartung, Reich and Benbasat(Kearns &Lederer, 2003)	Same definition as Reich &Benbasat, 2000	“Interviewees were asked to recount their <b>career</b> in the military. This information was used to determine their <b>level of IT involvement</b> and current awareness of new technology.... Since IT Officers are not able to work outside the IT function, military experience (total time in the military minus training time) was used as a surrogate for their business experience” (p. 290).
Jeffers, Muhanna, and Nault 2008	Same definition as Ray et al., 2005	Scale of Ray et al., 2005
Henderson 1990	The appreciation and understanding of each other’s task environment	Interviews: knowledge of each other’s environment, culture and processes
(Nelson &Cooprider, 1996)	The understanding or appreciation among group members for issues that affect performance	Survey items
(R. M. Grant, 1996; Kearns &Sabherwal, 2007)	A shared anticipation of behavioral responses from other members when faced with a signal	Conceptual

Table 2.3 The different definitions and operationalizations of shared knowledge.

### 2.3.3.2 The importance of cross-domain knowledge

Cross-domain knowledge (CDK) is important for the operation of the firm. It helps organizational members understand each other's statements more easily when these statements contain shared facts, concepts and propositions (Hoopes & Postrel, 1999). Moreover, because it is essential for communication, CDK can enhance a group's efficiency when group members can anticipate and understand each other's responses (Cohen & Levinthal, 1990).

CDK also helps in creating an absorptive capacity that is needed to receive new knowledge (Kearns & Sabherwal, 2007) and to integrate the knowledge of the human capital. If employees of the firm have cross-domain knowledge, that helps to create an absorptive capacity that allows those employees to receive, understand and integrate new knowledge. Reich and Benbasat (2000) redefined cross-domain knowledge descriptively as the "ability of IT and business executives, at a deep level, to understand and be able to participate in the others' key processes" (p. 86). Common knowledge is a key element for effective working relationships in the organization (J. C. Henderson, 1990). Within the sphere of human capital, increasing the level of common knowledge between business and IT leads to an increase in IT performance (Nelson & Coopride, 1996). Cross-domain knowledge can also uncover IT-based opportunities that work toward strengthening the competitive position of the company (Kearns & Lederer, 2003), leading to competitive advantage.

CDK creates overlapping competencies and serves as a common ground for shared understanding (Davis et al., 2009), which allows for a better understanding of the requirements and limitations of new technology, thus leading to more implementation effectiveness. By integrating pieces of knowledge between IT and business, IT becomes better able to adapt the technology to fit the organization, and business becomes better able to adapt the work processes to create better flow within the organization. These capabilities lead to a better integration of the new technology with the business processes, which in turn results in more value for the firm. Thus, increased levels of CDK between IS and business lead to increased IS performance (Nelson & Coopridge, 1996).

Mechanisms for knowledge integration actually depend on an underlying base of common knowledge between groups (R. M. Grant, 1996; Kearns & Sabherwal, 2007), and the existence of shared vocabulary enables the combining of information (Boland & Tenkasi, 1995). CDK allows the human capital to integrate its faculties of knowledge about the business and IT, which can lead to an increase in the impact of IS.

Further, CDK contributes to differentiating the human capital resource. While explicit knowledge is available in books or other mediums, the right level of commonality of knowledge is something that is difficult to identify. Questions related to this subject have not been answered at the time of this writing, which implies that the right level of cross-domain knowledge is still not known and, as thus, not imitable. This writing taps into the importance of cross-domain

knowledge of human capital for creating value from IT. Another cause of inimitability derives from the fact that knowledge is composed of tacit and explicit components. These qualities make it difficult to discover the knowledge possessed by the human capital, especially since tacit knowledge is difficult to articulate. Also, while one employee might be substitutable, the group of employees with their “right” level of knowledge might not be. Hence, this characteristic is inimitable and un-substitutable, which adds value to the human capital of a company.

#### 2.3.3.3 Sources of Cross-Domain Knowledge

Cross-domain knowledge can come from education and training or from experience working in another domain. Experience is an important source of knowledge; however, the data set used in my research does not provide enough information on cross-domain work experience. Thus, I will limit my review here to training and education, which are significant sources of knowledge. The effects of employee education and training during an IT implementation, or ahead of it, have been the focus of previous research.

The purpose of employee training is to help employees acquire the knowledge and skills needed for the fulfillment of their job obligations (Latham & Stuart, 2007). Most end-user training research shows direct effects of training on IS implementation success (Gallivan et al., 2005), which affects the impact of IS. Akkermans and van Helden(2002) considered educating employees as one of the critical success factors in IT implementation, in line with Bingi et al. (1999), Somers and Nelson (2001), Umble et al. (2003), and others. Training helps employees

break down the knowledge barriers that would otherwise prevent them from using the system (Fichman & Kemerer, 1997).

As an important characteristic of human capital, cross-domain knowledge can be created through training in an alternative domain, as previously mentioned. Training can provide application knowledge, business context knowledge, and collaboration task knowledge (Kang & Santhanam, 2003). The interaction of these types of knowledge can in turn create new knowledge (Alavi & Leidner, 2001). When applied to IT implementation, training can increase the employees' acceptance of the system, provide them with the knowledge necessary for using the system, decrease the amount of necessary adjustments and adaptation time, and lower the overall costs of implementation. Not only that, these mechanisms can be used to integrate the knowledge between IT and business employees, especially during a new IT implementation. By increasing the acceptance level, providing users with the knowledge needed and integrating employee knowledge, training can enhance the abilities of the human capital with IT leading to a higher impact of IS.

When employees train together, they have the chance to learn about each other's expertise and abilities (Argote, 2005; Sharma & Yetton, 2007), which has the effect of providing the human capital with greater access to knowledge (Wegner, 1986). For systems providing collaborative applications, "training programs must not solely focus on developing users' system proficiency skills but must also educate users about the business processes that the collaborative application

will support” (Kang & Santhanam, 2003, p. 257). For the purposes of this study, I refer to this type of training as cross-domain training.

Cross-domain training provides new knowledge to employees about IS and about work-related processes, and this “additional knowledge will enable users to deal with technology-induced changes in the business processes” (Kang & Santhanam, 2003, p. 257). At this point, training users with the new IT and training them for the new work processes develops the necessary CDK that can help employees overcome the knowledge barriers (Attewell, 1992; Fichman & Kemerer, 1997; Robey, Ross, & Boudreau, 2002; Sharma & Yetton, 2007) barriers. As a result, the firm’s human capital learns to utilize the IS resource more efficiently, which leads to greater impact of IS.

One item used to measure CDK is the number of courses or training sessions that employees have taken in both business and IT. When an employee (whether business or IT) takes courses or training both in business and in IT, then that employee is exposed to knowledge about the other domain and receives CDK. Hence:

*Hypothesis 2a: The amount of cross-domain courses and training between employees in a firm enhances the business value of IT.*

While it is easy to imitate the amount of training that employees of a company might have and the number of courses that they take, it is not easy to know the amount of domain knowledge and cross-domain knowledge that such training and courses have imparted to the employees. Thus, CDK is a characteristic of human capital that is inimitable, unsubstitutable and untransferable.

#### 2.3.3.4 Summary

In general, while it might be possible for a company to imitate the diversity ratio on one or two dimensions, it is more difficult to imitate the diversity ratios on several dimensions. Adding to the complexity of the social context in an organization is the amount of cross-domain knowledge that employees have that allows them to form stronger relations between business and IT. Diversity and cross-domain knowledge stand out as two characteristics of human capital that make this particular asset very difficult to imitate or substitute, adding to its value to the firm. Something that can add to this resource's ability to support sustained competitive advantage is its ambiguity. While the components of human capital and its sources may be known, it remains difficult to assess how much knowledge from diversity and how much CDK a firm possesses. Consequently, imitating that human capital becomes almost an impossible task. If it remains difficult to assess what tools are actually adding value to the firm, as in the case of cross-domain knowledge or a specific mix of perspectives, then the resource has high ambiguity and low substitutability and has potential to support sustained competitive advantage.



This section has addressed human capital and its diversity and cross-domain knowledge, two characteristics that make this resource inimitable and unsubstitutable. These characteristics in turn come to bear on BVIT. The next section addresses organizational characteristics and how they also can have low imitability and substitutability and may relate to the business value of IT.

### **2.3.4 Organizational Characteristics**

Organizational characteristics are expected to affect the use and effectiveness of information systems. Since there are variables in the WES survey that are designed to bring out the characteristics of organizations, I reviewed the WES documentation and relevant management literature in order to produce several variables of interest. In this work, I will research five characteristics of an organization: degree of professionalization, degree of unionization, available incentives plans, degree of centralization, and structural organicity. IS researchers have suggested that higher level concepts related to these characteristics, namely climate and structure, also have effects on the IS (Bharadwaj, 2000; Melville et al., 2004; Wade & Hulland, 2004) and have been shown to have the attributes of inimitability and unsubstitutability. In addition, Dewett and Jones (2001) presented a model where IT moderates the relationship between organizational characteristics (including climate and structure) and organizational outcomes, thereby showing an interaction between the two.

Before I suggest hypotheses for these characteristics, I will review the literature on organizational climate and structure in order to establish the relevance and adequacy of these concepts for exploration in relation to the business value of IT.

#### **2.3.4.1 Organizational Climate**

Organizational climate refers to the “shared perceptions of organizational policies, practices, and procedures” (Reichers & Schneider, 1990, p. 22) and includes assumptions, values and norms. A company’s climate encourages a certain type of behaviour, which in turn affects the perceptions of the employees concerning the extent to which the use of a new innovation is rewarded (Klein & Sorra, 1996). Some researchers consider organizational climate to be intertwined with organizational culture (Schneider, Brief, & Guzzo, 1996), while others feel that the two are one and the same (Hopkins, 2006). Accordingly, research findings about the effects of both organizational climate and organizational culture on the impact of IS are equally valid here, and I will use the term “climate” to refer to both.

##### **2.3.4.1.1 How does Organizational Climate affect IS?**

Hoffman and Klepper (2000) researched the effects of organizational climate type on technology assimilation. Their research revealed that certain types of climates –namely, those with high solidarity of employees – are positively associated with successful technology implementation. In people oriented cultures, where autonomy, trust, flexibility and teamwork are valued, IT

implementation is more successful than in a climate where rules, precision, conformity and predictability are valued (Harper & Utley, 2001). Organizational climate is the most critical factor in successful technology assimilation (Cabrera, Cabrera, & Barajas, 2001), and hence, for proper and effective implementation, the right climate must exist (Klein & Sorra, 1996).

Organizational climate may play a lesser role in the decision to adopt new technology and a greater role in the timing of that adoption (Leidner & Kayworth, 2006). Leidner and Kayworth (2006) advise that groups that see a fit between their own values and their firm's technology are more likely to adopt it. The concept of fit has been discussed also by Srite & Karahanna(2006), Loch et al.(2003) and others, and it shows the importance of considering values while purchasing new technology. Moreover, a good fit between IT values and the overall organizational values will likely lead to a more successful implementation (Dube` & Robey, 1999). When there is no fit, conflict arises. As conflict arises and is resolved, the climate of the organization changes (Leidner & Kayworth, 2006). This chain of events points to an important interaction between IT and organizational climate. In order for technology assimilation to be successful, the technology has to fit the organizational climate; otherwise, the climate has to adapt to the technological demands (Cabrera et al., 2001). Thus, organizational climate is an important variable in considering BVIT.

Organizational values, assumptions and norms of behaviour might prove to be a mix that is very difficult to understand and imitate. While norms of behaviour may be observable and/or written

down, the values and assumptions of organizational members may be ambiguous and may remain hidden from observers. Accordingly, organizational climates are sources that are ambiguous and not easy to imitate or substitute because they create certain practices and instill certain norms, values and assumptions in the organization.

#### 2.3.4.1.2 Elements of Organizational Climate Measured

There is no specific measure of organizational climate, nor do I attempt to measure it. Rather, I will use three elements of climate that have the potential to affect the business value of IT. These elements are the degree of professionalization, degree of unionization, and employee incentive plans.

The organizational climate is reflected by the policies and procedures in a firm, and compensation and extrinsic motivators are integrated with the organizational climate (Brock, Zmud, Kim, & Lee, 2005; Grojean, Resick, Dickson, & Smith, 2004). Hence, incentives like profit-sharing programs reflect the organizational climate. Moreover, the policies, procedures, values and norms do not come from the organization alone; employee groups also have (or dictate) their own policies, procedures, values and norms. The most notable of these employee groups, which have the power to affect policies and procedures and to shape the climate with their values and norms, are unions and professional groups. Unions apply or enforce a set of standards regarding both tangibles (e.g., sick leave, salary) and intangibles (e.g., procedures and policies for dealing with employees). These standards and policies influence the climate in the organization by affecting employee's satisfaction and their sense of being treated fairly. At the

same time, companies usually create policies or procedures to accommodate the professional group of employees. These policies relate more to the type of work done by these employees and not to the individuals themselves. The professionals themselves also bring a set of values and norms into the mix, usually stemming from their profession. For example, at an accounting firm, a climate of timeliness, preciseness and confidentiality is likely to prevail. Accordingly, the degree of unionization and the degree of professionalization in a company, that is, the ratio of professionals in a firm, will affect the climate in that firm. Thus, the three measurable characteristic of a firm, namely degree of unionization, degree of professionalization, and the presence of incentives, will be studied in order to assess their interactions with the IS resource and their effects on the dependent variable, BVIT.

