OPPORTUNITY MANAGEMENT OPERATIONS AT IBM MICROELECTRONICS

AN E-BUSINESS CASE STUDY

by

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A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy

Capella University

August, 2005

UMI Number: 3182595

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

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Abstract

A qualitative case study of the IBM Microelectronics Division Opportunity Management e-business initiative was conducted to develop empirical data about how and why a company implements Internet and Web technologies and practices to mediate internal operations. Defined as e-operations, electronically supported internal business operating processes are framed and influenced by the firm's strategic and operational context. Findings show that the firm was rationally inspired to utilize e-business to improve a key operating process. E-business catalyzed changes in roles, responsibilities, collaboration methods, and organizational structure. Technology implementation difficulties appeared to be less serious than various forms of organizational resistance. Availability of and access to key operational data was the primary motivating and sustaining incentive for all constituents of this project.

Dedication

This research project, that culminates three years of study and scholastic labor, was supported and nurtured by my loving wife, Jane, and our beautiful daughter, Hollyjean. They, happily, gave me the space and time to pursue those most solitary activities-reading and writing-and they were extraordinarily patient with my educational and research preoccupations. Over the years, they have come to know more about organization, management, and e-business then they expected and perhaps more than they cared for. Yet, without their understanding, thoughtful consideration, and consistent encouragement this work would not likely have succeeded.

Acknowledgment

It is a delight to have the opportunity and platform to formally express appreciation to those who have contributed, in important ways, to the successful conclusion of this dissertation. First, my sincere thanks to my advisor and mentor, Dr. Sheila Fournier-Bonilla. She has proven to be a sagacious, clever, talented, and supportive coach. She was no less than an expert at formulating the most probing questions, demanding scrupulous analysis, and at coaxing me to bring forth my own voice in my written work. Second, I'd like to thank my committee, Dr. John Hannon, Dr. Barry Persky, Dr. Don Haggerty, and Scott Willett. Thanks to their keen eyes, critique, and suggestions this work was improved to a level beyond that which I would have accomplished alone. Additionally, their questions and observations made for interesting discussion and thoughtful reflection during the various stages of the dissertation process. Third, the concept of accessible, rigorous, enriching distance education as practiced by Capella University can not be understated. Without this model, embracing the notions of the adult-learner and scholar-practitioner, those of us who are working professionals would not have the venue or opportunity to pursue education at the highest levels. Finally, I must acknowledge the professional support provided by IBM and all of my colleagues who might now understand what has absorbed me over the past three years. Of particular note are Pat Brennan and Joe Touchette. These two wise and experienced professionals have been especially encouraging, interested, and eager to figure out ways to use my new found knowledge. To them and all the rest who helped along the way, I offer my most respectful gratitude.

Table of Contents

List of Tables

List of Figures

CHAPTER 1. INTRODUCTION

"I was brought up to believe that the only thing worth doing was to add to the sum of accurate information in the world." *Margaret Meade*

Background of the Study

Nearly one billion people, 14% of the world's population (Internet World Stats, 2005), are now able to access the Internet, a global network of computer networks, and the World Wide Web, one of the Internet's most popular services. This enormous and growing population represents a tantalizing wellspring of potential customers, suppliers, partners, and employees for those firms that exploit Internet-era digital computing and communications technology for business purposes, a phenomenon known as electronic business or e-business (Hoffer, Prescott, & McFadden, 2002).

Firms have found that e-business has inspired new and unique commercial forms and approaches (Evans, 2001; Hadaya, 2004; Plant, 2000; Webb, 1999), design of innovative business models (Eisenmann, Hallowell, & Tripsas, 2002; Osterwalder & Pigneur, 2002; Plice, 2003; von Krogh, Erat, & Macus, 2000; Yoo, 2003), and deployment of newer more agile business processes and operations (Fahey, Srivastava, Sharon, & Smith, 2001; A. Gunasekaran, Marri, McGaughey, & Nebhwani, 2002; Hall, 2000). The technology has given new degrees-of-freedom to those who must devise ways to create value in the marketplace, enhance value propositions, improve value chain performance, and generally fortify competitiveness (Chesbrough & Rosenbloom, 2000; Mahadevan, 2000; Porter, 2001; Pujari, 2004; Schwager, 2004). The salient theme of these e-business developments is that the progressive use of digital technology can provide powerful communication and collaboration linkages between businesses and their many constituents.

The nature and character of e-business has greatly intrigued practitioners, consultants, and scholars since the mid 1990s. Their earliest discourses were devoted to tracking the development of Internet technology, assessing the financial and economic impacts of the dotcom boom and bust, and understanding the marketing implications of Web Site design (Barnes, Hinton, & Mieczkowska, 2002; Clegg, Icasati-Johanson, & Bennett, 2001). In recent years, however, the e-business research literature has expanded coverage to address e-business strategy (Cunningham, 1998; Diana, 2001; Hackbarth & Kettinger, 2000; Porter, 2001), implications of user attitudes on Internet marketing (S. A. Brown, 2003; Cutshall, 2004; Dewan, Jing, & Seidmann, 2000; Faja, 2004; Fong, 2004; Good & Schultz, 2002; Gould, 2004; Grossnickle & Raskin, 2001; Kozinets, 2002; Ragins & Greco, 2003; Watson, Akselsen, & Pitt, 1998), advancements in Knowledge Management (Allard & Holsapple, 2002; Bose, 2002; du Plessis, 2003; Holsapple & Singh, 2000; Malhotra, 2000; Singh, 2000; Tiwana, 2002), unique characteristics of e-business project implementation (Alameri, 2003; C. Chan & Swatman, 2000; Lientz & Rea, 2001; Neef, 2000; Rifkin & Kurtzman, 2002; Weill & Broadbent, 1998) and e-business quality requirements (Cox & Dale, 2001; Dedhia, 2001; Foss, Henderson, Johnson, Murray, & Stone, 2002; Pujari, 2004). This host of topics demonstrates the omnipresence of e-business, the opportunities and challenges presented to firms by the Internet and World Wide Web, and the transformations those companies are making as they invest in electronically mediated and integrated operations.

The existing literature makes it abundantly clear that e-business initiatives are thought to be complex and multifaceted endeavors that require adjustments to business strategy, changes to computing systems, and adaptation to new e-business operational processes and methods of

managing them (Q. Cao & M. J Schniederjans, 2004; Mieczkowska, Barnes, & Hinton, 2002; Neef, 2000). In fact, the integration of business processes and new technology and the people dimensions of organizational transformation form the epicenter of the e-business strategy dialogue (Evans, 2001; Grey et al., 2003; Hackbarth & Kettinger, 2000). As viewed through the electronic strategy lens, information and communications e-business technology, by accelerating information flows and connecting geographically dispersed players, enables business processes to be performed in a more communications-based, flexible, and automatic manner (Boyer, 2001; Fahey et al., 2001; Huizingh, 2002; Malhotra, 2001). The Internet, then, offers the communications scope and reach from which firms can correspond with a huge and expanding world wide audience, the platform from which to deliver novel methods for conducting myriad organizational activities, and the global infrastructure from which to stage the complex technical and business interrelationships that comprise electronic business.

Statement of the Problem

While e-business coverage has become significantly more comprehensive during the past few years, information regarding the contemporary use of Internet and Web technologies and practices to enable a firm's internal transactions and processes is still confusing, scarce, and under reported. This has been emphasized by Feeny (2001), Tsikriktsis, Lanzolla, and Frohlich (2004), Brews and Tucci (2003), Rust (2001) and in numerous articles by Barnes, Hinton, and Mieczkowska (Barnes et al., 2002; 2004; Barnes, Mieczkowska, & Hinton, 2003). These scholars argue that more academic research should be conducted to understand the extent to which established firms use the Internet to conduct business, develop empirical evidence of the

different factors that affect the adoption of electronic processes in firms, and establish the impact of e-business on internal business processes and operations.

These various calls for rigorous empirical research have, thus far, been answered by only a handful of research teams. Barnes, Hinton, and Mieczkowska (2003), studying seven United Kingdom-based financial services and manufacturing firms have produced preliminary results that characterize the motivations, intentions, and difficulties encountered by firms that have implemented e-business initiatives. Their five significant findings were that: 1) e-business investments have been driven by firms' fears of being left behind in their use of technology rather than the inspiration to use technology to improve business performance, 2) investments were used to automate rather than redesign existing processes, 3) e-business processes were not integrated with pre-existing processes, 4) there was little evidence of companies using formal performance measurements to assess their e-operations, and 5) pre-existing legacy systems present major encumbrances to system integration efforts.

Tsikriktsis, Lanzolla, and Frohlich (2004), on the other hand, found that firms are motivated to embrace e-business by desires to improve business efficiency and respond to external customer and supplier pressures to keep pace with technology. They also determined that internal barriers such as resistance to change, pre-existing organizational form and hierarchy, and lack of motivation and skill, impede the adoption of e-business processes. Interestingly, their work was also conducted in the United Kingdom. Finally, Kreindler, Maislish, and Wang (2004) have surveyed small and medium sized Israeli hi-tech companies. From this population, they have ascertained that the transition to e-business resulted in organizational redesign and improvements in how the firms interacted with customers and suppliers. They observed that e-

business had positive effects on formal organizational communications and information flows within the firms.