Professionalization leads to professionals having their own culture and belief systems and that affects the organizational climate (Bloor & Dawson, 1994). A high **degree of professionalization** could mean that the values of professionals, such as autonomy and collegiality, may be adopted by the whole organization (Saidel & Cour, 2003). The degree of professionalization should not be mistaken for the degree of specialization in this writing. The degree of professionalization is the ratio of professionals or specialists in the company to the total number of employees (Blau, Heydebrand, & Stauffer, 1966). The degree of specialization, on the other hand, may include the division of labour in a company (Blau et al., 1966) or it may refer to the company's specialization in a certain market, product or service. Both of these meanings of the term "specialization" refer to concepts not under study in this work. The attitudinal beliefs and autonomy of professionals is reflected in their use of technology (Chau &

Hu, 2001), and professionals tend to have more training and skills and are able to adapt to and adopt technology faster than other employees (Saidel & Cour, 2003). Moreover, professionals' use of computers often increases with time as users become accustomed to the system (Hegney et al., 2006). This could affect BVIT positively. However, the effect of having more professionals in an organization on the business value of IT is not clear especially when there is more than one group of professionals. It is also not clear if professionals would form their own group and build barriers, which could create hurdles for effective technology use and lead to a negative impact. Thus:

*Hypothesis 3a: The degree of professionalization impacts the business value of IT.*

The beliefs that professionals hold can affect the climate of a firm, and professionals' assumptions about behaviour may create even further changes in the organizational climate, as stated above. These two characteristics are not easily imitable, since beliefs often go unexplained or unspoken, and since the mix of beliefs from the various professionals within organizational climate might be inimitable. Further, the degree to which non-professionals might be affected by professionals' beliefs and assumptions remains ambiguous. Adding to this difficulty in deciphering the organizational climate is the degree to which some professionals have been affected by the beliefs and assumptions of other professional groups within the organization. As a result of this mix, a given organizational climate remains rare, inimitable and unsubstitutable.

The second variable that relates to organizational climate is the **degree of unionization**. Unionization affects the type and level of interaction between employees and management, which consequently affects the work climate (Blair & Roe, 1999). Unionization is a characteristic that is tied to firm performance (Clark, 1984), and the degree of unionization may affect the policies and norms in an organization. The literature on unionization shows that a higher degree of unionization, when coupled with good human resources practices, may lead to higher productivity (Black & Lynch, 2001). However, there is little evidence of the effect of unionization on technology adoption, implementation and technological change (Link & Siegel, 2002). Nonetheless, when an organization installs new IT and a large number of its employees belong to a union, it might be difficult to install and use certain parts of that IT because the change might affect employees' work arrangements (Melville et al., 2004). In this situation, parts of the IS would not be fully operational or not operational at all. Unions may also oppose labour-saving technologies and resist their implementation because new technologies may result in a need for fewer workers (Link & Siegel, 2002). Unionization "may constitute an obstacle to the adoption and use of new technologies" (Link & Siegel, 2002, p. 616), which will likely increase the difficulty of implementation and decrease the benefits derived from the system, in turn lowering the impact on an organization. Moreover, labour unions slow down the technical progress of organizations (Chintrakarn & Chen, 2010). Hence, we are likely to find that:

*Hypothesis 3b: A higher degree of unionization suppresses the business value of IT.*

**Employee incentive plans** also reflect an aspect of organizational climate. Incentives that are provided to employees, both individually and in groups, affect the climate of the organization and influence the way employees act and behave (Brock et al., 2005; Grojean et al., 2004). When employees perceive implementation policies comprehensively and consistently, the climate of implementation becomes stronger, and the climate includes employee incentives that can reinforce implementation policies. Incentives act as motivators to encourage employees to comply with policies and to try harder to achieve their work goals (Levesque, 2007), including technology adoption, assimilation and usage. Indeed, several researchers have found that incentives provided to employees affect the level of technology adoption (Cummings, 1995; Robinson et al., 2009). Simple incentive plans can have a considerable effect on employees' adoption and use of IT (Dewan, Freimer, Seidmann, & Sundaresan, 2001). Accordingly, providing incentives to employees will likely cause them to utilize the technology to achieve their work goals, which would likely lead to performance gains.

*Hypothesis 3c: Incentives enhance the business value of IT.*

An incentive plan may be easy to imitate, especially if the incentives are monetary. Other incentives, such as being named "employee of the month" or "hero of the year," might not be easy to imitate as these might develop a cultural meaning of their own that cannot be copied by competitors.



#### 2.3.4.2 Organizational Structure and Relation to IS

Organizational structure is the formal allocation of work roles and the mechanisms used to control and integrate work activities (Child, 1972). It is the distribution of units and positions in a company (James & Jones, 1976). In other words, and perhaps more clearly, it is the ways in which the work within an organization is divided into components and the relationships of coordination and control among these components (Johnson, 1998).

Structural elements, such as power distribution, horizontal and vertical integration arrangements, and control systems, may help or deter an IT implementation (Silva & Hirschheim, 2007). When the IS is not compatible with structural elements, then there is resistance or difficulty in implementation. Such resistance arises because of uncertainty risk or because of required organizational changes (Silva & Hirschheim, 2007). Moreover, the introduction of new IT could bring with it “interdependent relationships, single database and standard management and processing rules, all of which are capable of causing various degrees of change within the company” (El Amrani, Rowe, & Geffroy-Maronnat, 2006, p. 79), and may create uncertainty or difficulty in work processes.

One of the common themes during IT implementation involves firms experiencing misalignments between the functionality of the new IS and the functionality required by the organization, depending on the prevailing structure. Thus, implementing a new IS often requires disruptive organizational change, and the outcome of an implementation depends on the adaptability of both the IT and the organizational structure, in order to align the functionality

offered with the functionality required (Leonard-Barton, 1988; Wei, Wang, & Ju, 2005). Organizations that are successful with IT are usually those that are committed to IT (Tomlin, 1991) and that willingly adapt some of the firm's structural elements in order to facilitate a successful changeover. Adapting the structure might not be an easy task, however, although it might seem so at first glance. An organization's structure is usually at fit with its competitive environment. Accordingly, adapting the organizational structure might be expensive and may lead to a loss of competitive advantage.

RBV (Barney, 1991) considers that capital resources include the reporting structure and the controlling and coordinating systems. Ortega et al. (2010) used RBV to analyze the nature of the organizational structure and concluded that it is both a resource and a capability. The effect of the organizational structure on other resources needs to be researched because positive effects may lead to competitive advantage, and negative effects must also be dealt with. Furthermore, and citing Powell (1992), Ortega et al. (2010) explain how the organizational structure manifests the characteristics of the resources needed for competitive advantage, such as rarity, imperfect imitability, value production and low transferability. The authors conclude that organizational structure will not directly influence performance, but it may influence the other resources in the firm.

#### 2.3.4.2.1 Structural Elements Measured

According to the definition presented above, organizational structure should be viewed as the ways in which an organization's work is divided into components and the relationships of coordination and control among these components (Johnson, 1998). WES 2005 provides information about the degree of centralization and the level of organicity of firms. Centralization and organicity are two structural characteristics of an organization that describe the relationships between the components of work and will therefore be addressed in this study.

**Centralization** refers to the locus of decision-making within an organization – the degree to which decision-making authority is concentrated in a few positions (Van de Ven, 1976). Centralization represents the relationship of coordination and control in a firm (Johnson, 1998) and has been found to have a negative association with initiation, adoption and implementation of innovations (Grover & Goslar, 1993). Moreover, one view is that “centralization may cause a firm to ignore the beneficial changes generated by a new technology and focus instead on the costs and risks of the changes. As a result, a highly centralized firm may strongly object to the incorporation of a technological innovation into the organizational systems” (Bao, 2009, p. 126). However, centralization may also bring uniformity and standardization. Uniformity and standardization in organizational processes and technological systems may allow for faster communication, standard interfaces between systems, and a uniform approach to the utilization of IT. This may reflect in less problem, more use, and more value created from the system. Thus, centralization may have a positive impact on the business value of IT as well. Hence:

*Hypothesis 4a: The degree of centralization impacts the business value of IT.*

The other variable relating to organizational structure is organicity. **Organicity** refers to flexible structure and the ability of the company to respond quickly to environmental changes (Thibodeaux & Faden, 1994). Organizational organicity can be reflected through a tendency to use specialized teams and self-directed groups (Thibodeaux & Faden, 1994), which can be considered the components of the firm among which relationships of coordination and control exist (Johnson, 1998).

Increased organicity increases structural complexity and lowers formalization and standardization (Kennedy, 1983; Truong, 2009). Increased structural complexity will likely increase the complexity of the information system necessary to accommodate the information needs of the organization. This result could reflect in having a slow system or one that is difficult to use or maintain. At the same time, organicity involves having problem-solving groups and self-managed teams. Both types of groups are composed to be able to adapt quickly to changes, including technology induced changes, and to solve problems that arise at the work place. Having those characteristics, organicity may also allow for faster adaptation of the organization to IT changes and for reaping the benefits of the new technology. Hence:

*Hypothesis 4b: Structural organicity impacts the business value of IT.*

*Organizational structure* and *climate* are organizational characteristics that have been shown to be unique, inimitable, untransferable and have the potential to affect IT outcomes. The next section will address the interaction of these two resources and the possible effects of that interaction on BVIT.

## **2.4 Interaction of Concepts**

Given the characteristics of human capital explained above and the characteristics of an organization, a question of this study concerns whether an interaction between some of these characteristics affects the business value of IT. It is important to explore the effects of such an interaction, given the possibility of interaction of some elements, as suggested by previous work.

Incentives may interact with diversity. For example, if employees come from cultures with high uncertainty avoidance, where people avoid uncertain or ambiguous situations, then incentives might be necessary in order to get employees to act in certain ways. As an example, employees of different ages may be more inclined to learn the new technology if there are incentive plans related to it. Hence, having incentives is likely to motivate more of the diverse employees to conform to the standard of work behaviour or to work harder. Moreover, incentives can also dramatically enhance cooperation and reduce conflict that might arise between different groups (J. C. Henderson, 1990; Reich & Benbasat, 2000). Thus, we may hypothesize that incentives will likely cause employees to cooperate for the benefit of the organization:

*Hypothesis 5a: In an organization, incentives are expected to moderate the effects of education diversity on the business value of IT.*

*Hypothesis 5b: In an organization, incentives are expected to moderate the effects of age diversity on the business value of IT.*

*Hypothesis 5c: In an organization, incentives are expected to moderate the effects of cultural diversity on the business value of IT.*

*Hypothesis 5d: In an organization, incentives are expected to moderate the effects of gender diversity on the business value of IT.*

Cross-domain courses and training are expected to equip employees with the knowledge necessary for successful communication and collaboration. In an organization, such shared information allows for a shared language and enhances the communication between the different employees. This effect is expected to reduce any conflict and misunderstanding that may arise and allow for better cooperation. Organicity divides the organization into specialized teams and groups that may become strangers to each other. Having cross-domain knowledge may bridge that gap, allowing the teams to communicate more efficiently and mitigate the negative effects of organicity. This, in turn, will lead to higher gains in the business value of IT.

*Hypothesis 5e: In an organization, cross-domain knowledge positively moderates the effects of organicity on the business value of IT.*

## **2.5 Detailed Research Model**

The detailed research model with the hypothesized relations is shown in Figure 2.2

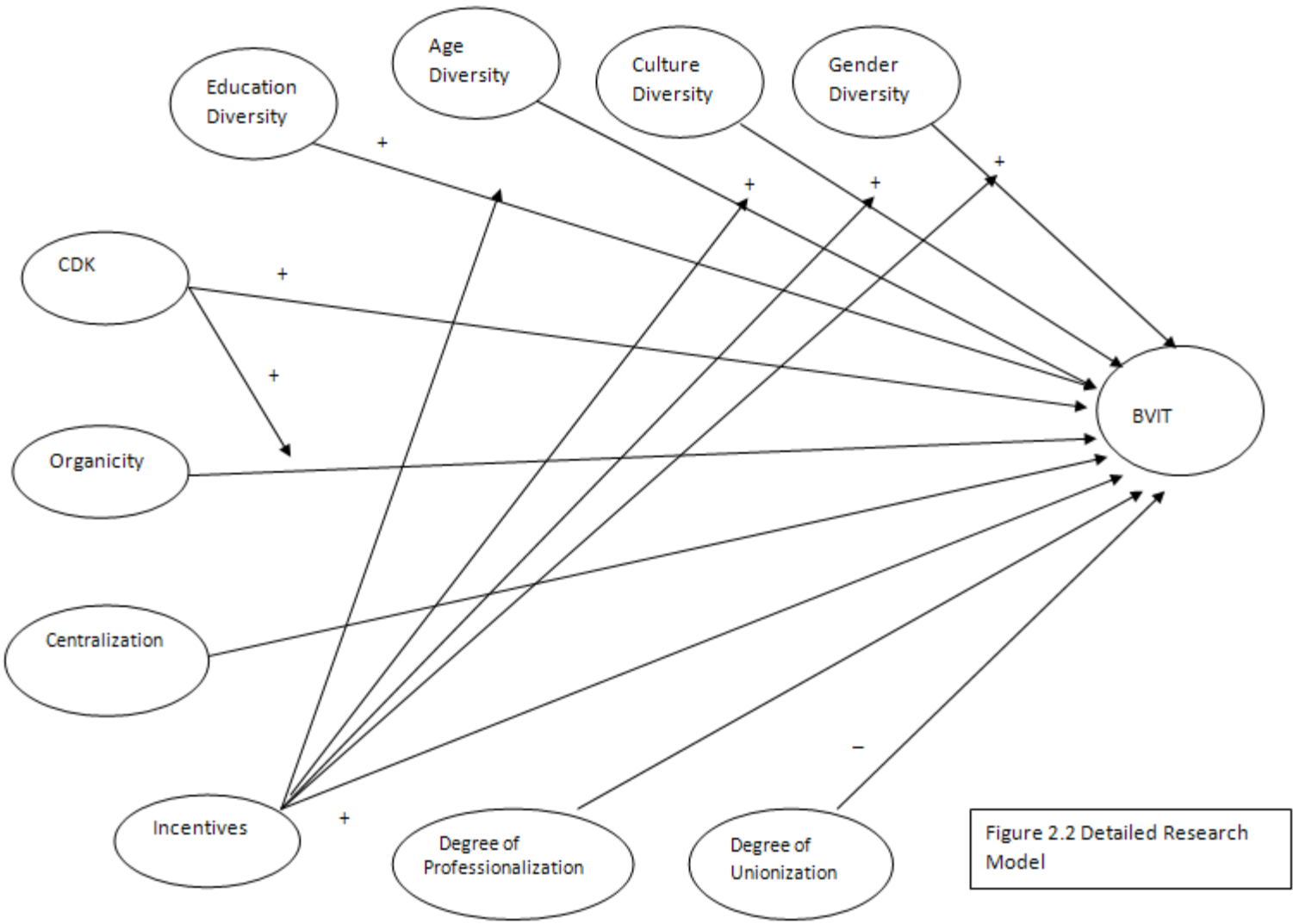


Figure 2.2 Detailed Research Model



## **2.6 Conclusion**

This chapter has reviewed several aspects of the IS literature and other literatures and explored two resources in particular, human capital and organizational characteristics. These characteristics of organizations are proven to be valuable resources that are difficult to imitate or substitute, which means that they may enhance the ability of the firm to sustain competitive advantage.