Even though these research results are part of a nascent line of inquiry, they do present some interesting yet conflicting information. While Barnes and colleagues have noticed a predominant tendency to embrace technology for the sake of using technology, Tsikriktsis and team have seen both the technology-driven motivation and a rational intent by firms to exploit technology to improve business performance. Where Kreindler and associates have discovered that e-business overtly influences organizational redesign, Barnes and colleagues have observed e-business as being used predominately to automate rather than redesign existing processes. Clearly, new research, featuring different venues, different types of e-business projects, yet aimed at understanding organizational impact, can greatly contribute to enriching the body of scholarly and practitioner knowledge about e-business influences on internal operations and add more dimension to the results already obtained.

Purpose of Research

In aggregate, the foregoing suggestions for e-business research generate four criteria by which to fashion a study. First, the study should concentrate on an established firm rather than a startup company. Brews and Tucci (2003) have observed that very "little information is available on the extent to which established firms use the Internet to conduct business" (p.8). They suggest that in the aftermath of the dotcom implosion of 2000-2001, it is sensible to expect that most of the Internet's economic benefit will accrue to existing firms as they convert to Internet-based infrastructures. In other words, existing firms will likely gain the most from Internet-related investment projects. Therefore, much can be learned from studies that assess

how established firms use the Internet to transform, control, and manage their business operations.

Second, the research should focus on internal business processes and operations. As early as 1999, it was noted that advances in e-business were driving changes within operations management; the management of internal business processes (Grover & Malhotra, 1999). Yet, in two papers, Barnes, Hinton, and Mieczkowska (2003; Barnes et al., 2004) found it necessary to highlight that scant research attention has been given to the impact that e-business has made on the way that organizations configure their internal processes and systems to respond to competition. In their view, "operations has been the neglected function in e-business"(Barnes et al., 2002, p. 134). Attending to their concern, a study would be aimed away from business-to-business, business-to-consumer, and other extra-organizational topics and focus attention solely on what goes on inside a firm that is implementing e-business as a modification, supplement, or transition away from its pre-existing internal processes.

Third, the study should provide empirical evidence based on observation and experience as a means to explain and understand the environmental factors that shape an e-business project. It has been noted numerous times (Barnes et al., 2002; Brews & Tucci, 2003; Feeny, 2001) that there are ample e-business discourses based on industry stories, anecdotal information, or predictive assessments as opposed to evidence-based, rigorous investigations. Tsikriktsis and colleagues (2004) sustain this by noting that research is needed "that provides empirical evidence of the different factors that may or may not contribute to the adoption of e-processes" (p. 216).

Fourth, the research should be academic rather than commercially motivated. Clegg, Icasati-Johanson, and Bennett (2001) and Barnes, Hinton, and Mieczkowska (2003) note that much of

the published material on e-business has, thus far, been led and shaped by organizations that have a vested interest in its development-consultants, IT hardware vendors, and software suppliers. They suggest that impartial, scientific work focusing on internal business operations and conducted by academics would add to the credibility and utility of e-business findings and thus better support the development of theory and business practice.

In summary, then, an academic, scientific, empirical study that draws upon the experiences, knowledge, and learning that an established business organization has gained through the application of e-business to its internal operating processes can add value to the body of knowledge about electronic business. Specifically, this type of study could produce much needed understanding about the extent to which established firms use the Internet to conduct business, develop empirical evidence of the different factors that affect the adoption of electronic processes in firms, and establish the impact of e-business on internal business processes and operations.

A suitable venue meeting these criteria was identified within the Microelectronics Division (MD) of International Business Machines (IBM), Corp's Server and Technology Group. Over the past five years, MD has invested in a significant, wide ranging project, their Opportunity Management (OM) e-business initiative, to serve their Application Specific Integrated Circuit (ASIC) and Foundry Services businesses. IBM, a century old institution, meets the criteria of being an established business as does it's Microelectronics Division which has been supplying IBM internal and Original Equipment Manufacturer (OEM) technology needs for over forty years. MD's Opportunity Management initiative is a project aimed at improving ASIC and

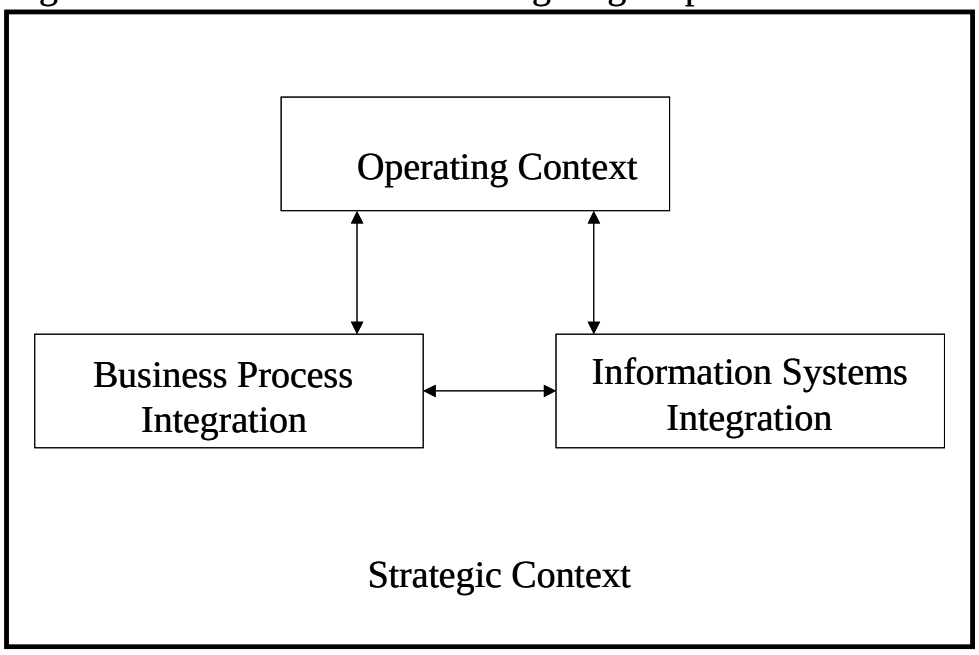
Foundry end-to-end internal business operations. Further, the responsible MD Executive agreed to sanction an academic case study of the project by this researcher.

The purpose of this case study, therefore, was to investigate the e-business technologies and practices used by and in the IBM MD initiative to enable its internal Opportunity Management business processes and operations. This project explored the strategic and operational factors that provided the context and influenced the decision by IBM MD to invest in its Opportunity Management e-business initiative. This study also describes how this context shaped the design of internal business operating processes and the selection and deployment of e-business Information and Communication Technology (ICT). For the purposes of this research, context is meant to portray the setting, milieu, or frame of reference that gives meaning and character to the ideas and events associated with the MD project.

Conceptual Framework

To guide this study and keep it focused on the essential elements of strategy, operations, business processes, and information technology, a framework for investigating e-operations was used (Barnes et al., 2002) (See Figure 1). Hereafter, this framework or model is referred to as the Barnes Model. The Barnes Model is a conceptual framework that focuses a researcher's attention on the interactive relationships between Business Process Integration and Information Systems (IS) Integration. Moreover, the model encourages the researcher to investigate and understand the operational and business strategies that underpin the e-business project and create its unique context. It also helps to expose those strategies that motivate and inspire a firm's e-business transformation imperatives.

Figure 1: Barnes Model for investigating e-operations[1]



[1]Adapted from "Developing a Framework to Investigate the Impact of E-commerce on the Management of Internal Business Processes," by D. Barnes, M. Hinton, and S. Mieczkowska, 2002, Knowledge and Process Management, 9(3), p. 141. Copyright 2002 John Wiley & Sons, Ltd.

The Barnes Model characterizes Business Process Integration in terms of the work activities, communications, and decisions that embody business processes as well as the extent to which an organization's business processes are intertwined. Business Process Integration is concerned with inter- and extra-organizational integration as well as integration between existing and new electronically mediated processes. Information Systems Integration follows essentially the same pattern. IS integration is concerned with the architecture, components, and competencies of the organization's ICT infrastructure and with the extent to which Information Systems are internally and externally linked. The Model recognizes the interactive relationship between ICT and business processes whereby business process requirements drive the specifications for supporting ICT even while advanced ICT presents new capabilities and possibilities-a manifestation of a

market pull and technology push phenomenon (Probert, Farrukh, & Phaal, 2003)-that can be leveraged to design and operationalize new types of business processes.

Consideration of Operational and Strategic Contexts is perhaps the most insightful element of the Barnes Model. By placing special emphasis on understanding an organization's objectives, structures, culture, environment, and special circumstances, the Model channels research efforts towards establishing a coherent frame-of-reference for the e-business project. This frame of reference supports the researcher's comprehension and interpretation of the research data by providing a view of the bigger picture surrounding the object of inspection.

Research Questions

The Barnes Model, with strategic context providing the background for the interactions among operating context, business process integration, and information systems integration, establishes the structure upon which to investigate the motivations, experiences, applications, and results that IBM Microelectronics experienced with its Opportunity Management e-business implementation. Within this framework, three central research questions were proffered.

Research Question One: Why was the firm motivated to invest in e-business?

This question is accompanied by three supporting sub-questions:

a) What was the nature of any extra-organizational influence to adopt e-business;

b) What internally generated factors influenced the organization to adopt e-business; and

c) What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?

Research Question Two: How has e-business been utilized to implement organizational, process, and information integration?

This question is supported by the following sub-questions:

a) How have pre-existing business and technology infrastructures influenced the evolution of the e-business project;
b) How do the economies of e-business technology enable the management of internal operations; and
c) How has e-business influenced the automation, creation, or redesign of business processes?

Research Question Three: What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations?

The following sub-questions add dimension to the primary inquiry:

a) What practices, under what conditions, proved to be the most and least useful and successful;
b) How are the information requirements of operations addressed; and
c) How has e-business affected the level of integration between business processes?

These questions were inspired by the intention to discover and understand the firm's e-business evolution. This includes learning about how organizational players managed their operations, and how they adapted traditional pre-existing processes, practices, and organization to leverage e-business. The exploratory nature of these questions, their focus on processes, predominance of how and why interrogatives, and the reality that the researcher had no control

over the events within the research settings called for the use of a flexible, qualitative research strategy, the Case Study (Yin, 2003), as the most appropriate and efficient means for gathering information from this unique, contemporary venue.

Definitions of Key Terms

The following terms are defined operationally as they are used in the study.

ASIC – Application Specific Integrated Circuit, a type of semi-custom logic semiconductor product.

Barnes Model –Refers to the Barnes, Hinton, and Mieczkowska (2002) conceptual framework for investigating e-operations that postulates that the benefits available from e-operations center on the degree of integration that an organization can achieve within and between its business processes and its information systems.

Business-to-Business (B2B) – A form of e-commerce wherein commercial transactions occur between two or more companies.

Business-to-Consumer (B2C) – A form of e-commerce wherein commercial transactions occur between a company and individual consumers.

Business Process Integration – The aggregation of activities, tasks, procedures, and behaviors that have been synchronized and coordinated to produce a complete, interoperable sequence, or flow of work.

Context – describes the setting, milieu, or frame of reference that gives meaning and character to ideas and events.

E-business - "refers to the way businesses are adapting to the new environment by utilizing electronic technologies in their activities as well as the mindset they adopt to make these changes" (Allard & Holsapple, 2002, p. 20).

E-commerce – a sub-set of electronic business wherein Internet and Web technologies are used to digitally enable commercial transactions between and among organizations and individuals (Laudon & Traver, 2002).

E-operations – a sub-set of electronic business wherein the Internet and Web are used to digitally enable business processes and operations internal to the firm.

IBM Microelectronics Division (MD) –Semiconductor technology development and manufacturing arm of IBM Systems and Technology Group.

IBM MD Opportunity Management e-business initiative (see OM) – The specific e-business project deployed within IBM MD that is the object of this study.

Information and Communication Technology (ICT)- An umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them.

Information Systems Integration – The progressive linking and testing of computing equipment, programs, and data to merge their functional and technical characteristics into a comprehensive, interoperable system.

Model – refers to the Barnes Model for investigating e-operations.

OEM – Original Equipment Manufacturer, producer of electronic equipment for wholesale or retail consumption.

Operational Context – Refers to the interaction between an organization and its environment that creates the unique setting within which that organization operates and includes such considerations as the extent to which an organization is engaged in e-business (Mieczkowska et al., 2002).

Opportunity Management (OM) – The unit of analysis for this proposed research; the specific e-operations initiative developed, deployed, and supported by IBM Microelectronics.

Strategic Context-The relationship between an organization's motives and intentions in its use of e-business and its corporate strategic objectives (Barnes et al., 2002).

Delimitations and Assumptions of this Study

This research examined the e-business experiences, learning, and knowledge gained by a specific population of a single U.S.-based multinational manufacturing and services corporation. As well, it focused on the practices associated with a unique e-business project-the IBM MD Opportunity Management initiative.

A stratified purposive sample of executives, managers, and staff that had first-hand, personal knowledge, and experience with the initiative was solicited for voluntary participation. Thus, variables and conditions that were beyond the control of the researcher undoubtedly exist. No assumption is made, therefore, that missing data, as a result of non-participation, was supplied by those who did. The nature of the sampling procedure and the venue decreases the potential generalizability of the results; however, the intent was not to generalize but rather to understand the IBM MD experience and then compare and contrast the findings with previous work.

Upon reflection, this was a highly retrospective study grounded in the experiences and recollections of individual participants and a chain of evidence developed from project archives.

Thus, the qualitative evidence could be subject to other interpretations. While IBM MD endorsed the conduct of this study, it does not necessarily endorse the results, assessments, or opinions presented by the researcher.

Significance of the Study

There are a variety of reasons why this study of the IBM Microelectronics Opportunity Management e-business initiative is important. First, it has the obvious benefit of providing a new perspective and adding an empirical data point to the slowly evolving research literature about the use of e-business technology and practices to enable a firm's internal business processes. It answers the call for more research that was outlined earlier. Second, it represented an opportunity to conduct and in-depth investigation into a United States-based multinational high technology corporation. Previous qualitative research has concentrated on small and medium sized firms in the United Kingdom and Scandinavia. Third, this project exercised the Barnes Model; thus offering the opportunity to evaluate its parsimonious yet flexible framework in a new setting and to comment on its applicability and robustness. Fourth, this research exposes the decision-making processes used by the participants in the study. This can provide decision making guidance for other practitioners by pointing out alternative practices and background rationale on why certain courses of action were taken with respect to technology selection, business process design, and organizational change tactics. Fifth, practitioners typically lead academics in the application of new technologies and practices (Benbasat, Goldstein, & Mead, 1987). Consequently, an examination of IBM MD, a science and technology leader, may provide useful learning insight about strategies for applying emerging, dynamic technologies and practices for the improvement of internal business operations.

Researcher Perspective

This research project was conducted by a career IBM manager operating within IBM settings. The project, thus, offered a special opportunity to produce findings that are potentially unencumbered with threats to validity from respondent reactivity or bias (Robson, 2002); a direct benefit from the researcher's prolonged involvement in the research setting and familiarity with the proposed participants. The culture and customs of IBM are well understood, the key executives, managers, and project staff are well known, and access to these participants was not difficult to obtain. In many respects, this is similar to other research projects wherein one or more of the researchers was extremely familiar with the research setting and population or were insider researchers (Balogun, Huff, & Johnson, 2003; Coghlan, 2003; Doyle & Brannick, 2003; Kreindler et al., 2004; St. Maurice, 2002). Coghlan (2003) notes that insider research is valuable because it "draws on the experience of practitioners as complete members of their organizations and so makes a distinctive contribution to the development of insider knowledge about organizations and organizational change" (p. 451). Additionally, familiarity with and trust in the researcher has been shown to be an antecedent to obtaining access to vital data in a research project (Irvine, 2003).

By embracing a formal research framework and adhering to a strict research protocol, the researcher attempted to collect data in a professional and scholarly manner that reflects the best qualities of the scholar-practitioner (see Appendix B). Additionally, the researcher was acutely attuned to the possibility that researcher bias (Robson, 2002) could negatively influence data collection. Thus, the research protocol specifically highlights this potential source of bias in all participant briefings.

Organization of this Research Report

The following sections of this research report consist of a literature review that covers the essential elements of strategic context, operating context, business process integration, and information systems integration. Additionally, it assesses the contemporary works that delve directly into the e-operations topic. This provides theoretical background, clarifies the value of the research's conceptual framework, and highlights the state of understanding within the e-operations domain. Next, the research methodology is described and the rationale for its selection presented. Following that, the results of the study are presented and analyzed. The results are discussed, compared, and contrasted to previous research. They are evaluated for lessons learned and information themes that can inform and promote the general understanding of e-operations. The results are also examined for theoretical consistency with the Barnes Model. Finally, opportunities for further research are identified.

CHAPTER 2. LITERATURE REVIEW

"Learn what is true in order to do what is right" *Thomas Henry Huxley*

Introduction

In Chapter 1, the motivation for pursuing a study about the electronically mediated internal operations of a firm was presented. This chapter presents deeper insight into the electronic operations topic and the theoretical underpinnings of the Barnes Model for investigating e-operations. This chapter also attempts to clarify the rationale for and the significance of the research questions introduced in Chapter 1.

Chapter 2 begins by addressing the nature of Internet technology, describing and discriminating between the concepts of e-commerce, e-business, and e-operations, and by characterizing the electronic business operations arena. Next, the nature and implications of the Barnes Model are analyzed and it is presented as a vehicle to bound, focus, and to guide the proposed investigation. Finally, the specific, contemporary non-empirical and empirical e-operations research is systematically scrutinized in order to depict the current status of internal e-business research and create a basis and rationale for the proposed research questions.

Internet Technology

Soon after the Defense Advanced Research Project Agency and the National Science Foundation turned control of the Internet over to the private sector, firms very quickly recognized its potential business value. By leveraging the ubiquity, global reach, universal standards, interactivity, and information density of the Internet and World Wide Web (WWW) (Laudon & Traver, 2002), firms were able to overcome the communication limitations inherent

with proprietary, closed networks that had until that time stymied any conception of large scale business networking.