The chapter also developed a series of hypotheses about the relationship between human capital and organizational characteristics on one side and about the business value of IT on the other. Human capital diversity, cross-domain knowledge, organizational structure and climate all represent characteristics that are expected to affect the business value of IT. By doing so, these resources may lead to sustained competitive advantage.

The next chapter covers the sample and the data used and explains the methodology for conducting the research.

## **Chapter 3**

### **Methodology**

This chapter covers the methodology used to carry on the proposed research. While the previous chapters produced several hypotheses about the expected relations between human capital variables, organizational characteristics variables, and the business value of IT, this chapter will explain the details involved in testing these hypotheses using the Partial Least Squares method. Previous research has pointed to the relationships between several variables that are not part of my research and organizational performance. Accordingly, I will control for these variables, although they do not have a known relationship with the specific dependent variable in this study. First, the chapter will explain the source of data used and the benefits it brings. After that, an explanation of the control variables used in this research is provided, followed by separate sections about the main constructs under study. The chapter ends by presenting an overview of Partial Least Squares, followed by procedures of data processing and the basis for modeling the concepts. The product indicator approach (see Appendix B) was used for measuring the interaction effects of human capital and organizational characteristics hypothesized.

#### **3.1 The Workplace and Employee Survey (WES)**

WES was developed and administered by the Business and Labour Market Analysis Division and the Labour Statistics Division of Statistics Canada. Statistics Canada

conducts this survey annually, with slight modifications to the format, and keeps track of the surveyed organizations. The survey itself is composed of two questionnaires: one for employers (workplace) and another for employees. The database contains pointers relating employees to their workplaces. Thus, it is possible to connect a group of employees to their organization(s). Moreover, Statistics Canada applies a series of procedures, including removing outliers,<sup>2</sup> to guarantee the anonymity of respondents. The organizations to be surveyed each year are selected from the Business Register of Statistics Canada, which contains all businesses in Canada. Companies in the Canadian territories are removed from the set before sampling.

The data used for this study were collected by the Workplace and Employee Survey (WES) for the year 2005, which was the most recent data available from this survey. For 2006, the employee questionnaire was not administered and there is no information about later surveys.

The sample is stratified according to industry (14 industries), region (6 regions), and size of employer (3 sizes). Statistics Canada provides case weights for each organization in the sample. A case weight is a number that is assigned to a case to reflect the number of similar cases that are present in the population. In other words, if there are  $x$  companies in

---

<sup>2</sup> Companies that are considerably different from others on some attributes may be identified using these attributes. Removing outliers helps increase anonymity.

the population with similar properties and one of them is sampled, then that company will have a case weight of  $x$ . These case weights are adjusted to account for non-response later, in order to increase the precision of estimates derived from the data. Using case weights allows for making more accurate inferences for the whole population (Ciol et al., 2006; Sarndal, Swensson, & Wretman, 2003) because they affect the representation of companies in the sample. Statistics Canada also supplies case weights at the employee level, which are useful for individual level research. Since this analysis is at the organizational level, only the organizational level case weights were used.

In 2005, 6,693 organizations completed the survey, out of 7,864 employers sampled, providing a response rate of 85%. The majority of non-respondents were owner-operators with no paid employees. The respondent to the workplace questionnaire is the person responsible for the daily operations of the business, except for large businesses, where several people were sought to answer the different parts of the questionnaire according to each person's area of expertise. The total number of employees that answered the survey was 24,197, for a response rate of 81.2%.

Only organizations with five or more respondents in the corresponding employee questionnaire were retained for the analyses in parts 2, 3 and 4, since using five or more respondents or data points for a group decreases the biases in making inferences about that group (Bliese & Halverson, 1998; Liao, Joshi, & Chuang, 2004).

### 3.1.1 Benefits of Statistics Canada Data

As opposed to other sources of data, the data set provided by Statistics Canada has several advantages. First, the data cover many variables for organizations selected from and representative of the whole country. Hence, the results are more readily generalizable and are not confined to one area or industry. Second, the data are very rich with many variables collected at the same time. This breadth of data allows for researching several aspects of the organization at the same time. Third, the number of organizations surveyed is very high, which provides more statistical validity to the results. And fourth, the response rate is also high, and Statistics Canada maintains that the majority of non-respondents were owner-operators with no paid employees, and that means that the threat of non-response bias is low.

Moreover, there is a minimal threat of common methods bias in this data. According to Doty et al. (Doty, Glick, & Huber, 1993), “Common methods variance creates a problem whenever the same informants (or method) provide data for both the independent and the dependent variables in a study *and* a pattern of responses on the independent variables obviously and logically implies a pattern of responses on the dependent variable” (p. 1240).

For this research, independent variables are derived from the employee-level questionnaire and from the workplace-level questionnaire, while the dependent variable

comes from the workplace/firm-level questionnaire. The first condition is not satisfied with independent variables coming from the employee-level questionnaire because a different questionnaire is used for the dependent variable and the responders are different. And when we consider the independent variables coming from the firm-level questionnaire (structure, climate and gender composition), answering the questions about incentive plans (climate) or number of managers (centralization), for example, is not likely to cause bias in answering questions about the effects of IT implementation. The set of answers provided by managers concerning these independent variables does not “obviously and logically impl[y] a pattern of responses on the dependent variable.” Thus, the second condition does not hold here.

Moreover, Statistics Canada takes care to keep all data recorded –both individual and organizational – anonymous, further eliminating any inclination among the respondents to answer the questions in a non-truthful manner. In addition, the questions used in this work require specific evaluation and careful attention that engages the responders’ consciousness, and these factors lower the probability of bias in the answers. Based on this assessment, the threat of common methods bias is not a major concern in this work.

The characteristics of the data provided by WES and explained above make it very meaningful to use WES for research since it would be difficult to acquire this breadth, size and reliability of data using other collection methods. Even the use of similar survey

instruments might prove unprofitable since private surveys tend to have a much lower response rate than those of Statistics Canada, and since organizations might be unwilling to trust a private survey with the kind of information they provide to Statistics Canada.

### **3.2 Control Variables**

This study has several control variables that have been shown to have a relation to firm output. I have decided to control for these variables to isolate their effects and get a higher degree of confidence in my results.

Company size and industry have been considered as variables in prior IS research (Premkumar & King, 1994). Although size and industry were not found to be significant in Premkumar and King's study, their research speaks to the importance of these two characteristics of organizations. This study will test the significance of these two variables for firms that want to extract value from IT. Moreover, size and age have been linked to organizational ability and experience. I will control for these variables in my analyses. For organizational size, Statistics Canada uses the Business Labour Market Analysis definition and provides a Standard Size that groups organizations into four size groups. Organizational age will be the number of years the organization has been in existence. As for the industry, Statistics Canada has divided the areas of operations of firms into 15 different industries. The related questions are shown below:

<i>Variable</i>	<i>Question</i>	<i>Questionnaire</i>	<i>Comment</i>
<i>Organization Size</i>	<i>1.a In the last pay period of March 2005 and March 2004, how many employees receiving a T4 slip were employed at this location?</i>	<i>Workplace</i>	<i>Answer is coded by Statistics Canada into four groups: very small, small, medium, and large. Very small and small (&lt; 50 employees) were grouped together.</i>
<i>Organization Age</i>	<i>32 (a) Thinking now about your entire organization, including all locations, approximately how long has it been in operation?</i>	<i>Workplace</i>	<i>Number of years</i>
<i>Industry</i>	<i>(Statistics Canada provides the industry group that an organization belongs to)</i>	<i>Employee</i>	<i>Recoded into three groups. Dummy variables used.</i>

Two types of training variables are represented in the questionnaires and are important for the study as control variables because they may affect the dependent variable. Those two variables are (1) the total training expense of the organization and (2) the specialized training of employees. Total training expense shows up as a variable in the questionnaire, and specialized training is a variable that is measured as a ratio of the number of employees that received training for the specific application implemented to the total number of employees that use the application.

The questions used are from the workplace-level survey, as seen below:



<i>Variable</i>	<i>Question</i>	<i>Questionnaire</i>	<i>Process</i>
<i>Training expense</i>	<i>15.a Please estimate this workplace's total training expenditure, between April 1, 2004, and March 31, 2005.</i>	<i>Workplace</i>	
<i>Specialized training</i>	<i>45.b.b How many employees use this technology?</i>	<i>Workplace</i>	<i>Ratio (0-1)</i>
	<i>45.b.d How many employees received training directly related to this new technology?</i>		

In addition, the average level of education in a company will be used as a control variable, as stated in Chapter 2. Following the research produced by Statistics Canada and that utilizes WES (Wannell & Ali, 2002), the answers in the related question are mapped into a point system and then the average is taken. The question used is shown next.

<i>Variable</i>	<i>Question</i>	<i>Questionnaire</i>	<i>Measure</i>
<i>Average education</i>	<i>50 What was that education? (Check all that apply.)</i>	<i>Employee</i>	<i>The answers are mapped into a point scale.  The points correspond to the estimated number of years of education for each</i>
	<b><i>Trade-vocational:</i></b>		
	<i>1-Trade or vocational diploma or certificate</i>		
	<b><i>College:</i></b>		
	<i>2-Some college, CEGEP, institute of technology or nursing school</i>		
	<i>3-Completed college, CEGEP, institute of technology or nursing school</i>		
	<b><i>University:</i></b>		

	4-Some university		<i>answer with some adjustment to account for degrees that need a similar number of years of education.</i>  <i>The points are then added for all answers and then the average is taken.</i>  <i>Appendix B of Wannell and Ali (2002) shows the point scale. No one chose 'Other'</i>
5-Teachers college			
6-University certificate or diploma below bachelor level			
7-Bachelor or undergraduate degree or teachers' college  (e.g. B.A., B.Sc., B.A.Sc., 4-year B.Ed.)			
8-University certificate or diploma above bachelor level			
9-Master's degree (M.A., M.Sc., M.Ed., MBA, MPA and equivalent)			
10-Degree in medicine, dentistry, veterinary medicine, law, optometry or theology (M.D., D.D.S., D.M.D., D.V.M., LL.B., O.D., M.DIV.) or 1-year B.Ed. after another bachelor's degree			
11-Earned doctorate			
12-Industry certified training or certification courses			
13-Other, specify			

### 3.3 Human Capital

Human capital variables were selected from the employee-level questionnaire. Several variables were used to measure human capital, and those are variables at the organizational level that were drawn from information in the employee-level survey. These measures reflect the diversity of employees and the commonality of knowledge between them.

### 3.3.1 Human Capital Diversity

There are a number of measures/indexes for measuring diversity, such as ratio, coefficient of variation, standard deviation, Blau's index (1977) and others. Ratios are simple to use, and they reflect the ratio of the number of different categories present within the group to the size of the group. The result is a number between zero and one. Blau's index uses the formula  $(1 - \sum(G_i/N)^2)$  where  $G_i$  is the size of sub-group with characteristics 'i', and  $N$  is the size of the whole group.  $G_i/N$  is the fraction of the group with characteristic 'i'. Blau's index treats data as categorical where a group member either has characteristic 'i' or not. The maximum theoretical index here is  $(N-1)/N$ . Some researchers consider this index to be a good measure of diversity, even for dichotomous variables (Harrison & Klein, 2007), while others propose that using a proportional measure is better for dichotomous variables, especially for gender diversity (Yang & Konrad, 2010). In this respect, a measure of 0.4 on Blau's index for gender diversity might not be meaningful in itself, while a proportional measure of 40% females is easy to understand.

Another diversity measure is standard deviation, which is a well-known measure in statistics; standard deviation is a measure of distance that shows the concentration of occurrences around the average. The coefficient of variation is a measure of the ratio of the standard deviation to the mean. This measure may be useful in some kinds of research; however, since it is obtained by dividing the standard deviation of numbers by the average of those numbers, it is affected by the value of the average. Hence, a lateral translation of those numbers changes the coefficient of variation, but it does not change

their standard deviation or dispersion. For this reason, standard deviation is a better measure of the diversity of numbers on a continuum, while the coefficient of variation is not.

As stated in Chapter 2, this work researches cultural, educational and gender diversity as variety because they represent the variety of groups to which the employees belong. Gender, education and nationality are categorical variables, and the use of distance measures, such as standard deviation or the coefficient of variation, does not indicate anything meaningful. In the case of gender diversity, variation indexes are not an option as well because they do not have a meaningful interpretation. Thus, the gender composition in a firm, a form of ratio, seems to be the best option.

For education and cultural (nationality) diversity, ratios and Blau's index are meaningful measures. There is no indication in the diversity literature as to which of the two is a better measure, if any. Accordingly, I have calculated educational diversity by counting the different degrees that employees have and dividing that number by the number of employees in the sample. For nationality diversity, the ratio is the number of different countries of origin divided by the number of employees in the sample.

Age diversity is researched as separation because it varies along a continuum, and although it represents difference in knowledge, it does not represent status (Harrison & Klein, 2007). Age is a continuous variable, and its diversity can be measured by standard deviation or by the coefficient of variation. However, the coefficient of variation is affected by the position of the mean (or a lateral translation of the scores) on a scale (Bedeian & Mossholder, 2000) as stated earlier, which makes standard deviation a better measure of age diversity.