As a global network of networks connected to millions of computers, the Internet made it possible for businesses to cost effectively reach out and interact with a geographically dispersed audience of potential customers, partners, suppliers, and employees. Most of this was enabled by the open and standardized architecture of Internet technology. By embracing packet switching, transmission control protocols, addressing and domain naming conventions, data security and control standards, and other technical attributes of the public Internet (Connolly, 2003; Leiner et al., 2003; Ruffin, 1996), firms were provided with a low cost information and communications infrastructure that exceeded the reach of previously existing proprietary network and computing systems.

Perhaps the single most enabling technology feature of the Internet and Web was the invention of the Web browser (Yager, 2001; Zalud, 2000). The defining elegance of this World Wide Web application was that it enabled the Internet-using public to employ natural language addresses or Universal Resource Locators (URLs) instead of arcane numeric computer addressing schemes to locate computing platforms within the system. This emancipated the general user from the mysteries of programming and the clumsiness inherent with text menus that preceded the point-and-click interface of the WWW. Any user with a browser could connect to any Web application and experience the ease and seamlessness of navigating forward or backward among various Web Sites.

This plethora of new technology, then, presented businesses with the standardized infrastructure, interfaces, and technical means with which to communicate, interact, and

collaborate with all their constituents. Thus, the public Internet, in concert with electronic environments based on Internet architecture, provided firms with a solid foundation for the aggressive pursuit of electronic business.

Electronic Commerce, Business, and Operations

The academic and practitioner literature varyingly refers to the business use of Internet and Web technology as electronic business (e-business) or electronic commerce (e-commerce). In fact, the word "electronic" or the icon "e-" has become the signal prefix to indicate that there is an integration of a business function or activity with Internet and Web Information and Communications Technology (ICT). Examples of this can be seen across the literature: e-strategy, e-markets, e-trading, e-team (Neef, 2000), e-fulfillment (Saenz Jr., 2001), e-reputation (Chun & Davies, 2001), and e-opportunity (Feeny, 2001). Each of these terms illustrates and connotes the relationship between a business function and its enablement by, reliance on, and intimate connection with electronic ICT.

An unfortunate by-product of this e-mania, particularly as it relates to e-business and e-commerce, is a continuing lack of clarity and distinction between these two terms. There are substantial differences in the definitions of these concepts, uneven usage across published works, and even inconsistent use within articles. For example, Clegg, Icasti-Johanson, and Bennett (2001) define e-business as "the transaction of commercial activities on global open networks between an ever-increasing number of corporate and individual participants" (p. 294). However, Cox and Dale (2001) use the term e-business to characterize "a business that has a virtual presence or Web site on the Internet either to promote brand awareness or enable e-commerce" (p. 121). Both of these definitions attempt to capture the association with, if not the reliance on,

technology but neither leaves a crisp picture of just where e-business begins, ends, or what it encompasses. In fact, both use a form of the word commerce to explain e-business. Clarifying the terms e-business and e-commerce, thus, is a necessary and value adding prerequisite for an e-business study in general and one aimed at internal business operations in particular.

Electronic Commerce

To clarify the definitions of e-commerce and e-business, it is best to start with e-commerce because of its historical significance. By many accounts (McLeod & Schell, 2001; Wigand, 1997), the term e-commerce entered the business lexicon during the 1970s with the expanding use of Electronic Data Interchange (EDI), Electronic Funds Transfer, and FAX technology. Of these three, EDI was the most important. It established structured, formal information exchange standards for computer-to-computer business transmissions over value added networks. Typically, companies would contractually agree to participate in EDI transactions and establish the necessary ICT infrastructure, usually leased circuits from telecommunications suppliers, to support the interchange of business documents such as quote requests, quotation responses, purchase orders, bills of lading, receiving notices, and invoices. Each of these documents is associated, in one manner or another, with the exchange of value in the marketplace and is part of the administrative infrastructure of modern commercial trade (Holsapple & Singh, 2000). At this stage of evolution, e-commerce was seen as a way to automate and increase the efficiency of these administrative functions.

Beginning in 1995, with the commercialization of the Internet (Laudon & Traver, 2002), the concept of e-commerce expanded beyond the mere automation of administrative function and was seen as a way to bring the entire commercial process into an automated, on-line, interactive

environment. Representative definitions arising from this more encompassing view of e-commerce tended to emphasize two key points, the commercial transaction and the importance of information technology. Some examples are: 1. “E-commerce can be stated as any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct contact” (Dedhia, 2001, p. 397); 2. “Electronic commerce is defined as the conducting of business communications and transmissions over networks and through computers, specifically the buying and selling of goods and services, and the transfer of funds through digital communications” (Good & Schultz, 2002, p. 111); or 3. “Electronic Commerce encompasses all forms of interactive business transactions, which are facilitated by networks of computers” (A. Gunasekaran et al., 2002, p. 186).

These definitions are representative of those that can be classified as having a “trading view” (Holsapple & Singh, 2000, p. 152). This means that the buy and sell transaction or trade is the central theme of e-commerce. The trading view implies that e-commerce revolves around markets where supply and demand interact (Wigand, 1997). No doubt, this is influenced by the general concept of commerce as a trading activity, the historical transaction-centricity of EDI, and the increasing capability to conduct old and new forms of commerce via the Internet medium. As well, Singh (2000) and Holsapple and Singh (2000), after investigating scores of e-commerce definitions, determined that the trading view of e-commerce is the most common, popular perspective. Therefore, a trading view will be used to anchor this e-commerce definition. For the purposes of this proposed research, e-commerce is considered simply to be the use of the Internet and the Web to digitally enable commercial transactions between and among organizations and individuals (Laudon & Traver, 2002).

Electronic Business

Allard and Holsapple (2002) building on the work of Holsapple and Singh (2000), concluded that there is a distinction between e-business and e-commerce. In their framework, e-commerce is defined in the narrow terms prescribed by the trading view, as previously described, while e-business is conceived in terms of what they call the value chain and effects views. These views stipulate that e-business is differentiated from e-commerce because its focus is on the goals and objectives of digital enablement and the effects expected to derive there from. For instance, by applying technology within one or more value chain activities, business processes, or operations, the firm will expect to create value within and across the organization and, thus, better achieve business goals. Equally important, the effects view refers to the wider concerns of business strategy, planning, evaluation, and process designs that will produce useful outcomes and benefits for an organization. E-business; therefore, transcends the narrow trading view of e-commerce and embraces a broader, strategic, more overarching organizational perspective.

Examples of definitions that invoke a wider organizational point of view are: 1. “An e-business is the electronic integration of all operations within a business that link with customers, suppliers, partners, and employees” (Evans, 2001, p. 11); 2. An e-business is “a technology-enabled business that is using Internet-related technology to facilitate the development of more integrated relations with customers and suppliers (Hoffer et al., 2002); or 3. “Electronic business refers to the way businesses are adapting to the new environment by utilizing electronic technologies in their activities as well as the mindset they adopt to make these changes” (Allard & Holsapple, 2002, p. 20). As expected, these definitions invoke the technology dimension but instead of centering on transactions, they highlight bigger themes-integration, links, relations-

across operations and multiple stakeholders. Given this larger perspective, Allard and Holsapple concluded that the concept of e-business subsumes e-commerce. Said differently, an enterprise becomes an e-business by executing a strategy to embrace and participate in the digitally enabled environment. Hence, the Allard and Holsapple definition of e-business will be adopted for the purposes of this research.

Electronic Operations

With e-business and e-commerce suitably defined, one additional issue needs to be resolved and that is to settle on an acceptable terminology for those areas of an e-business that are automated for the purpose of conducting internal operating processes. Laudon and Travers (2002) offer a simple test. From their perspective, only those processes that involve the exchange of value across organizational boundaries should be referred to as e-commerce. Again, this is a trading view perspective. Thus, they note that, "e-business applications turn into e-commerce precisely when an exchange of value occurs" (p. 7). All else can be denoted as internal e-business or e-operations (Barnes, Hinton et al., 2003; Boyer, 2001).

In summary and for the purposes of this research, the term e-commerce is isolated and reserved for those special e-business instances that utilize the Internet and Web to conduct business in retail, wholesale, business-to business, or business-to-consumer transactions. The term e-business, on the other hand, has a macro-connotation that refers to the circumstances where a firm has made the commitment to configure itself to participate and conduct various of its activities in the online, electronic environment. This will be referred to simply as e-business. Equally important, e-business has a micro-connotation when referring to the digital enablement of processes within a firm. This could encompass the use of secure environments such as

intranets and extranets, wireless and handheld devices, as well as e-mail, and the public Internet infrastructure. Forthwith, this will be referred to as internal e-business or e-operations.

The Characteristics of Electronic Business Operations

The challenge of internal e-business implementation projects is to reconfigure operational processes to fit within the overall context of a firm's business strategy and to ensure that information and communication-based e-business technologies are installed to support these processes (Mieczkowska et al., 2002). What is uniquely interesting about these projects is that they take advantage of the standardized network infrastructure, protocols, browsers, and scripting languages supported by the Internet (Laudon & Traver, 2002). Thus, interconnectivity and communication issues are of less concern to e-business implementers than are the central issues of business process design and functional application deployment. On the other hand, since the Information and Communication Technologies (ICT) of the Internet are based upon public standards and infrastructure, there is no innate competitive advantage to the technology. Rather, it is how firms apply this technology in their own context to create unique Information Technology capabilities and skills that will determine the firm's overall success at e-business (Bharadwaj, 2000). In internal e-business implementations, e-operations, the unique application of ICT is primarily devoted to improving existing business operations, designing new processes, and then interconnecting and automating them.

Aside from discriminating between e-business and e-commerce and establishing a suitable nomenclature for e-operations, the forgoing analysis also reveals the broad, encompassing themes that characterize an e-business and its e-operations sub-component. First, the concept of e-business is inextricably tied to business strategy. Strategic intent and subsequent commitment

to embrace e-business presages changes to operations strategy (Barnes et al., 2004) and sets the stage for a more cooperative and participatory view of business management that can create the potential for strategic advantage (Gibson & Edwards, 2004). Second, internal e-business focuses on operations; that part of an organization that is concerned with the management of the activities that ultimately produce the goods and services supplied to customers (Barnes et al., 2002). This point is emphasized by those who foresee the value that accrues to operations through the integration and synchronization of all the activities within a firm's value chain (A. Gunasekaran et al., 2002; Kehoe & Boughton, 2001).

Third, e-business operations are composed of business processes that dictate the organized flow of work and information. Business processes are important because, through e-business, firms are presented with " the electronic means to enable connections among and between processes to take place in fundamentally new ways and at such speeds that it literally opens up the ability to radically reconfigure each core operating process" (Fahey et al., 2001, p. 895). Fourth, information and communications technology is the underlying technological enabler for e-business. Organizations can use their e-business technology infrastructures to support goals such as operational flexibility (Kumar, 2004), quality, delivery, or cost reduction (Q. Cao & M. J. Schniederjans, 2004). As well, they can use information technology to orchestrate the synergistic merging of the virtual and physical worlds that creates the e-business environment and, hopefully, leads to enhanced business performance (Grover & Malhotra, 1999). Thus, we have four vital areas of interest that give internal e-business its special character: strategy, operations, business processes, and ICT.

The Barnes Model for E-operations Research

In their work, *Developing a Framework to Investigate the Impact of E-commerce on the Management of Internal Business Processes*, Barnes, Hinton, and Mieckowska (2002), have organized these four themes of e-business into a coherent conceptual framework to guide investigations into internal e-business initiatives (See Figure 1, p. 15). They aver that the strategic and operational elements of e-business establish a context setting influence and frame of reference that depicts the motivations for and the nature of internal e-business deployment. Additionally, they position the interrelationship between business process integration and information systems integration as the basic components of internal e-business or e-operations deployment.

To more thoroughly elucidate on the four broad themes of e-business and investigate the ramifications of the Barnes Model as a vehicle for studying e-business, the following discussion will address its various components. Consequently, this section will explore the nature and implications of strategic and operational context and the distinctiveness of business process and information systems integration. This provides the necessary theoretical framework to properly bound the research into the Opportunity Management e-business initiative within IBM Microelectronics and validate that the Barnes Model is indeed adequate to guide the study.

Strategic and Operating Context

The notion of context is usually meant to describe the setting, milieu, or frame of reference that gives meaning and character to an idea or event. Context provides a reference point for understanding a problem and enables researchers and research report readers to understand how a problem fits into a bigger picture (Booth, Colomb, & Williams, 1995). Miles and Huberman

(1994) stress the importance of understanding context as it is usually critical to the success of qualitative research. They caution that focusing solely on individual behaviors or events without first establishing context exposes a researcher to the serious risk of misunderstanding the meaning of those events. Thus, Barnes and associates, a qualitative methods research team (Barnes, Hinton et al., 2003), have placed high priority on understanding both Strategic and Operational Context as a backdrop to investigating e-business operating processes and systems.

Strategic context. The Barnes Model concentrates on Strategic Context in order to elicit analysis of a firm's e-business motivations and intentions as influenced by its strategic objectives (Barnes et al., 2002). This directs researcher efforts toward gathering information about the firm's short- and long-term strategy and business goals (Weill & Broadbent, 1998) and understanding the cumulative organizational impact of management's internal resource allocation decisions (Collis & Montgomery, 1998; Priem & Butler, 2001; Wernerfelt, 1984). Additionally, it is very useful for researchers to understand, as much as possible, the internal culture, politics, and leadership dynamics within the firm. This allows them to effectively characterize the firm's internal context. This should be supplemented by gaining knowledge of the firm's external strategic context; represented by political, economic, sociological, and technological factors related to opportunities in the wider business environment (Conner & Prahalad, 1996). This entire breadth of information provides texture, meaning, historical overtones, and environmental groundings that frame the e-business investigation.

An additional construct that helps to more fully define the domain of strategic context is strategic intent (Hamel & Prahalad, 1989). A firm's strategic intent establishes its long-term goals. It describes a vision of where a firm is headed and channels a firm's myriad incremental

decisions in a consistent reinforcing direction. Strategic intent focuses attention on the firm's future opportunities as opposed to its current problems. This stands in juxtaposition to current strategy which specifies how a firm conducts business in the present (Weill & Broadbent, 1998). Since internal e-business projects are aimed at transforming basic business processes and changing the nature of a firm's operations (Hackbarth & Kettinger, 2000), they are likely to be framed in context to a strategic intent that specifies the firm's vision for the future. This is particularly relevant to the study of e-business as knowledge of strategic intent establishes a basis for understanding why a project has been commissioned, what roles the business processes are intended to fill, and why certain technical solutions were selected.

By paying attention to Strategic Context, e-business researchers can learn about a firm's core business processes (Meade & Rogers, 2001), what key decisions emanate from these processes, what information is really important to the business, and what effect information and knowledge may have on firm performance (Davenport, Harris, De Long, & Jacobson, 2001). By grasping the essentials of Strategic Context, the researcher will begin to understand the effect that the initiative has on all or a large part of the organization (Kaye, 1995) and how the e-business project fits in relationship to the firm's environment. This will illuminate the forces that formed and shaped the firm's e-business approach and made it unique.

Operating context. Operating Context is concerned with decisions that are confined to only a part of the organization and particularly with those addressing the internal matters of transforming inputs into outputs (Kaye, 1995). According to the Barnes Model, Operating Context can be viewed from three vantages: customer context, e-business context, and organizational context (Barnes et al., 2002). Customer context is concerned with how

operational processes touch a company's customers. If the company is involved in business-to-business (B2B) interactions, there will be different issues and concerns than if the processes facilitate business-to-consumer (B2C) interactions. For instance, B2B interactions may place a premium on high volume, data intensive transactions while B2C might require more emphasis on look, feel, and ease of interaction with the e-business operation and supporting software applications. It is likely that customer context would have indirect influence on e-operations and direct impact on e-commerce. E-business context provides a frame of reference for the progress the firm has made as it transmogrifies from a traditional business enterprise to an electronically facile organization. Understanding e-business context helps to discriminate between those firms that are taking their initial, tentative, exploratory steps on the e-business journey from others who are experienced, sophisticated, electronic organizations. Finally, organizational context is concerned with goals and objectives, organization size, and other micro-environmental conditions that are crucial to the proper implementation and management of business operations (Grover & Malhotra, 1999). In the course of understanding these various factors, the e-business researcher will, again, gain a better frame of reference for understanding why specific e-business decisions were made and how they affected the conduct of e-operations.

By grasping the ramifications of both the Strategic and Operational Contexts of an e-business initiative, a researcher will be better enabled to understand how the company has positioned its e-business operating processes and what role they play in the evolution of the business (Barnes & Rowbotham, 2003). For instance, it might be determined that e-business operations are not strategically relevant and that the business maintains the operations in a minimalist manner as a requirement for participating in the industry. Alternatively, the operational processes may be

tuned to remain at competitive parity within the industry. At the next level of sophistication, the operating processes may be in synchronization with overall business strategy and deployed to directly support that strategy. In some cases, the e-business operating processes may actually be prime forces for driving the firm's business strategy (Barnes et al., 2004). These several roles demonstrate how Operating Context influences e-business operations within the broader, overarching Strategic Context of the business. By investigating and understanding these two contexts, the researcher should be better positioned to grasp the Business Process Integration and Information System Integration dimensions of an e-operations implementation initiative.

Business Process Integration

The Business Process Integration module of the Barnes Model fixes research attention on the details of an organization's e-business operating processes. It bounds the scope of a study to include such things as understanding the firm's value adding activities and business processes, the extent to which both internal and external processes are integrated, the difficulties and problems encountered, and the value or benefit realized through e-business transformation.

Business processes. Davenport and Short (1990) describe business processes as sets of logically related tasks performed to achieve a defined business outcome. However, there are many additional characteristics and attributes that can refine this definition and more fully illustrate the character of business processes. For instance, a business process incorporates the notions of sequence (Nyamekye, 2000); the idea that there is a prescribed order necessary for the proper disposition of work. Business processes are generally independent of formal organizational structure (Davenport & Short, 1990) and can not exist as isolated, discrete, stand-alone activities but, rather, as an interdependent continuum of value adding operations (Champy,

2002) that are instituted to create valuable products and services for customers (A. Gunasekaran & Kobu, 2002). An essential attribute of business processes is that they are an aggregate of activities, tasks, procedures, and behaviors that have been synchronized and coordinated to produce a complete sequence of work. More succinctly, then, a business process is a logical sequence of related and interconnected activities that use cross-organizational resources to create products and services to meet customer needs.