The variables of interest in this research and the related questions in the survey are listed below:

<i>Variable</i>	<i>Question</i>	<i>Questionnaire</i>	<i>Measure</i>
<i>Gender Diversity</i>	<i>1.i.a Of the total employment in March 2005, how many were male and how many were female?</i>	<i>Workplace</i>	<i>Ratio of smaller group divided by 50% (30% males would mean 60% diversity) A 50-50 split is 100% diversity</i>
<i>Age Diversity</i>	<i>43 In what year were you born?</i>	<i>Employee</i>	<i>Standard deviation of age</i>
<i>Cultural Diversity</i>	<i>46 Were you born in Canada?</i>	<i>Employee</i>	<i>Ratio of different countries to total (0-1)</i>
	<i>46.b From what country did you emigrate?</i>		
<i>Education Diversity</i>	<i>50 What was that education? (Check all that apply.)</i>	<i>Employee</i>	<i>Ratio of different degrees to total (0-1)</i>
	<b><i>Trade-vocational:</i></b>		
	<i>1-Trade or vocational diploma or certificate</i>		
	<b><i>College:</i></b>		
	<i>2-Some college, CEGEP, institute of technology or nursing school</i>		

	<i>3-Completed college, CEGEP, institute of technology or nursing school</i>		
	<b>University:</b>		
	<i>4-Some university</i>		
	<i>5-Teachers college</i>		
	<i>6-University certificate or diploma below bachelor level</i>		
	<i>7-Bachelor or undergraduate degree or teachers college (e.g. B.A., B.Sc., B.A.Sc., 4-year B.Ed.)</i>		
	<i>8-University certificate or diploma above bachelor level</i>		
	<i>9-Master's degree (M.A., M.Sc., M.Ed., MBA, MPA and equivalent)</i>		
	<i>10-Degree in medicine, dentistry, veterinary medicine, law, optometry or theology (M.D., D.D.S., D.M.D., D.V.M., LL.B., O.D., M.DIV.) or 1-year B.Ed. after another bachelor's degree</i>		
	<i>11-Earned doctorate</i>		
	<i>12-Industry certified training or certification courses</i>		
	<i>13-Other, specify</i>		

### 3.3.2 Human Capital's Cross-Domain Knowledge

Cross-domain knowledge is the knowledge that people have of a domain other than their main job domain. In this respect, WES provides information about training and courses taken by employees, including the number and type of courses or training sessions taken by the employees. To consider an employee as having cross-domain knowledge, I chose the employees that had courses or training in both computer-related and business-related topics. This operationalization capitalizes on a state where employees were exposed to knowledge in a different domain. It is similar to the common operationalizations of measuring IT managers' knowledge of business and business managers' knowledge of IT

(J. C. Henderson, 1990; Reich & Benbasat, 2000), but at the employee level. To identify instances of cross-domain knowledge from courses and training, these questions were used:

<i>Variable</i>	<i>Question</i>	<i>Questionnaire</i>	<i>Comment</i>	
<i>Cross-domain knowledge</i>	<i>25.b.i What was the main subject of the last course you completed?</i>	<i>Employee</i>	<i>Ratio (0-1) #employees with CDK divided by sample size</i>	
	<i>25.c.i What was the main subject of the second most recent course you completed?</i>			
	<i>25.d.i What were the main subjects of the on-the-job training? (Check all that apply.)</i>			
	<i>Note: All three questions above repeat for courses/training that was not paid for by the employer. The set of answers is the same and shown below.</i>			<i>Course numbers 2, 5, 9 and 10 were considered courses in business. Course numbers 6 and 7 were considered courses in IT. Employees with courses from both groups have CDK.</i>
	<i>1-Orientation for new employees</i>			
	<i>2-Managerial/supervisory training</i>			
	<i>3-Professional training</i>			
	<i>4-Apprenticeship training</i>			
	<i>5-Sales and marketing training</i>			
	<i>6-Computer hardware</i>			
	<i>7- Computer software</i>			
	<i>8-Other office or non-office equipment</i>			
	<i>9-Group decision-making or problem-solving</i>			
	<i>10-Team building, leadership, communication</i>			
	<i>11-Occupational health and safety, environmental protection</i>			
	<i>12-Literacy or numeracy</i>			
	<i>13-Other, specify</i>			

### **3.4 Organizational Characteristics**

Two organizational characteristics were argued to affect BVIT: organizational climate and organizational structure. Organizational characteristics variables were selected from the organizational-level questionnaire. The organizational climate is affected by an organization's degrees of professionalization, unionization and the presence of incentives, while structure is reflected by the degree of centralization and organicity.

#### **3.4.1 Organizational Climate**

Organizational climate is the policies and rules that create a certain work environment within the organization. In this research, organizational climate is measured through three variables: degree of unionization, degree of professionalization, and incentives. The degree of unionization of an organization is measured using a ratio of the number of unionized employees to total employees. Higher ratios mean more unionized organizations. Similar to the unionization measure, the degree of professionalization of a company is measured by the ratio of professionals to total employees (Bergeron, Raymond, & Rivard, 2004). Higher ratios mean a higher degree of professionalization.



Variable	Question	Questionnaire	Comment
Unionization	<i>1.c Of the total employment in March 2005, how many employees were covered by collective bargaining agreements at this location?</i>	Workplace	Ratio(0-1) 1.c/size
Professional-ization	<i>1.e Of the total of non-management employees not covered by a collective agreement, how many were in the following categories?  ... professionals ...</i>	Workplace	Ratio  (0-1)  [(1.e+1.f)/size]
	<i>1.f Of the total of non-management employees covered by a collective agreement, how many were in the following categories?  ... professionals ...</i>		
	<p><b>Professionals</b></p> <p>Employees whose duties would normally require at least an undergraduate university degree or the equivalent. Examples: medical doctors, lawyers, accountants, architects, engineers, economists, science professionals, psychologists, sociologists, registered nurses, marketing and market-research professionals, nurse-practitioners and teaching professionals. Include computing professionals whose duties would normally require a minimum of an undergraduate degree in computer science. Include professional project managers and supervisors not included in senior managers</p>		

Incentives provided to employees individually and in groups motivate employees and influence the ways they behave (Brock et al., 2005; Grojean et al., 2004). Having more incentives at an organization may translate into having higher employee motivation, whether to work harder or to engage the new information system. The scale below asks about five different individual and group incentive plans, and the number of incentive plans present at an organization will be used as the measure of incentives.

<i>Variable</i>	<i>Question</i>	<i>Questionnaire</i>	<i>Comment</i>
	<p>6.a Does your compensation system include the following incentives?</p> <ul style="list-style-type: none"> <li>• Individual incentive systems</li> <li>• Group incentive systems</li> <li>• Profit-sharing plan</li> <li>• Merit pay or skill-based pay</li> <li>• Employee stock plans</li> </ul>	Workplace	Number of incentive plans offered
	<p>1. "<b>Individual incentive systems</b>" such as bonuses, piece-rate and commissions are systems that reward individuals on the basis of individual output or performance.</p> <p>2. "<b>Group incentives systems</b>" such as productivity /quality gain-sharing are systems that reward individuals on the basis of group output or performance.</p> <p>3. "<b>Profit-sharing plan</b>" is any plan by which employees receive a share of the profits from the workplace.</p> <p>4. "<b>Merit pay or skill-based pay</b>" is a reward or honour given for superior qualities, great abilities or expertise that comes from training, practice, etc.</p> <p>5. "<b>Employee stock plans</b>" are employee stock purchase plans, ownership plans or stock options.</p>		

### 3.4.2 Organizational Structure

Organizational structure is also expected to affect the business value of IT (BVIT). Two characteristics of organizational structure are hypothesized and measured in this work: the degree of centralization and structure organicity. Centralization can be measured as a ratio of managers to total employees (Bergeron et al., 2004; Blau et al., 1966). Accordingly, the measure of centralization in this study is the ratio of managers to total employees. Lower ratios indicate more centralized organizations. The questions used for this variable are the following:

Variable	Question	Questionnaire	Comment
Size	<p><i>1.a In the last pay period of March 2005 and March 2004, how many employees receiving a T4 slip were employed at this location?</i></p> <p>A: _____ March 2005</p> <p>B: _____ March2004</p>	Workplace	<p>Ratio (0-1)</p> <p>Lower ratio means more centralization</p>
Centralization	<p><i>1.d. Of the total employment in March 2005, how many were in the following categories?</i></p> <p><i>Management:</i></p>		

The degree of structural organicity brings flexibility and is reflected through the presence of specialized teams and self-directed work groups and is characterized by participative

work designs (Thibodeaux & Faden, 1994). Accordingly, three items of WES will be used to measure the degree of organicity in a company. Those items derive from question 18 in the workplace level survey:

Variable	Question	Questionnaire	Comment
Organicity	18. For non-managerial employees, which of the following practices exist on a formal basis in your workplace? B. Flexible job design D. Problem-solving teams F. Self-directed work groups	Workplace	Number of items selected divided by 3. Ratio (0-1)
(Item explanation)	<b>Flexible job design:</b> Includes job rotation, job enrichment/redesign (broadened job definitions), job enrichment (increased skills, variety or autonomy of work). <b>Problem-solving teams:</b> Responsibilities of teams are limited to specific areas such as quality or work flow (i.e. narrower range of responsibilities than F). <b>Self-directed work groups:</b> Semi-autonomous work groups or mini-enterprise work groups that have a high level of responsibility for a wide range of decisions /issues.		

### 3.5 The Dependent Variable: Business Value of IT

The dependent variable (DV) in this study is represented by three factors that derive from a question in the workplace questionnaire that asks about the effects of the implemented IT on the performance of the firm. This question (and dependent variable) is well suited for this study, which researches the business value of IT. This DV presents “lower-than-

firm-level performance data” (Armstrong & Shimizu, 2007, p. 971), which is data that represents the effects of resources under research only. The use of the DV achieves three important goals in this study: 1) it shows the effects of a single resource (and its interactions) on the firm’s performance, which allows for researching the effects of that particular resource confidently; 2) it helps mitigate confounding problems by isolating the effects of this resource from the effects of other resources in the firm; and 3) it isolates the effects of this particular resource from effects of factors outside the firm. This question is answered by CEO’s or general managers, who are expected to have a more rounded and unbiased view of the effects of resources on company performance.

The question for the DV asks for the effects that the new implementation had on elements of input, market share, and overall outcomes. A factor analysis was conducted to verify the questions and extract factor scores. The factor analysis will be presented in the next chapter and the factors will be used as measures of BVIT. The question is shown below:

Variable	Question from the workplace questionnaire	Comment																																																																																										
BVIT	<table border="1"> <thead> <tr> <th colspan="5" data-bbox="342 352 1284 426">47. What effects has the implementation of the new technology with the largest cost had on the following factors?</th> </tr> <tr> <th data-bbox="342 457 727 531"><b>EFFECTS ON PRODUCTS AND PROCESSES</b></th> <th data-bbox="727 457 906 531">Not applicable</th> <th data-bbox="906 457 1036 531">Positive effect</th> <th data-bbox="1036 457 1141 531">No effect</th> <th data-bbox="1141 457 1284 531">Negative effect</th> </tr> </thead> <tbody> <tr> <td data-bbox="342 562 727 615">A. Profit margin</td> <td data-bbox="727 562 906 615" style="text-align: center;"><input type="radio"/></td> <td data-bbox="906 562 1036 615" style="text-align: center;"><input type="radio"/></td> <td data-bbox="1036 562 1141 615" style="text-align: center;"><input type="radio"/></td> <td data-bbox="1141 562 1284 615" style="text-align: center;"><input type="radio"/></td> </tr> <tr> <td data-bbox="342 625 727 678">B. Quality of products or services</td> <td data-bbox="727 625 906 678" style="text-align: center;"><input type="radio"/></td> <td data-bbox="906 625 1036 678" style="text-align: center;"><input type="radio"/></td> <td data-bbox="1036 625 1141 678" style="text-align: center;"><input type="radio"/></td> <td data-bbox="1141 625 1284 678" style="text-align: center;"><input type="radio"/></td> </tr> <tr> <td data-bbox="342 688 727 741">C. Technological capabilities</td> <td data-bbox="727 688 906 741" style="text-align: center;"><input type="radio"/></td> <td data-bbox="906 688 1036 741" style="text-align: center;"><input type="radio"/></td> <td data-bbox="1036 688 1141 741" style="text-align: center;"><input type="radio"/></td> <td data-bbox="1141 688 1284 741" style="text-align: center;"><input type="radio"/></td> </tr> <tr> <td data-bbox="342 751 727 804">D. 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Working conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	E. Lead times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	F. Range of products or services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<b>FACTORS OF PRODUCTION</b>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	G. Labour requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	H. Energy requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I. Capital requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	J. Material requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	K. 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Question 44 asks about IT implementation and was used to filter out companies that implemented other technologies not under study in this work. For analyzing question 47, shown above, companies that answered all 1s (“not applicable”) or did not answer this question were removed from the analysis. Other companies that had (“not applicable”) in their answer set, it was recoded as “missing.”

44 (b)	Most recent implementation	Second most recent implementation
A. When was the most recent implementation of new software or hardware	__ __ Month __ __ __ __ Year	__ __ Month __ __ __ __ Year
B. How many employees use this new software or hardware	__ __ __ __ __ __	__ __ __ __ __ __
C. What was the approximate cost of implementing this new software or hardware in this workplace?	\$__ __ __ __ __ __	\$__ __ __ __ __ __
D. How many employees received training directly related to this software or hardware?	__ __ __ __	__ __ __ __

As stated earlier, IS researchers have noted that IT does not affect the organizational outcomes on its own and that there are other organizational resources that interact with IT to affect outcomes. This thesis is in line with that research and has theoretically developed concepts and hypotheses based on this idea. When resources are complementary, they have a mutual effect on the outcome. Complementary resources interact and act like a single resource in the sense that they act together to affect outcomes. For example, and using the ensemble view of information systems adopted in this thesis, an IS does not impact an organization on its own, and the presence of human

capital affects that impact. Moreover, the organizational resources of structure and climate also affect the impact of IT. Thus, the dependent variable, business value of IT, reflects the impact of IT and its complementary resources.