In many respects, an organization can be viewed as a collection of processes (Armistead, Harrison, & Rowlands, 1995; Armistead & Machin, 1997). Some of these are management processes, others operational, and some concerned with strategy, direction setting, business planning, and controls. Operating processes are those which are directly related to satisfying the requirements of customers. In traditional firms, these processes may serve to transform physical resources into products and services but in an e-business setting, a business process is equally likely to involve the flow and transformation of information (Kaye, 1995), knowledge (Bose, 2002), or ideas (Weill & Broadbent, 1998). A supposition of the Barnes Model is that successful adaptation of e-business in an organization's operations will hinge on the extent to which information flows can be enhanced to enable the more efficient management of a business process (Barnes et al., 2002). This is not inconsistent with Yogesh Malhotra's (2001) observation that better integration of e-business across the enterprise is expected to result in faster information flows and thus faster feedback loops that will positively affect business performance. This implies that a well designed process that produces, captures, and shares good information will improve decision making, enhance efficiency, and, hopefully, provide a competitive advantage to an organization.

Barnes and associates maintain that "everything in the new economy points to the reliance of operations on information and hence on the information systems and information technology that enables effective and efficient information processing" (Barnes, Mieczkowska et al., 2003, p. 630). This highlights one of the primary goals of an e-business initiative which is to tightly integrate internal business processes and use the power of Information and Communication Technologies to interconnect and manage information flows.

Integration difficulties and benefits. Historically, organizations have found it especially difficult to improve and integrate the business processes of their diverse operations (Hammer, 1990). They struggle to overcome traditional tendencies to remain functionally isolated (Bingi, Sharma, & Godla, 1999), evolve beyond "silo" (Morash, Droge, & Vickery, 1997) mentalities, or expand outside of stand-alone process configurations (Smith & Fingar, 2003). E-business; however, offers the promise of overcoming these weaknesses by enhancing the accuracy and speeding the transfer of organizational information (Malhotra, 2001), by merging new e-business processes with existing traditional business process (Barnes et al., 2002), and by giving companies the wherewithal to coordinate value activities in far-flung geographic locations (Porter & Millar, 1985). Reflecting back on the implications of Strategic and Operational Context, it is important for researchers to understand the organization's cultural predisposition for embracing change (Bacharach & Bamberger, 1996; Khong & Richardson, 2003; Winklhofer, 2002). While e-business technologies make the technical aspects of e-business implementation easier than was the case with earlier generations of Information Technology, it is still a significant challenge to train organization members to execute new or adjusted processes, learn

to utilize new technology, and become familiar with the rationale and motivation underlying the operational changes.

Once an organization accepts e-business enabled business process integration, it can appropriate valuable business benefits. Processes can be simplified by eliminating unnecessary iterations, handoffs, and excessive reviews and approvals (Kane, 2003). E-business integration can help the firm speed up important processes (Pink, 2001), reduce resource consumption and boost productivity (Attaran, 2003). Integration can improve output quality and customer satisfaction (Davenport & Short, 1990), align decision support activities like planning, budgeting, forecasting, and reporting of strategic objectives, and increase response time to real-time operating events (Kane, 2003). Finally, in the best of cases, organizational knowledge can be embedded in the organization's business processes to provide the firm with special, unique capabilities to service its customers (Gottschalk & Khandelwal, 2002). All of these benefits serve, in one manner or another, to increase operational efficiency, decrease operating expenses, and provide competitive advantage for the organization.

The above listed benefits are but a sample of the types of values that a firm might realize and researchers may discover during an investigation of a firm's e-business operations. For the firm, these benefits demonstrate the value of integrated business processes and information flows that can be achieved when accurate information is shared by diverse stakeholders across an organization's boundaries (Malhotra, 2001). For the researcher, discovery of these realized benefits can lead to a chain of evidence that characterizes the organization's intent, its business process design point, and the concepts and choices that underlie its operational implementation.

All of these findings can be germane to understanding the business process attributes of an e-business implementation.

As mentioned earlier, the work expended to understand business processes and conceive of integration possibilities produces requirements for e-business ICT solutions. Alternatively, ICT capabilities can influence the nature and extent of business process automation and integration that may be attempted. Researchers can examine the evidence of these dynamics by studying the Information Systems Integration induced by an e-business initiative.

Information Systems Integration

The purpose of the Information Systems Integration module of the Barnes Model is to sharpen researcher attention on the external and internal links enabled by e-business Information and Communications Technology (ICT) (Barnes et al., 2002). This requires researchers to investigate the deployment of e-business technologies to see how ICT capabilities have been utilized, what value the organization has extracted from them, and how they interact with business processes.

Technical foundations. The ICT that enables e-business includes computer hardware, software applications, and telecommunications resources that deliver data, information, and knowledge to individuals and processes (Attaran, 2003). It also includes the standards, encryption algorithms, data base design, and all of the various networking protocols and substructures of the Internet and World Wide Web (Laudon & Traver, 2002). This e-business technology enables the identification and sharing of information and ensures the standardization, control, security, and integrity of data (Gyampoh-Vidogah, Moreton, & Proverbs, 2003). E-business ICT supports cross-functional communication by improving the accuracy of

information exchanges across organizational boundaries (Olalla, 2000). E-business technology helps compress business process execution times by moving necessary information into work processes for faster decision making (Ross, Vitale, & Weill, 2001) and by establishing links between parallel functions that coordinate them while their activities are in process rather than after they are completed (Hammer & Champy, 2001). All of these capabilities and functions serve to highlight the interdependency and interactivity that exists between business processes and the supporting ICT.

There are three elements of ICT capability that must work in harmony to support e-business operations. First, the firm must have a reliable IT foundation or technical infrastructure in place. In this case, foundation refers to the public Internet infrastructure as well as the ICT services such as servers, Local Area Networks, and databases that are shared throughout the firm and are usually coordinated by a central ICT functional organization. Research by Weill and Broadbent (1998) indicates that having a robust foundation or infrastructure in place significantly increases the speed with which new applications can be implemented to meet a firm's business strategies and objectives. Second, the firm must possess sufficient human ICT resources, both technical and managerial, to mobilize and deploy ICT-based solutions (Bharadwaj, 2000). Third, the firm must have the discipline to manage an overall ICT architecture and enforce programming, interface, and data standards (Weill, Subramani, & Broadbent, 2002). Architecture and standards enable the firm to more easily and consistently coordinate and link its internal processes. These three domains of ICT capability, when in synchronization, reinforce a firm's capacity to quickly respond to strategic imperatives and display the agility and flexibility necessary to deploy e-business technology.

Systems Integration. Companies embarking on an e-business integrative strategy typically attempt to seamlessly link up their systems across multiple locations and functions (Kane, 2003). They establish architectures and broadly enforce standards as a precondition for streamlining and connecting internal processes (Weill et al., 2002). They use ICT in partnership with business processes to create more flexible, automatic, communication-based work capability (Koch, 2002). When firms properly utilize e-business technology, they can eliminate delays, reduce administrative intermediaries, avoid redundant processing steps, and provide access to information that allows companies to avoid mistakes inherent to complex, repetitive tasks (Olalla, 2000). ICT makes it easier to coordinate operations within and without the organization. It smoothes and augments the collaboration-the ability to exchange information-among employees, customers, vendors, and partners. Moreover, ICT, especially its human component, sustains an organization's innovative capacity, its ability to find novel ways to utilize its ICT assets.

Barnes Model Summary and Its Purpose in This Research

Perhaps the overriding motivation that induces researchers to investigate e-business operations is to learn about what actually works in the real world and how firm performance is affected by strategic decisions, operational processes and ICT choices. Chan, and Huff (1997) have shown that companies with high ICT strategic alignment are better performing companies but they also noted that realized and intended Information System strategies frequently diverge. Thus, an investigation into the e-business operations of a firm can provide insightful data about what an organization has done to improve its performance, how it did so, and if its actual execution was in line with strategic expectations.

Barnes, Hinton, and Mieczkowska have seized upon this relationship between operations and strategy to construct a model that guides the study of e-business operations. This Barnes Model, thus, directs researchers to concentrate on the details of Business Processes and Information Systems while at the same time forcing them to step back and view the situation from a broader strategic perspective. The Barnes team contends that, by doing so, the researcher will achieve a higher likelihood of making sense of what is transpiring in the venue being studied.

The Barnes Model is succinct, simple, and clear. Its goal is to clarify the domains of interest to researchers who are investigating internal operations. By explicitly addressing both Strategic and Operational Context, the Model stresses the importance of understanding background, setting, and environment as a precondition for interpreting and evaluating operational details. This Model has been used with some success by the Barnes team who, as proponents of qualitative research methods, have professed its value in five research papers (Barnes et al., 2002; Barnes, Hinton et al., 2003; Barnes et al., 2004; Barnes, Mieczkowska et al., 2003; Mieczkowska et al., 2002). From a business operations point of view, the Barnes Model provides enough focus on the domains of business process integration and information systems integration to keep an e-business research project on topic, on target, and within scope. However, it is also flexible enough so as not to restrict any of the avenues of investigation that could be germane to understanding an e-business setting. It also keeps the notions of interactivity in front of the researcher. Business processes interact and respond to supporting ICT and vice versa. Both business processes and ICT react to and are products of operational

context and in the wider view, processes, systems, and operational context are functions of strategic context.

E-operations: Non-empirical and Empirical Research

To this point, the nature and domain of Internet-enabled business and the working definitions of e-business, e-commerce, and e-operations have been characterized. As well, the viability of using the Barnes Model for investigating the strategic and operational context and business process and information system integration dimensions of e-operations has been established. What remains to be done is to inspect the relevant, contemporary literature for specific information regarding the use of e-business for internal operations and evaluate how that information informs and enriches this study.

A classification scheme inspired by Romano, Jr. and Fjermestad (2001) will be used to provide order and structure for the evaluation of e-operations-related literature. Within this scheme, articles are classified on the basis of whether their content is either non-empirical or empirical. Non-empirical works are further subdivided into illustrative and conceptual categories while empirical works are parsed into qualitative and quantitative groupings. The illustrative category is composed of literature that espouses opinion, personal experiences, or examples of applications of the topic. Conceptual articles develop frameworks, models, theory, or provide conceptual overviews of the topic. The empirical works, on the other hand, present data from structured, academic investigations that derive and benefit from observational or experiential data.

Interestingly, once sorted and classified, a loose pattern emerges in the historical timeline of the e-operations topic. In general, the illustrative articles began to appear in the 2000 to 2001

time frame, conceptual works began to surface in 2001 and 2002, and by late 2003 and into 2004 serious qualitative and quantitative studies began to appear in academic and professional society journals (see Tables 1a and 1b). Following this temporal progression, each of the categories will now be reviewed and summarized.

Table 1a: E-operations-related Published Literature

Non-empirical Literature		***Empirical Literature***	
Illustrative	**Conceptual**	**Qualitative**	**Quantitative**
Fisher, M. (2000) – Using E-commerce to Deliver High Productivity	Grover, V. & Malhotra, M.K. (1999) – A Framework for Examining the Interface between Operations and Information Systems: Implications for Research in the New Millennium	Mieczkowska, S.M., Barnes, D.L., & Hinton, C.M. (2002) – Finding the Fit: Applications of B2B E-business in Three UK Insurance Companies	Nemati, H.R., & Barko, C.D. (2002) – Enhancing Enterprise Decisions Through Organizational Data Mining
Lord, C. (2000) – The Practicalities of Developing a Successful E-business Strategy	Clegg, W.C., Icasati-Johanson, B., & Bennett, S. (2001) – E-business: Boom or Gloom?	Barnes, D., Hinton, M., & Mieczkowska, S. (2003) – Competitive Advantage Through E-operations	Cao, Q. & Schniederjans, M.J. (2004) – Empirical Study of the Relationship Between Operations Strategy and Information Systems Strategic Orientation in an E-commerce Environment
Rust, R. (2001) – The Rise of E-service	Fahey, L., Srivastava, R., Sharon, J.S., & Smith, D.E. (2001) – Linking E-business and Operating Processes: The Role of Knowledge Management	Barnes, D., Hinton, M., & Mieczkowska, S. (2004) – The Strategic Management of Operations in E-business	Brews, P.J. & Tucci, C.L. (2003) – Internetworking: Building Internet-Generation Companies
Ebner, M., Hu, A., Levitt, D., & McCrory, J. (2002) – How to Rescue CRM	Kehoe, D.F. & Boughton, N.J. (2001) – New Paradigms in Planning and Control Across Manufacturing Supply Chains:The Utilisation of Internet Technologies	Aldin, N., Brehmer, P-O, & Johansson, A. (2004) – Business Development with Electronic Commerce: Refinement and Repositioning	Barua, A., Konana, P., & Whinston, A.B. (2004) – An Empirical Investigation of Net-Enabled Business Value

Table 1b: E-operations-related Published Literature (Continued)			
Non-empirical Literature		***Empirical Literature***	
Illustrative	**Conceptual**	**Qualitative**	**Quantitative**
DeMark, E.F. & Harcourt, R.R. (2004) – Companies Must Adapt to the Internet to Survive	Barnes, D., Hinton, M., & Mieczkowska, S. (2002) – Developing a Framework to Investigate the Impact of E-commerce on the Management of Internal Business Processes		Chen, Q. & Chen H-M. (2004) – Exploring the Success Factors of eCRM Strategies in Practice
Gunasekaran, A., Sarkis, J., Sundarra, R.P., & Burn, J.M. (2002) – Editorial E-commerce Enabled Manufacturing Operations: Issues and Analysis	Gunasekaran, A, Marri, H.B., McGaughey, R.E., & Nebhwani, M.D. (2002) – E-commerce and its Impact on Operations Management		Kreindler, M.I. , Maislish, R., & Wang, S. (2004) – An Empirical Test of the Impact of Electronic Commerce on Organizations
Balakrishnan, A. & Geunes, J. (2004) – Collaboration and Coordination in Supply Chain Management and E-commerce	Barnes, D., Hinton, M., & Mieczkowska, S. (2003) – Integrating Operations and Information Strategy in E-business		Tsikriktsis, N., Lanzolla, G., & Frohlich, M. (2004) Adoption of E-processes by Service Firms: An Empirical Study of Antecedents
	Ragins, E.J. & Greco, A.J. (2003) – Customer Relationship Management and E-business: More Than a Software Solution		
	Gibson, P.R. & Edwards, J. (2004) – The Strategic Importance of E-commerce in Modern Supply Chains		
	Kumar, R.L. (2004) – A Framework for Assessing the Business Value of Information Technology Infrastructures		

Non-empirical Literature

Illustrative articles. The illustrative literature was authored primarily by consultants (DeMark & Harcourt, 2004; Ebner, Hu, Levitt, & McCrory, 2002; M. Fisher, 2000; Lord, 2000) or academics calling for research into the interesting area of e-business operations (Balakrishan & Geunes, 2004; Angappa Gunasekaran, Sarkis, Sundarraj, & Burn, 2004; Rust, 2001). These expositions focus on the dynamics of the new economy represented by the increasing emphasis on services and the rapid expansion of the information economy and electronic networks (Rust, 2001). They tend to concentrate on the useful characteristics of the Internet for the conduct of business (M. Fisher, 2000), the difficulties and travails of e-business deployment (Ebner et al., 2002; Lord, 2000), and the opportunities for using e-business to improve operational efficiency (DeMark & Harcourt, 2004). The theme of Internet-enabled collaboration and coordination is underscored as a principle benefit of e-business (Balakrishan & Geunes, 2004). These articles were crafted, for the most part, to inform practitioners, raise interest in the e-operations subject matter, and establish that e-business initiatives were significant organizational ventures requiring focused attention on core, mission critical business processes, information flows, and technology application decisions. This material validates the burgeoning and continuing interest that practitioner's have in this topic for which this research addresses. Academics, such as Rust (2001), recognized the developing importance of e-business as applied to operating processes and began suggesting that this was an abundant area for serious research. Nonetheless, academics have been slow to investigate these phenomena as a means to add knowledge and understanding about e-operations (Angappa Gunasekaran et al., 2004); a situation that this study seeks to ameliorate.

Conceptual literature. The conceptual literature that either directly or obliquely addresses operations and internal processes within the e-business context reinforces the theme that the strategic and operating environments influence the nature and characteristics of a firm's internal e-business processes and technologies. Early on, Grover and Malhotra (1999) predicted that the collaborative and coordinative capacity of e-business technology would likely drive future business strategies and that those strategies would be dependent on the successful integration of operations and information systems strategy. They, like Kumar (2004), envisioned that Internet technology would dynamically interact with business processes within the organizational context to produce business value. Clegg, Icasati-Johanson, and Bennett (2001) supplemented this overarching view by further clarifying the technological and practice dimensions of e-business value. They proposed that successful e-business operating activities would be based not only on new technology but also on refashioned business relationships, redesigned or newly conceived processes, and empowered employees. These scholars effectively characterized the dimensions of e-business; the strategic and operating context and business process and information systems integration that Barnes and colleagues (2002) formalized into their framework for e-operations research.

These same themes have been examined and evaluated in light of diverse operating processes. Gunasekaran (2002) contemplated the use of e-business to influence all operations within the firm: marketing, purchasing, product design, production, sales, distribution, and human resource management. However, most theoretical attention has been directed at supply chain management (Gibson & Edwards, 2004; Kehoe & Boughton, 2001), customer relationship management (Ragins & Greco, 2003), and, to a much lesser extent, product design management

(Fahey et al., 2001), as all are considered to be the significant or core operating processes that can benefit from e-business. In all cases, the espoused theories predicted the successful conduct of business, increased operational efficiency, and the attainment of competitive advantage through the implementation of e-business.

A variety of e-business mechanisms and avenues were expected to produce organizational value. Some predicted that end-to-end business process integration would lead to the efficient flow of information within a business and thus create organizational value (Kehoe & Boughton, 2001). Similarly, it was believed that a more cooperative and participatory working environment fostered by use and reuse of an organization's information and knowledge would produce competitive advantage (Gibson & Edwards, 2004). Barnes and team (2003) and later Kumar (2004) made the point that the flexibility of e-business systems and infrastructure, the ability to quickly and economically adapt to changing business requirements, would be a significant component of ICT value. This is important because one of the hallmarks of the modern e-business environment and information driven economy is the exposure to almost continuous change. The value that firms could expect to appropriate from e-business, their motivations for launching e-business projects, is an important element in the e-business equation. Presumably, companies have thought through their risk-return equation and concluded that e-business initiatives bring value. However, it is not wise to presume this but rather seek evidence to validate or contest this presupposition. Accordingly, Research Question One is aimed precisely at this point: Why was the firm motivated to invest in e-business?