### **3.6 Data Cleaning and Data Reduction**

The data cleaning process involved several steps (Figure 3.1). First, out of the 6,631 Canadian companies that answered the survey in 2005, companies that implemented new technology were 1,217 companies (over 18% of the companies). Out of this number, 107 companies had implemented new technology and answered the question about the effects of this technology by choosing “Not applicable” for all items. This might be due to the fact that the implementation was not finished or because it was too early to report results. Since the purpose of the study is to research the business value of IT (BVIT), and since those companies did not provide any usable data about BVIT, they were removed from the analyses related to BVIT. Those 107 companies were treated as non-responders and were analyzed separately to see whether they differed significantly from the set of responders. After that, out of the group that reported effects of new technology (i.e., 1,110 companies), companies with five or more respondents for the employee questionnaire were selected to be the main group under study. It was necessary to choose companies with five or more respondents because the data reduction process depends on procedures that manipulate this data to find a defining characteristic. These procedures seek averages or variation coefficients for studying the diversity of each sample; hence, having five or more data points is important for producing a valid aggregate measure that



can be used for analysis at the organizational level (Bliese& Halverson, 1998; Liao et al., 2004). For data cleaning, both SPSS and Excel were used.

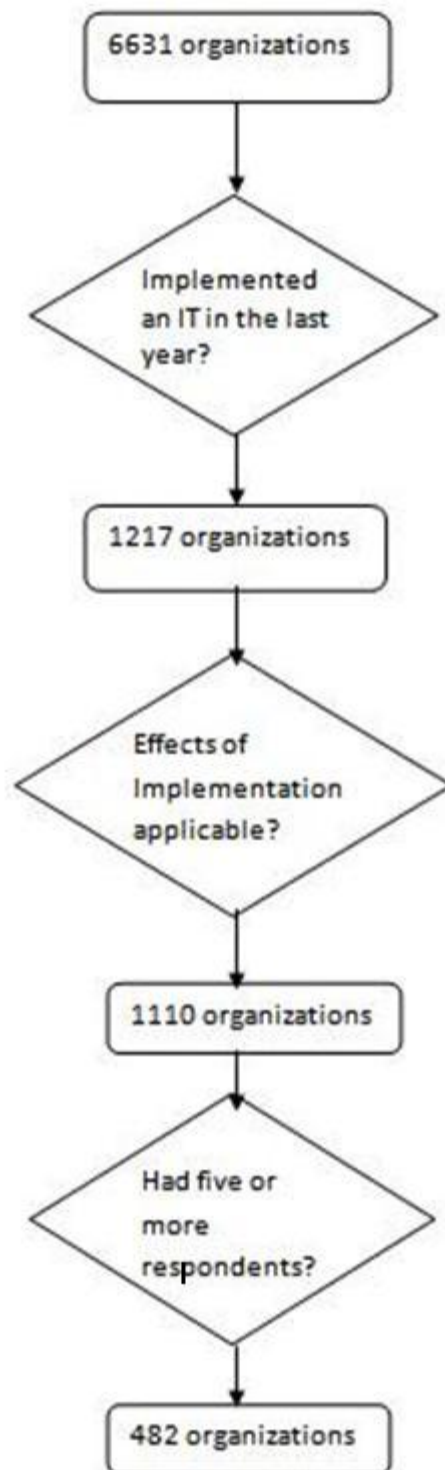


Figure 3.1: The Data Cleaning Process

### 3.7 Overview of Partial Least Squares

Partial Least Squares (PLS) is a regression method that combines features from principal component analysis and multiple regression (Abdi, 2003). This method is widely used in research studies as a structural equation modeling technique (Esteves, Casanovas, & Pastor, 2003; Thompson, Higgins, & Howell, 1991). PLS extracts factors of both predictors and predicted variables and follows an iterative process to produce weights and loadings (W. W. Chin, 1998; Tenenhaus, Vinzi, Chatelin, & Lauro, 2005). One advantage of PLS is that this method does not require that predicting variables be uncorrelated nor that they are normally distributed (Wynne W. Chin & Newsted, 1999), which means that, compared to other methods, PLS is more resistant to problems caused by skewness and multicollinearity<sup>3</sup> (Cassel, Hackl, & Westlund, 2000; Haenlein & Kaplan, 2004). According to the same authors, a further advantage comes from the fact that PLS makes no assumptions about the data. Similar to other SEM techniques, a PLS model can be thought of as consisting of a structural model (relationships between latent variables) and a measurement model (relationships between indicators and latent variables) (Haenlein & Kaplan, 2004).

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<sup>3</sup> Tests for skewness are addressed later in this chapter. Tests for multicollinearity included the following: 1) The independent variables in the study were tested for multicollinearity using SPSS. The highest VIF was below 1.7. 2) The independent variables and the controls were then tested for multicollinearity simultaneously. The industry dummy variables showed a VIF of 18. Removing one of the industry dummy variables brought the highest VIF down to 2; however, executing the PLS models with one or two dummy variables for industry produced similar results.

### 3.8 Data Processing before Analysis

Other than the characteristics of WES data mentioned before, this section will comment on procedures followed to prepare the data for analysis.

Question 47 (shown previously) displays four answer choices. A choice of “not applicable” is coded as “missing” because it does not provide information about the effects of the IT implementation. The other three answer choices are coded by Statistics Canada as 2 (increase), 3(no effect) and 4(decrease). These answers have been recoded as 1(increase), 0(no effect) and -1(decrease). This recoding was necessary in order to avoid introducing meaning that *decrease* (4) is twice of *increase* (2).

Descriptives of the sample of the 482 companies ready for analysis showed that the IT implementation cost of companies in this sample ranged from \$200 to \$12 million. To obtain a more consistent sample, the data set was trimmed at both ends removing companies with very low IT implementation cost (below \$5,000), and those with very high IT implementation cost (above \$1 million). The final sample size is 405 companies.<sup>4</sup>

Statistics Canada takes all care to remove outliers from the data on the basis that they may be used to identify the companies or individuals involved. With respect to the missing data, Statistics Canada provides a special code to identify these items. Missing

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<sup>4</sup> The results of tests of hypotheses are similar for both samples (405 and 482), except for CDK. The effects of CDK are diluted in the 482 sample.

data tests showed that they are random and not systematic – there were no significant differences in indicators of BVIT between groups of respondents that answered a question and those that did not. Ninety-four (23%) of the cases had missing data in one or more items. Dealing with missing data through deletion methods can lead to a loss of statistical power (Schafer & Olsen, 1998), and hence, missing data of a particular variable were replaced by the mean of that variable. According to Tabachnick and Fidell (2001), mean replacement is a conservative method for dealing with missing data.

Tests show that PLS is able to process skewed data correctly (Cassel et al., 2000), but it is not clear how much skew poses a problem. Tests on the data showed that diversity variables are slightly skewed, while organizational characteristics variables are moderately skewed. Cross-domain knowledge showed a high degree of skewness, with over 90% of the cases with a value of zero. For these reasons CDK was dichotomized into “0 = no CDK exists” and “1 = has at least some CDK.”

Following recent research that utilizes WES (Zeytinoglu, Cooke, Harry, & Chowhan, 2008), industry was coded into three major groups: primary industries, manufacturing and utilities, and services. These groups were coded using two binary dummy variables.

### 3.9 Data Descriptives

Although, as mentioned before, the Partial Least Squares analysis technique does not make any assumptions about the distribution of data, the following descriptive statistics are provided for completeness:

	Min.	Max.	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Age diversity	1.48	21.25	9.39	3.48	0.30	0.02	-0.14	0.04
Education diversity	16.67	100.00	63.18	18.01	0.01	0.02	-0.43	0.04
Gender diversity	0.00	100.00	49.80	31.12	0.11	0.02	-1.37	0.04
Cultural diversity	4.55	100.00	33.32	18.09	0.78	0.02	-0.52	0.04
Incentives	0.00	5.00	1.26	1.06	0.64	0.02	0.08	0.04
Degree of professionalization	0.00	94.00	12.60	18.69	1.83	0.02	2.84	0.04
Degree of unionization	0.00	100.00	23.71	37.93	1.10	0.02	-0.61	0.04
Degree of centralization	0.00	53.00	11.42	9.14	1.99	0.02	5.89	0.04
Structure organicity	0.00	6.00	1.96	1.69	0.53	0.02	-0.62	0.04
CDK	0.00	1.00	0.08	0.27	3.16	0.02	7.95	0.04

Table 3.1 Descriptive statistics of independent variables

### 3.10 Modeling BVIT

The independent variables in this work are measured through single items that reflect the characteristic of the variable under study. For example, age diversity is measured through standard deviation of the ages of employees. Although some variables may be grouped under a second order construct – diversity variables, for example, – a purpose of this work is to discover the separate effects of these variables. BVIT, on the other hand, is a second order construct that is of interest. This section will comment on the modeling of BVIT as a formative construct.

Petter et al. (Petter, Straub, & Rai, 2007) and later Coltman et al. (Coltman, Devinney, Midgley, & Venaik, 2008) reviewed the literature on formative and reflective constructs and noted the following: 1) Reflective constructs represent a latent variable that exists independently of the measures used, while a formative construct is a combination of its measures; 2) variation in a reflective construct causes variation in its measures, while this is not so for formative constructs; 3) adding or dropping items/indicators from reflective constructs does not change these constructs, while that may cause a change in the domain of a formative construct; 4) the items of a reflective construct have a common theme and have similar relationships with the antecedents and consequences of the construct, while this may not be true for the items of formative constructs; and 5) for formative constructs “internal consistency or reliability is unimportant because measures are examining

different facets of the construct” (Petter et al., 2007, p. 626), and convergent validity and discriminant validity tests do not apply well to formative constructs because “with formative constructs, there is no restriction on the magnitude of correlations between indicators, so there are no definitive rules on between- versus within-construct correlations” (Petter et al., 2007, p. 641).

There are 14 items representing the business value of IT (BVIT), all of which are factor analyzed (details in results chapter) to produce four measures of BVIT: profit margin, effects on products and processes, inputs, and market share. These four measures address different aspects of BVIT that may exist separately, and a change in one measure is not necessarily related to changes in others. Moreover, removing one of these measures – effect of IT on market share, for example – can limit the domain of the construct. Accordingly, and based on the above discussion, this construct is modeled as formative.

### **3.11 Conclusion**

This chapter has presented the data and the processes of variable measurement. It also presented an overview of Partial Least Squares, followed by an explanation of the reasons behind the choice of formative or reflective construct modeling for analysis. The next chapter will present the results of the necessary analyses.



## **Chapter 4**

### **Results and Discussion**

This chapter will present the analyses done, the results obtained, and discussions on the results where applicable. The analysis starts by obtaining general descriptives of the data and the organizations involved. After that, Partial Least Squares models are presented, followed by a discussion of the results.

#### **4.1 General Descriptives**

This part of the study is aimed at understanding the characteristics of the sample and attaining descriptives. Descriptives provide information about commonalities and ratios in the sample that might help in understanding why firms are implementing new technology or what factors may be related to technology implementation.

The analysis started with a large set of companies in the Statistics Canada WES 2005 databases. The workplace-level database included 6,631 companies, and the employee-level database included 24,197 employees. These are the respondents to the surveys.

As stated in Chapter 3, of the 1217 companies that reported implementing new IT, 107 respondents did not report any effects (by choosing the “Not applicable” option) and

1110 companies did. I used comparison of means of the two sets (Table 4.1). This test revealed that the two sets of companies are not significantly different on gross operating revenue and percentage of revenue change from last year, but they are significantly different on the cost of new IT implementation, organization age and number of employees in the organization.

Measure	Group	N	Mean	Standard Deviation	Test of variance	t	Sig. (p)
Revenue / Loss (\$ millions)	Reported Effects	1,110	37.6	158	Not equal	-1.303	.195
	Did not report	107	68.5	241			
Revenue change from last year (%)	Reported Effects	1,110	12.77	57.57	Not equal	-.952	.343
	Did not report	107	24.43	125.40			
Cost of implementation (\$ 1000)	Reported Effects	1,110	197	697	Not equal	2.518	.012
	Did not report	107	114	266			
Organization age (Years)	Reported Effects	1,110	35.5	30.19	Not equal	2.029	.044
	Did not report	107	29.9	26.9			
Number of employees	Reported Effects	1,110	288	933.3	Not equal	3.177	.002
	Did not report	107	160	301.1			

Table 4.1 Comparison of means for the two groups reporting/not reporting effects

The results show that those 107 companies have spent less money, on average, for implementing new IT, are relatively younger and have fewer employees. These results do not answer the “why” question; however, it is likely that these companies were in the middle of an implementation and could not report results just yet. Having spent less money may support that conclusion, since a completed implementation should cost more than one that is only 60% complete, for example. Moreover, the fact that this set of companies is not different from the others on revenue and on revenue change from last

year suggests that the alternative explanation of IT failure is not viable. In a case of IT implementation failure, the costs would have to be written down as expenses, which would affect the companies' reports of both the operating revenue and the revenue change from last year.

#### **4.1.1 Factors of the Dependent Variable**

The dependent variable used in this thesis comes from Question 47 in the workplace survey. Question 47 asks about the effects of technology implementation on many variables of the organization in the following manner:

Respondents answering “Not applicable” on all items were excluded from the data set, as explained in Chapter 3. There were 298 cases (73%) with missing values in one or more of the 14 variables. Missing values in a variable were replaced by the mean of that variable.<sup>5</sup> The 14 relevant variables about which the question asks were grouped into three categories in the survey: Overall Effects, Factors of Production, and Market Shares. Factor analysis was performed on these variables to see whether the business value of IT is a multidimensional construct.

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<sup>5</sup> In a separate test, cases with more than half the values missing were dropped from the analysis. The results were similar.

47. What effects has the implementation of the new technology with the largest cost had on the following factors?				
<b>EFFECTS ON PRODUCTS AND PROCESSES</b>	Not applicable	Positive effect	No effect	Negative effect
A. Profit margin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B. Quality of products or services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C. Technological capabilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D. Working conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E. Lead times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
F. Range of products or services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>FACTORS OF PRODUCTION</b>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
G. Labour requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
H. Energy requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I. Capital requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
J. Material requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
K. Design costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>MARKET SHARES</b>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
L. Shares in local market	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
M. Shares in regional or national markets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
N. Shares in foreign markets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Profit Margin was removed in order to be analyzed separately because it is a measure of a final result. Then, a factor analysis on the dependent variable items was performed with principal components analysis as the extraction method and with a Varimax rotation. The table below shows the results with item-loadings below 0.3 suppressed. One item was removed from the analysis (crossed out in the table). Labour Requirements loads with almost the same value on two factors, with both values being moderate. Hence, it was removed. The three resulting factors were named Effects on Products and Processes (Items: Quality of products or services, Technological Capabilities, Working Conditions, Lead times, and Range of products or Services); Inputs (Items: Energy requirements, Capital requirements, Material requirements, Design costs); and Market Share (Items: Shares in local market, Shares in regional or national markets, Shares in foreign markets). The factor scores created by SPSS together with profit margin are used as formative indicators leading to BVIT.

	Effects on Products and Processes	Market Share	Inputs
Effect Of Implementation: Quality Of Products Or Services	.797		
Effect Of Implementation: Technological Capabilities	.763		
Effect Of Implementation: Working Conditions	.719		
Effect Of Implementation: Lead Times	.725		
Effect Of Implementation: Range Of Products/Services	.710	.411	
Effect Of Implementation: Labour Requirements	<del>.385</del>		.407
Effect Of Implementation: Energy Requirements			.731
Effect Of Implementation: Capital Requirements			.764
Effect Of Implementation: Material Requirements			.781
Effect Of Implementation: Design Costs			.765
Effect Of Implementation: Shares In Local Market		.874	
Effect Of Implementation: Shares In National Market		.948	
Effect Of Implementation: Shares Foreign Markets		.911	

Table 4.2 Factor analysis of the items in the dependent variable scale

#### 4.2 Partial Least Squares Model

The Partial Least Squares model is developed using the PLS Path Modeling module of XLSTAT. The model tests the relations hypothesized in Chapter 2, where independent variables are measured with one-item measures and BVIT is a formative construct with four indicators: Profit Margin, Effects on Products and Processes, Inputs, and Market Share.

#### 4.2.1 Testing the Model<sup>6</sup>

To test the effects hypothesized in Chapter 2, a Partial Least Squares model was developed and executed using XLSTAT utilities. For testing significance, the Jackknife method was used. The results are shown in Figure 4.1. First, the model was analyzed without using control variables. In this case, the model explained 22.6% ( $R^2$ ) of the variance. After that, the full model was tested with control variables.  $R^2$  changed to 26.3%. The results in the figure were obtained when the control variables were included in the model. These control variables were removed from the figure for clarity. Except for training expense, all controls included were significant at the 0.05 level.

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<sup>6</sup> The 107 companies that were removed from the sample earlier for answering 'Not applicable' to all items related to the dependent variable were processed and added to the sample with the values of the items recorded as "missing." The results were similar in significance and direction to those shown below.

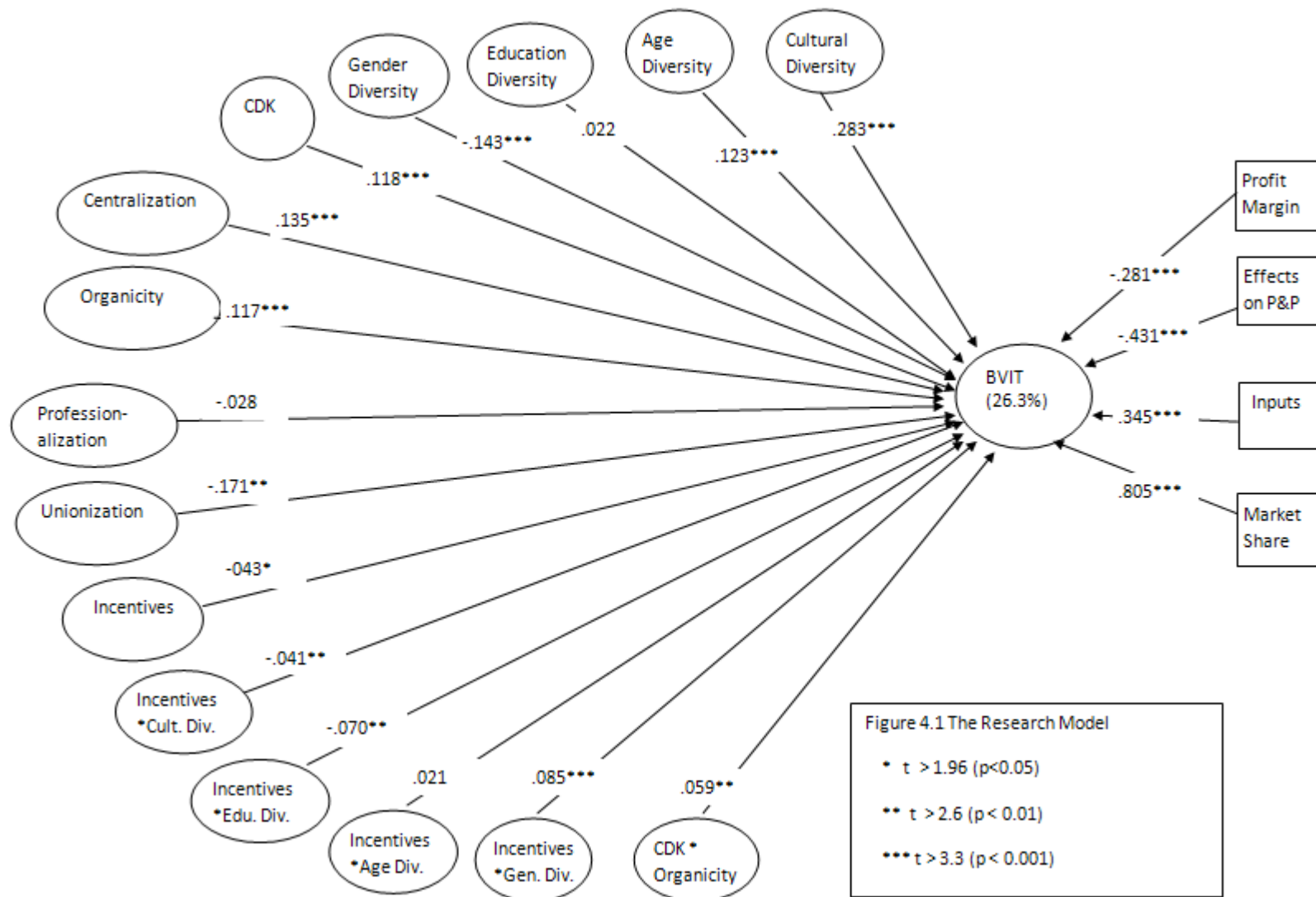


Figure 4.1 The Research Model

- \* t > 1.96 (p < 0.05)
- \*\* t > 2.6 (p < 0.01)
- \*\*\* t > 3.3 (p < 0.001)



#### 4.2.2 Assessing the Model

For the measurement model, as mentioned in the discussion about formative and reflective constructs, internal consistency (composite reliability), convergent validity, and discriminant validity are not assessed statistically for formative constructs (Gotz, Liehr-Gobbers, & Krafft, 2010). The significance of the weights of indicators leading to formative constructs represents the significance of the item measures. All items forming the BVIT construct are highly significant.

Some researchers maintain that, for formative constructs, composite reliability can be assessed through testing for multicollinearity where the guideline is that the variance inflation factor (VIF) should be below 3.3 (Petter et al., 2007). In general, multicollinearity between formative indicators is a problem that may lead to estimation errors and insignificant results since the influence of each indicator cannot be distinctly determined (Diamantopoulos & Siguaaw, 2006). This result occurs because collinear indicators contribute similar information. At the same time, removing one of the formative indicators to reduce multicollinearity could change the domain of a formative construct, which in turn would affect its content validity since the different indicators tap into different aspects of the construct (Petter et al., 2007). The measures of BVIT were tested for multicollinearity using SPSS, and the results show that VIF of these measures is below 1.3, meaning that multicollinearity is not a problem for this formative construct. Cenfetelli and Bassellier (2009) suggest providing the correlations and loadings of the formative indicators,

even when collinearity is not a threat. The relevant correlations and loadings are shown in Table 4.3.

	Profit Margin	Effects on Products and Processes	Inputs	Market Share
Correlation with Profit Margin	1	.400	.354	.269
Correlation with Effects on P&P	.400	1	.068	.035
Correlation with Inputs	.354	.068	1	.108
Correlation with Market Share	.269	.035	.108	1
Loading on BVIT	.112	-.455	.459	.836
Weights on BVIT	-.281	-.431	.345	.805

Table 4.3 Correlations, Loadings and weights of formative indicators

To assess the structural model, the Jackknife<sup>7</sup> technique was used to produce t-test values for the path coefficients. The significance of each path is shown in the model with the corresponding standardized path coefficient.

A negative weight of a formative indicator is the result of the pattern of correlations between the indicators (Cenfetelli and Bassellier, 2009). And according to Cenfetelli and Bassellier (2009), when a formative indicator has a negative weight and a negative loading, then that condition is equivalent to the indicator being reverse coded (Note 5, p. 696). However, the Effects on Products and Processes indicator is coded in the same manner as the other indicators, and the negative loading of Effects on Products and Processes on BVIT is surprising. One possible explanation is that, theoretically, the formative indicators do not have to behave in the same way and may be affected differently by the same antecedents (Cadogan, Souchon, & Procter, 2008). Thus, this set of antecedents may be leading to a negative effect on products and processes.

### **4.2.3 Explaining the results**

As Figure 4.1 shows, the model explains 26.3 % of the variance in the business value of IT (BVIT). The obtained results are discussed below.

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<sup>7</sup> Jackknife is more commonly used for complex survey designs (Heeringa, West, & Berglund, 2010; E. S. Lee & Forthofer, 2006)

Results show that aspects of diversity – namely, cultural diversity and age diversity – are positively related to BVIT as hypothesized. Diversity brings added skill and knowledge to the organization, which in turn enriches the human capital and leads to a positive impact on BVIT. The experiences that diverse people have and their various approaches and perspectives enrich the human capital of a firm, and that condition is expected to affect BVIT positively. Age diversity ( $b=.123$ ) and cultural diversity ( $b=.283$ ) have positive effects on BVIT. At least some level of age diversity is almost certain to exist in organizations, thereby giving all organizations the chance to learn how to benefit from this type of diversity. Cultural diversity has been extensively addressed in diversity research and in several other research areas as well, possibly providing managers with the knowledge and skill required to deal with both types of diversity and to benefit from the collection of skills and knowledge brought by these two types of diversity.

Other aspects of diversity were not found to be positively related to BVIT. Results show that educational diversity is not significantly related to BVIT ( $b=.022$ ) in the presence of moderated effects.<sup>8</sup> As well, gender diversity was found to be negatively related to BVIT. Gender diversity in organizations has been less well addressed than cultural diversity, especially in areas outside diversity research. Gender diversity was hypothesized to have a positive relation with BVIT because having both genders in an organization has been shown to increase the skill and perspective pool available, which is expected to reflect positively on BVIT. However, results

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<sup>8</sup> Educational diversity loses its significance when the moderated effect “Incentive  $\times$  educational diversity” is introduced.

show a negative ( $b = -.143$ ) path coefficient. Since multicollinearity is not a problem, as stated earlier (previous footnote, VIF of independent variables is below 2), and organizational characteristics (example: industry) have been controlled for, one explanation for the results is that men and women use information systems differently (Gefen and Straub, 1997), which may affect the conformity to one standard in the organization or affect the electronic work processes between the two genders. Another explanation is that a mediator may be in effect. For example, demography theory suggests that there is a positive relationship between gender diversity and turnover (Ali, Metz, & Kulik, 2010; C. Lee & Farh, 2004), thereby suggesting a mediating effect of turnover. As gender diversity increases, turnover increases, and the new employees need time to learn how to use the IT system effectively, all of which may negatively affect BVIT.

While diversity adds to the human capital and can affect BVIT positively, the results may simply mean that more work needs to be done on integrating the various employees in an organization especially for benefiting from gender diversity.

The second hypothesis concerns the impact of cross-domain knowledge (CDK) on BVIT. In this work, CDK is measured as a binary variable: companies either have CDK or they do not. CDK lowers communication barriers between employees and increases the common understanding of a given situation. CDK is hypothesized to increase the business value of IT, and the results provide support to this hypothesis ( $b = .118$ ). This outcome shows that companies with at least some level of CDK can earn more value from their IT. These results, together with those of the

diversity variables, provide support for the idea that human capital interacts with the IT resource, and that interaction leads to an impact on the business value of IT.

Hypothesis 4a predicted a relation between the degree of centralization (ratio of managers to non-managers) in a firm and the business value of IT. Centralization has been shown in previous research to be negatively associated with initiation, adoption and implementation of information systems (Grover & Goslar, 1993). Contrary to previous findings, results show that centralization is positively related to BVIT ( $b=.135$ ). The path coefficient is positive, which means that centralization may add to the value extracted from the IT resource. Centralization brings uniformity of processes, rules and behavior, and these may affect the business value of IT positively.

The fourth hypothesis concerns the other structural variable used in this study: organicity. The degree of organicity was hypothesized to impact BVIT. Organicity creates complexity in the structure of the organization, leading to a more complex information system that is difficult to use, or leading to having several systems that are difficult to maintain and interface. Organicity was found to be positively associated with BVIT ( $b=.117$ ). The measure of organicity reflects the presence of self-directed groups, flexible job design and problem-solving teams. All these resources add complexity to the structure of an organization, and the obtained positive effect may be the result of a hidden moderator. For example, information-sharing among organizational members stands as a characteristic of organic organizations (Thibodeaux & Faden, 1994). This characteristic may be able to moderate the expected negative effects of organicity on

BVIT. This can happen through arming the specialized teams with the information needed to solve IT-related problems. Moreover, information-sharing during IT implementation may ensure that the implemented system meets organizational members' needs, thereby allowing them to proceed with their work in a productive manner. Accordingly, this potential moderator may cause the relationship between organicity and BVIT to appear positive.

Incentives were expected to be positively related to the business value of IT (BVIT). Incentives increase employees' motivation to comply with rules and procedures and to work harder to achieve a goal. The measure of incentives in this work is the number of incentive plans used, and results show that it is negatively related to BVIT ( $b = -.043$ ). This result was unexpected. Further investigation into the literature on incentives showed that the presence of "too many" incentive plans can actually have a reverse effect on the employees and the organization (Rubinfeld & David, 2006). Rubinfeld and David (2006) noted that "in the absence of careful coordination in design and implementation, multiple incentive plans can actually reduce employees' motivation to perform" (p. 35). Accordingly, a separate investigation into different incentive plans and their moderating effects took place, and the results of this search are presented in Appendix A.

The degree of professionalization in an organization, which is the ratio of professionals to total employees, was hypothesized to be related to the business value of IT. Professionals are usually more able than non-professionals to use technology to achieve their tasks, and there is a dedicated technology (software) for almost every profession. Results show that the degree of

professionalization is not significantly related ( $b=-.028$ ) to the business value of IT. One explanation is that although IT might help professionals in their work, some professionals actually resist technology. For example, nurses and doctors have occasionally been found to resist technology leading to system failure and negative economic consequences (Lapointe & Rivard, 2006; Timmons, 2003). Another explanation is that some professionals might not be actively involved with technology, as the organization's IT staff may handle the firm's technology-related tasks. These occurrences can lead to an insignificant relationship between the degree of professionalization and BVIT.

The degree of unionization was hypothesized to have a negative effect on BVIT. The measure of the degree of unionization of a firm is the number of unionized employees to the total number of employees. Unions may sometimes work to prevent certain parts of an information system from being installed (Melville et al., 2004). Information systems process data quickly and are more efficient than human labour. Thus, some information systems may replace certain workers and unions interfere to protect workers' rights and prevent parts of the information system from being implemented. This situation leads to a negative impact on the organization, showing support for the unionization hypothesis ( $b=-.171$ ).

In terms of the moderated effects, results show that cross-domain knowledge positively moderates the effects of organicity ( $b=.059$ ). Thus, hypothesis 5e is supported. With respect to the other hypotheses predicting a moderating effect of incentives on diversity dimensions, the



results are mixed. Incentives positively moderate gender diversity, do not moderate age diversity, and negatively moderate cultural diversity and educational diversity. These results were unexpected; therefore, a look at the individual incentive plans followed. The incentives literature is not clear on which plan is expected to moderate what relations in an organization. Further investigation showed that different incentive plans moderate diversity variables differently. This investigation is presented in Appendix A.

### **4.3 Discussion of Hypothesis-Testing Results**

The results show that various dimensions of diversity interact with the information system and may enhance or suppress its business value. From a human-capital perspective, diversity dimensions are expected to enhance the business value of IT in every situation, although the negative effect of some diversity dimensions is not always easy to overcome. For managers, this means that more effort has to be devoted to managing diversity and integrating the separate elements of the company's skill and knowledge pool. The results clearly show that the other dimension of human capital, – cross-domain knowledge – interacts with information systems and is positively related to the business value of IT. For managers, this result means that in order to gain higher business value from IT, it is necessary to increase the amount of cross-domain knowledge in an organization.

Results also show that certain characteristics of organizational structure and climate interact with the information system and affect the business value of IT. Not all the aspects of structure and

climate were investigated, but the results are promising. Although it might not be easy to change the structure of an organization, it is relatively easier to change certain policies and incentive plans to encourage more interaction with the information system.

The overall results of this work are encouraging. Although some hypotheses were not supported, the results show a significant interaction between human-capital characteristics and the information system, a significant interaction between organizational characteristics and the information system, and significant moderation effects between human capital and organizational characteristics.

These are very promising results that can explain a substantial amount of variation in the business value of IT. With businesses spending large sums of money on acquiring IT (Pinsonneault & Rivard, 1998), it becomes highly important for firms to gain a clear understanding of the different factors involved in the creation of business value from new technology. Moreover, this work has also showed that other resources in the firm impact BVIT. Results from previous work about the business value of IT were not consistent (Dewett & Jones, 2001), a fact that served as one of the motivations behind this study. Researchers had suspected that complementary resources are behind the inconsistent results obtained from research on business value (Bharadwaj, 2000). The results of this study confirm that potentially complementary resources play a role in the creation of business value from IT. Another motivation behind this study was the high percentage of failures in the implementation of new IT (Shoniregun, 2004), which adversely affects the business and reflects negatively on information systems in general. This work has shown that IT business value creation is dependent on other

resources in the firm that are unrelated to IT, and hence, failing to extract business value from an IT application is not necessarily a technical failure within IT. The implications of these findings for research and practice are many, and these will be discussed in the coming chapter.

#### **4.4 Conclusion**

The analyses in this chapter show that the concepts of human capital and organizational characteristics interact with the information system to affect its impacts on costs and performance of organizations. The different variables used to represent human capital – namely, diversity and CDK – and the variables used to represent organizational characteristics, namely climate and structure, have showed significant relationships with the business value of IT. These variables have also showed great promise for future research.

The next chapter will comment on what these results mean for this line of research and elaborate on the contributions of this work.

## Chapter 5

### Discussion and Conclusions

This thesis has researched the impact of human capital and organizational characteristics on the business value of IT (BVIT). The need for this work stems from the fact that information systems are very costly, and failing to achieve the desired organizational impact of the IS resource can lead to eroded competitive advantage. Another need for this work stems from the IS literature itself. The literature has presented contradictory findings of the business value of information systems and has not addressed the impact of other resources on BVIT.

The challenge of understanding the business value of IT is not an easy one. BVIT has been researched for the last 30 years, yet the results of that research are still not clear (Dale Stoel & Muhanna, 2009). We still do not know how and why information systems impact organizations. Previous research has shown that information systems enhance the efficiency of processes, which may lead to faster and less costly production. The same research has also pointed to the existence of complementary resources that affect the use and benefit of IS in organizations. This study researches two of these potentially complementary resources – human capital and organizational characteristics – drawing on previous research findings in the IS field and elsewhere. In doing so, this study aids in clarifying how and why information systems impact organizations. The current study shows that human capital characteristics and organizational characteristics both have the power to affect the business value of IT.

As stated earlier, previous research used IT characteristics as independent variables in an attempt to understand the factors affecting the business value of IT. To test the validity of this approach, the indicators of BVIT were regressed separately against the cost of IT implementation. The results were not significant and are similar to the findings of Harris and Katz (1991) and others that found weak relationships or no relationships between IT variables and firm outcomes. However, when the cost of IT implementation was used as an independent variable in the PLS model with the potentially complementary resources, it showed a positive and significant relationship with BVIT. This outcome shows that the results of analyzing IT variables separately against BVIT (or firm performance) may be misleading and may be the cause of the mixed findings in the literature, as Powell and Dent-Micallef (1997) suggested. It also shows that including other variables is necessary in order to provide context for analysis.

## **5.1 Contributions**

This work developed the concept of human capital in IS and researched the concept of organizational characteristics. Certain aspects of human capital and organizational characteristics have been tied to IT assimilation and use, but the existing IS literature did not focus on either of these concepts in the way they are presented here. Accordingly, this work brings many contributions to the literature and to the field, which are related to the two independent variables used – human capital and organizational characteristics – and to the study in general.

### **5.1.1 Contributions Related to Human Capital**

In this work, there are several contributions that relate to human capital and its characteristics. One contribution is that this research synthesizes and develops the scattered work on elements of human capital, thus enriching the IS literature with regards to this concept. Factors related to human capital, such as training and shared IT knowledge, have been researched in the IS literature under adoption, implementation or other areas. This work puts forward the concept in a clear way by synthesizing the literature and developing it further, using theory from the literatures on employee diversity and shared knowledge. By synthesizing the knowledge accumulated in the various parts of the literature that relate to this concept, it becomes easier to suggest relations and research them. Moreover, this work stresses the importance of the impact of human capital on the business value of IT (BVIT). With the developments made to the human capital construct, studying its interaction with organizational characteristics is a new idea. In addition, while diversity has been addressed in the organizational behaviour literature, and common knowledge has been addressed in the knowledge management literature, this work is the first to group the two together as characteristics of human capital, thus adding to the literature on human capital. Combining these two concepts enlarges the notion of human capital, thereby allowing for a more encompassing conceptualization and a broader understanding of its reach.

This work may have implications for the literature on cross-domain knowledge. Although shared knowledge has been addressed in the IS literature before, this work is the first to consider cross-domain knowledge as a superset of shared-domain knowledge. Cross-domain knowledge does

not have to be common between parties. This research is also the first to consider cross-domain knowledge as a characteristic of human capital. Cross-domain knowledge between top management team members and between CEO and CIO has been addressed before, but researchers have mostly neglected the importance of shared knowledge between employees. This study addresses this gap and researches the effects of cross-domain knowledge, whether shared or not, between IT employees and business employees. The findings show that cross-domain knowledge positively affects the business value of IT.

This work may also have implications for the literature on employee diversity. Most IS-culture research studies have focused on differences between national cultures and “treat [organizational] culture as being homogeneous and do not specifically address the potential for competing values among organizational subgroups” (Leidner & Kayworth, 2006, p. 379). The current study answers the concerns of Leidner and Kayworth by addressing the cultural diversity of employees within organizations, and in doing so has uncovered the fact that cultural diversity is positively related to the business value of IT. Moreover, studies of the diversity of employees are limited in the IS literature. This work synthesizes the IS literature on elements of diversity and expands the concept further as a characteristic of human capital, bringing forward the issues of age diversity, educational diversity and gender diversity in addition to cultural diversity.

### **5.1.2 Contributions Related to Organizational Characteristics**

While researching aspects of human resources, Powell and Dent-Micallef (1997) established that open communication and organizational consensus are important for IS impact. The current work has established that incentive plans and the degree of unionization affect the business value of IT (BVIT). When combined, these variables imply that organizational climate is an important concept when considering BVIT. Building on these findings, future work can address this concept in a more profound manner (e.g.,: friendliness, tolerance, etc.) to research its relation to BVIT.

Previous work has addressed climate and structure separately and has shown that these conditions may affect technology adoption and/or implementation. However, that work is scattered and, to the best of my knowledge, this is the first IS study that tests these elements simultaneously in order to study their effects of BVIT. Simultaneously testing these elements allows for researching the unique effects of one while controlling for the other and provides a richer context for the research.

This research uses RBV to research organizational climate and organizational structure. In doing so, this study becomes one of the first IS studies to consider these organizational characteristics as resources of the organization for attainment of competitive advantage. Climate and structure have been addressed before as resources in the strategy literature, but the IS literature has not yet paid them enough attention. The results in this work show that the elements of organizational



structure and climate are important influencers on the effects of IT in general and provide evidence that these elements are significantly related to the business value of IT.

### **5.1.3 General Study Contributions**

This work has also established that while IT does not directly impact performance, IS relates significantly to performance. A given organization's package of resources seems to interact with IS in order to impact the organization. The encouraging results are also a call to explore more resources of the organization – or more characteristics of the resources explored, as suggested earlier – and test their complementarity with IS. All firms possess a variety of resources, and I expect that other resources that are complementary to IS and could therefore affect its impact do exist.

The previous works of Bharadwaj (2000) and Melville et al. (2004) have suggested that complementary resources that interact with IS are responsible for the effects of IS on organizations. Powell and Dent-Micallef (1997) made a similar proposal and are the only ones to have provided empirical evidence of complementarity of resources with IS in the retail industry.

The results of Powell and Dent-Micallef's (1997) work show that business resource variables do not have a significant effect on IS business value in the presence of human capital variables. The current work, which addresses variables not addressed before, shows that some organizational

characteristics are significant, even in the presence of human capital variables. For example, centralization and organicity are positively related to BVIT, even after including cross-domain knowledge and diversity variables in the model. This finding makes an important addition to the literature because it shows that we must continue to discover the effects of resources on BVIT through addressing more variables related to these resources. Diversity and CDK were not addressed by Powell and Dent-Micallef (1997), and my results show that they do have a role to play. Hence, the fact that CDK is found to be positively related to BVIT, as identified in this study, can serve as a concept to help guide future research.

This work brings out the factors and elements that interact with IS and in turn lead to a positive impact on organizations. There are several organizational characteristics (such as structural organicity and the degree of unionization) and several human capital characteristics (such as cultural diversity, gender diversity and cross-domain knowledge) that are investigated at the same time. The results show that these elements are important for research and that their interaction also has an effect on BVIT. These findings can help researchers and managers focus on the elements that are more effective in increasing the business value of IT.

In general, the results of this study help to explain the conflicts in much of the previous research. The presence of complementary resources and the type of interaction that these resources may have with IS is likely to affect the impact of information systems. This work also clarifies the nature of relations and antecedents to BVIT. Moreover, it supports the ensemble view of

information systems and shows that human capital and organizational resources work together with an IS to produce value.

The next section will address the limitations of this work, and the following sections will comment on how this study can affect future research and practice in addition to the contributions it provides.

## **5.2 Limitations**

The most significant limitation in this study stems from the variables or questionnaire used. One aspect of this limitation is that the dependent variable is measured by three points, which lowers the amount of precision that can be derived from the data. However, gaining access to the data and utilizing WES has its advantages, such as having more variables about organizations and employees and having a national-level survey; at the same time, precision is not a high priority in this exploratory research. Another aspect of this limitation is that there are several other questionnaires and measures for almost all the variables in this study. Organizational climate and structure and human capital diversity and shared-domain knowledge (the originating literature of cross-domain knowledge) are all concepts that have been researched before. Many researchers developed their own measures for these concepts and accordingly, other measures may be more accurate than the ones used in this study. However, it is unlikely that there exists a survey that measures all the required elements while at the same time providing the reliability and depth of data in the way that WES does.

Another limitation may stem from the fact that the data is five years old. As technology changes, its business effects may change as well. However, this research does not address any specific technology and uses more enduring concepts and relations between variables, such as the effects of diversity on BVIT. In addition, there has been no radical shift in business information systems in the last five years. Accordingly, the age of the data represents no real threat.

A third limitation to this study stems from the ability to draw causal conclusions. There are two main points that limit our ability to state causality. First, independent and dependent variables are both measured at the same time, and thus, it is difficult to prove temporal precedence or directional causality. Second, to show causality, there should be an expectation of that causality in the literature in addition to statistical findings. Although this thesis has developed the hypotheses for causality, the existing literature lacks such propositions.

Some researchers argue that the effects of IT on a firm may lag a year or two behind the implementation. Accordingly, those researchers may argue that studying BVIT at the end of the same year as the implementation is a limitation of this study. Part 1 of this study identified a group of companies that had not seen any effects of the IT implementation. This group was isolated and removed from the sample. Accordingly, the related risk is reduced. Moreover, the risks involved in researching lag times are huge. First, relating firm performance to the IT resource, even in a single year, confounds the effects of other resources on performance, and these confounding problems are hard to mitigate. If we consider several resources changing

several times a year over several years, then the amount of change in resources is great, which casts doubt on any time-lag study results. Second, if an IT-related dependent variable is found, as in this study, then it would be difficult to isolate the effect of a particular IT from the other installed systems after the passage of several years. Accordingly, by choosing the dependent variable in this study and by limiting the analysis to one year, this work avoids the shortcomings of lag-time research.

### **5.3 Implications for Research, Future Directions**

This work has addressed the impact of resources on the business value of IT. More specifically, this work has explored the impact of human capital and organizational characteristics on the outcomes of an IS resource in an organization. This section comments on the implications of these results in terms of future research.

This study and its findings have several implications for research. First, by showing that potentially IT-complementary resources affect BVIT, two new research questions are created: 1) What resources interact with IT? and 2) What can be done to enhance the effect of these resources on BVIT?

Second, diversity affects the company and “brings substantial potential benefits, such as better decision-making, greater creativity and innovation” simply by its delivery of different beliefs and different perspectives into the workplace. Surprisingly, this important topic has been largely neglected in the IS implementation literature, which means that this study marks the first to examine the effects of diversity on BVIT. Accordingly, there is a need for more research on cultural differences within the same organization in order to examine this phenomenon in a new way. A specific combination of employees may prove to be more beneficial than others because of the interaction their amalgamation provides with IS.

Third, cross-domain knowledge is the information that pertains to a specific field (domain) that has been acquired by individuals in another field or domain. This is an important topic, and it has been addressed before at the CIO and top management team level by IS researchers, especially because the effects of shared-domain knowledge at this level have been found to be positive. Davis et al. researched the effects of “joint IT competence” or users’ IT competence, which is a form of shared IT knowledge, and found that it affects user satisfaction. Future research can address the specific types of knowledge that are important. Questions about the necessity of having cross-domain knowledge of computer hardware or programming, for example, may be answered. Moreover, in this work, CDK was measured dichotomously, and future research can attain a continuous measure of the level of CDK to discover how that is related to BVIT.

A fourth opportunity for research lies in identifying the organizational processes that enhance human-capital knowledge and skills, such as social events that allow for the cross-pollination of ideas and perspectives in diverse groups. Another possibility concerns the enacting of policies or procedures that increase the positive effects of human capital characteristics or decrease possible negative effects. For example, increasing the degree of formalization in a company may decrease any negative effects of diversity, such as the negative effect of gender diversity, because all employees are forced to follow prevailing rules and procedures. In addition, other characteristics of organizational climate can be researched. For example, one can research the interaction of friendliness and tolerance, which are characteristics of the organizational climate, with diversity and their effects on BVIT.

Fifth, a study is needed that combines IT variables with complementary variables and then investigates their interaction. While the current study researched the effects of potentially complementary variables on BVIT, a more detailed future study should contain several dimensions of BVIT similar to the ones investigated here, especially that one of the indicators of BVIT behaved differently from the others. After showing that potentially complementary resources are important in this current study, it would be interesting to discover whether IT variables may be negatively related to BVIT at a time where the interaction of those IT variables with complementary resources could be positively related to BVIT.

## 5.4 Implications for Practice

One of the motivations behind this work concerns itself with the immense cost of IT implementation and the necessity to achieve a positive impact on the organization.

In this work, I synthesize and develop the literature about the effects of diversity at the workplace on BVIT from a human capital perspective. More specifically, this study researches the effects of age, gender, educational diversity and cultural diversity on IT implementation effectiveness. Based on this research, managers can attain some insight and foresight into the types of interactions that will occur between employees and IT and the effects of those interactions on BVIT. If management can predict the response, then they may be able to maneuver around the problems in order to encourage the kinds of responses they need. This finding has implications for IS implementation planning.

Clarifying the link between cross-domain knowledge and BVIT may have a significant effect on training programs and IT implementation processes. CDK is one of the controllable factors in an organization, as it relates to cross-training and education, something that organizations can provide. The existence of cross-domain knowledge between business and IT may lead to more successful cooperation since CDK helps organizational members to understand each other (Hoopes & Postrel, 1999); CDK can also enhance a group's efficiency since it is essential for communication (Cohen & Levinthal, 1990). Hence, increasing business employees' knowledge of IT and, at the same time, increasing IT employees' knowledge of business processes allows



for better communication between the two groups, as well as decreases the potential for conflict and increases cooperation and efficiency. Accordingly, managers can make good use of the methods that expand employees' knowledge of the organization and its resources in areas such as training, job rotation and others. Thus, a third implication of this research applies to job design and training.

## **5.5 Conclusion**

This study researches the business value of IT. Information systems do not impact organizations on their own; rather, potentially complementary resources exist that interact with IS in order to produce value. This study researches two of these potentially complementary resources, namely, human capital and organizational characteristics.

This research delivers many contributions to the literature in terms of the business value of IT within organizations, as well as to the field of information systems as a whole and to the methods of research.

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## Appendix A

### Effects of Incentive Plans

The variable used to measure incentives in this work is the number of incentive plans, as discussed in Chapter 3. This variable was expected to be positively related to BVIT; however, our results show that this variable is negatively related to BVIT. The explanation of this result, found in the incentives literature, is that too many incentive plans can have an adverse effect on an organization (Rubinfeld & David, 2006). Accordingly, the variable was decomposed into its components, and the various incentive plans were tested separately. The results of the effects of the various incentive plans are mixed, as shown below, and the incentives literature is not clear on which plan is expected to moderate what variables. The product indicator approach (see Appendix B) was used for measuring the interaction effects.

Replacing the “number of incentives” variable by the five incentive plans produces paths with different signs leading into BVIT:

Path	Stock Plans	Group Incentives	Profit Sharing	Merit based incentives	Individual incentives
BVIT	+	-	-	0	+

The use of different incentive plans as moderators in the full model produced mixed results as well. The various effects of the moderation are shown below, along with the increase in R-square after the introduction of the moderated terms:

Incentive plan moderation	Culture Diversity	Age Diversity	Educational Diversity	Gender Diversity	Increase in R <sup>2</sup>
Level	-	0	-	+	1.2
Individual Incentives	+	+	-	-	6.3
Profit Sharing	-	-	-	0	4.6
Group Incentives	-	0	-	+	3.2
Stock Plans	0	+	-	0	5.5
Merit Based	-	-	0	+	4.8

Thus, the various plans moderate the diversity variables differently, which is probably one of the reasons for having different incentive plans at the same organization. It is also worth mentioning that none of the incentive plans moderates educational diversity positively.

## Appendix B

### Measuring Interaction Effects

Henseler and Chin (2010)<sup>9</sup> reviewed four methods for testing interactions, and these are: product indicator approach, a two-stage approach, a hybrid approach, and an orthogonalizing approach. Those methods are summarized in the following paragraphs.

Using the product indicator approach the indicators of the interacting latent variables are multiplied in pairs and the resulting answers are used as measures of the interaction term. The two-stage approach, on the other hand, is suggested mainly for interacting formative constructs since the pair-wise multiplication of indicators is not meaningful for these constructs (Henseler and Chin, 2010). In stage one, estimates of the latent variable scores are obtained. In stage two, the interaction term is calculated as the product of the latent variable scores. After that this interaction term and the latent variable scores of the interacting constructs, together with other existing constructs, are used as independent variables in a regression on the latent variable score of the dependent variable.

The hybrid approach has elements of the previous two approaches and contains four steps. First, the latent variable scores are estimated using construct indicators, and then the interaction term is

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<sup>9</sup>Henseler, J., Chin, W. (2010). [A Comparison of Approaches for the Analysis of Interaction Effects Between Latent Variables Using Partial Least Squares Path Modeling, \*Structural Equation Modeling: A Multidisciplinary Journal\*, 17 \(1\) 82-109.](#)



calculated as the product of the related latent variable scores. Second, inner path coefficients are estimated using the available latent variable scores. Third, latent variable scores are estimated using the available information from the previous two steps. And fourth, and last, weights of indicators are estimated using latent variable scores and indicator values.

In the orthogonalizing approach the pair-wise product of indicators is calculated to produce product terms. These product terms are then regressed against all the individual indicators of the concerned constructs, and the error terms are estimated. These error terms are then used as indicators of the newly formed interaction term.

Henseler and Chin (2010) recommend the use of the product indicator approach for medium to large sample sizes, which corresponds to the sample size used in this research. Moreover, the two stage approach is considered to be a limited-information approach where the latent variable scores are calculated without taking into account the moderating effect. This is considered as a limitation to this method. In addition to that, the hybrid approach is not available in PLS software packages, and the orthogonalizing approach is more suitable for small sample sizes. Thus, the product indicator approach seems to be more suitable here and is the one used in this work.

## Curriculum Vitea

**Shady Fraiha**

### TEACHING EXPERIENCE

#### Accounting instructor

<b>Notre Dame University, Lebanon</b>	<b>2003-2006</b>
<b>American University of Science and Technology, Lebanon</b>	<b>2003-2006</b>
<b>Arcatech University, Lebanon</b>	<b>2002-2003</b>

- Enhanced the students' appreciation of the accounting field by providing practical examples resulting in more interest in the topic.
- Managed the learning tools and environment providing a better learning experience resulting in a higher success rate.
- Evaluated student performance and learning outcomes through exams and feedback, allowing for adaptation of lectures.
- Coordinated with superiors and peers about course content to ensure consensus, which led to uniform education.
- Coordinated with peers about exam content and teaching strategies for student benefit.
- Lectured, tested, graded, advised, and encouraged students helping them achieve higher, which increased their self confidence.
- Sought to continuously improve self, students, and the learning environment so that all participants can benefit.
- Participated in teaching special sessions designed for weak students, which led to enhancing their performance.
- Advised the Accounting Club members on activities.

#### Courses Taught

<b>Notre Dame University, Lebanon</b>	<b>2003-2006</b>
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- Accounting courses: Principles of Accounting I, Principles of Accounting II, Intermediate Accounting, Managerial Accounting, Auditing I, Accounting Information Systems (with computer applications).
- Others: Mathematics for Business and Economics (Known as "Theory of Interest").

<b>American University of Science and Technology, Lebanon</b>	<b>2003-2006</b>
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- Accounting Courses: Principles of Accounting I, Computerized Accounting.

<b>Arcatech University, Lebanon</b>	<b>2002-2003</b>
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- Accounting courses: Principles of Accounting I, Principles of Accounting II.
- Others: File Structure and File Systems, Database Management Systems.

## OTHER EXPERIENCE

### Systems Programmer

**Middle East Technical University Computer Center, Turkey**

**1999-2002**

- Analyzed data needs, designed and developed the database/web-interface allowing for thousands of users.
- Tested and maintained the system (unit test, black-box test) providing good quality service and user satisfaction.
- Trained coworkers on the new software providing more support to users.
- Documented the projects fully allowing new programmers to learn/enhance the project easily.
- Coordinated with coworkers for interfaces with other projects enhancing services to users and speeding up operations.

## EDUCATION

**PhD: Richard Ivey School of Business, UWO**

**2007-2011E**

- Took two courses from the Teaching Support Centre on *Communication in the Canadian Classroom*, which increased my knowledge of the diversity in Canadian classrooms.
- Took a course on management teaching and researched transformational learning and wrote a paper on the subject.
- Researched the effect of education and personal frames of reference on the way people understand issues in information systems and wrote a paper about it.

**MBA: Middle East Technical University, Turkey**

**1999-2002**

- Researched the organizational culture at Siemens (Ankara) as a part of a course on cultures and subcultures.
- Researched Goodyear International's marketing strategy.
- Graduated with honors.

**B.S. Computer Engineering, Middle East Technical University, Turkey** **1995-1999**

- Participated in programming-language research projects and developed a new computer language for creating written language dictionaries.
- Received the first place prize for the graduation project.
- Graduated with honors.

## Publications

### Refereed Journals

- Fraiha, Shady (2010). "Team Collaboration in Virtual Worlds", *European Journal of Management*, 10(2), pp. 28-36.
- Fraiha, Shady (2009) "Transformative Learning in Business Education: How Much Transformation is There?" *European Journal of Management*, 9 (2), pp. 77-85.

### Conferences

- Fraiha, Shady (2010) "Technology Adoption and Cross-Disciplinary Research: Past and Future", ASAC, Regina, May 22-25.
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- Fraiha, Shady (2009). "Transformative Learning in Business Education: How Much Transformation is There?" *IABE 2009 Proceedings*, Greece, June 4-6.
- Gardet, E. and Fraiha, S. (2009). "Coordination Modes established by the Hub Firm of an Innovation Network: The Case of a SME Bearer". *EMNet 2009 Proceedings*, Sarajevo, September 3-5.

### Case

- Fraiha, S., Haggerty, N. and Compeau, D. (2011) *Privacy Issues and Monetizing Twitter*. Ivey Publishing.