Along with expected benefits, there are also anticipated difficulties. Clegg and associates (2001) were particularly pessimistic about the ability of firms in the United Kingdom to

effectively implement e-business projects. They viewed the complexity of business process integration, the difficulties of integrating diverse legacy computing platforms, and the challenge of getting organizations to be receptive to change as being significant barriers to successful implementation and operation. Kehoe and Boughton (2001) postulated that the principle barriers to e-business deployment would be influenced by business processes and behaviors rather than artifacts of problematical technology installation. Grover and Malhotra (1999) also articulated the importance of understanding e-business implementation problems and pushed for investigations into the interaction between information systems and business processes. These concerns and warnings thus stimulate the inclusion of Research Question Three, as well as its sub-questions: What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations? What practices, under what conditions, proved to be the most and least useful and successful? How are the information requirements of operations addressed? How has e-business affected the level of integration between processes?

In aggregate, the conceptual literature probes at the relationship between business strategy, operational context, business processes, and e-business technology. It hypothesizes about the business value and competitive advantage that is derived there from. Given the consistency of focus across these articles, one is left confident in the capability of the Barnes Model to serve as a practical guide for studying and analyzing e-operations research. Further, this information provides solid grounding for two of the three research questions proposed herein.

Empirical Literature

Qualitative e-operations research. To date Barnes, Hinton, and Mieczkowska have been the most active e-operations qualitative researchers (Barnes, Hinton et al., 2003; Barnes et al., 2004; Mieczkowska et al., 2002). Beginning in 2002 and each year since, they have published the incremental results associated with a continuing research project investigating how United Kingdom (UK) organizations are undertaking electronic business and seeking competitive advantage through the management of their e-operations. Overall, they have produced case study research results covering twelve companies in the UK. These companies come from manufacturing, financial services, legal services, and retailing industries and represent small to multinational scope. While each company embodies a unique situation and it would be inappropriate to broadly generalize the results, Barnes and his team have been able to summarize several emergent issues from their aggregated data.

First, their results indicate that investment in e-business appears to be primarily a technology driven phenomenon. Companies fear being left behind by competition if they don't develop e-business technology expertise. Further, information technology appears to play the primary role in shaping e-business process design and how processes are subsequently managed. This implies that firms adjust their processes and operations to fit their electronic tools. Implementing e-business to improve business performance seemed to be a secondary consideration of this population of UK-based e-business firms. This research also indicates that even when firms follow general industry practice by implementing Internet-based ICT in their operations, that alone does not lead to any particular competitive advantage, rather it is how the technology is used that provides the unique business value.

Second, e-business companies are typically automating existing processes as opposed to re-designing them. This stands in counterpoint to the notions that processes should be freshly created through the exploitation of technology capabilities in context to business requirements (Davenport & Short, 1990; Hammer, 1990; Hammer & Champy, 2001). Third, e-operations are instituted as a discrete set of processes. There seems to be very little integration among e-business processes and conventional business processes. In some cases, this is by design and the result of strategic decisions to separate e-business initiatives from the mainstream of the traditional business operations. In other cases, it may be due to the difficulties of integrating legacy computing and communications equipment with open standards e-business technology.

Fourth, there appears to be a lack of formal performance measurements in e-business. This has two dimensions; one is that firms are not measuring the performance of their e-business projects. This seems to indicate that formal project management rigor is absent from e-business initiatives. Additionally, firms are not measuring the performance of their new e-business processes once they are implemented and operating. Fifth, legacy systems having architectures and design points that are inconsistent with Internet standards exacerbate the firm's ability to integrate its information systems. This makes it difficult to supply operations with the technologies that are both adequate and appropriate for the requirements. Finally, operations strategy and business strategy appear to be deeply intertwined. Changes to business strategy are likely to induce changes to e-operations strategy. Of course, this presumes that the strategic use of e-operations is a function of the development of an operations strategy that supports business strategy; an alignment issue.

Another qualitative study that contributes to the e-operations area of interest was produced by Aldin, Brehmer, and Johansson (2004). Investigating the Scandinavian operations of three medium-sized European companies, they determined that the e-business activities of these firms followed three stages of progressive development. In the first stage, a firm's e-business efforts were described as refining activities aimed at improving internal efficiency. The three companies in this study used e-business to fine tune their internal operating processes independently of the actions of their business partners. This is consistent with the definition of e-operations that underpins this proposed study. The second stage, in the progressive development cycle is the changing of processes for increased integration. Here the companies were looking for business value by contracting cycle times, reducing costs, and enabling services improvements. Again, this is consistent with the e-operations theme. Ultimately, the companies were trying to reshape business structures in order to reach new markets and customers. This may presage e-commerce initiatives and investments.

The results of the Scandinavian study supplements, rather nicely, the operational context module of the Barnes Model. The progressive development cycle further explicates the concept of operational context and adds more depth to the notion that firms evolve from traditional businesses to ones that are electronically endowed. A firm's e-business expertise and stage of development along the e-business path can be articulated in terms of the progressive development cycle.

The emergent findings of these studies prompt the inclusion of two specific research sub-questions: What types of project and operational measurements have been used to gauge the

effectiveness of the e-business project and its results? How has e-business influenced the automation, creation, or re-design of business processes?

Quantitative e-operations research. The e-business research community, thus far, has produced only a handful of quantitative methodology studies about the dynamics and interrelationships of e-operations strategy, operational context, business processes, and information systems integration. However, the few studies that have been completed add insight into certain firm's perceptions about strategy and motivation to pursue e-operations projects as well as expectations for benefits and value. They provide richer detail about organizational transformation and the associated barriers and inhibitors to successful e-operations implementation. Further, some of their evidence is inconsistent with the emergent issues that arose from the qualitative studies.

From a strategic perspective, it appears that most firms engage in e-operations as a product of the organization's strategic intent to achieve certain tangible and intangible business benefits (Chen & Chen, 2004). The tangible benefits include increasing revenue and profits, accelerating cycle times, reducing internal costs, and increasing employee productivity. Increased customer satisfaction, streamlined more efficient business processes, and improved customer service are some of the intangible benefits expected to derive from e-operations projects. Clearly, the companies surveyed by Chen and Chen (2004) were able to articulate specific rationales and motivations for engaging in e-operations. There is no evidence in this study that any sort of technological bandwagon effect was responsible for e-business investment.

Results from Tsikriksis, Lanzolla, and Frohlich (2004) seem to straddle those developed by Chen and Chen (2004) and those produced by Barnes and colleagues (2003). Their results

provide evidence that firms are motivated to take up e-operations both through an internally generated desire to improve business efficiency and as a result of external pressures to adopt e-business technologies. Thus, they observed that external pressures and expectations of increased firm performance were effective motivators to spur the development of e-operations projects.

Staying on the theme of firm motivation to pursue e-operations, Cao and Schniederjans (2004) looked at the strategic and operational mentalities that firms use when developing their e-operations perspective. They found that more successful companies-those showing market growth, high profitability, and solid reputations-emphasized quality, flexibility, and delivery in creating and leveraging their e-operations. Alternatively, low performing companies tended to adopt cost reduction strategies as a primary focus of their e-business endeavors. These results suggest that companies, reacting to their operational context, choose to implement e-business as a function of their intent to improve their businesses. Differing operational strategies are elected but, nonetheless, they are driven by the firm's rationale effort to improve rather than to react to external pressures.

The variety of results produced by these studies does not definitively answer the question: Why was the firm motivated to invest in e-business? This further justifies why this question, posed as Research Question One, was proposed for this study. In the end, there may be no one specific answer but rather an array of suitable answers. More information needs to be accumulated to determine what inspires firms to embrace e-operations. Is it out of strategic motives, reaction to external pressure, succumbing to bandwagon mentality, as a function of their performance and operational context, or some other stimuli? Thus, two sub-questions are

appended: What was the nature of any extra-organizational influence on the decision to adopt e-business? What internally generated factors influenced the organization to adopt e-business?

Another interesting dimension of e-operations is the relationship between a firm's transition to e-operations and the organizational changes it must endure. One of the emergent issues from a Barnes study (2003) was that firms appeared to be automating rather than re-designing their business processes. This seems to be counter intuitive to the business process transformation literature (Davenport & Short, 1990; Hammer & Champy, 2001; Smith & Fingar, 2003) and raises further interest in this aspect of e-operations. Barua, Konana, and Whinston (2004), looking at Internet-enabled business value, developed "strong empirical support for end-to-end digitization of the entire value chain … for enhanced business performance" (p. 612). This supports the notion that business process and systems integration leads to better business performance; however, they did not delve into the process change and creation aspects of system integration.

Kriendler, Maislish, and Wang (2004); however, directly addressed the transformation issue. They found, in a sample of Israeli companies, that transition to e-operations directly resulted in organizational redesign and improvement in dealing with customers and suppliers. They found that e-operations had positive effects on formal communications and information flows within the organization and that the "management of the organization must understand the processes of organizational design, redesign, and change" (p.66). Brews and Tucci (2003) also found that the use of the Internet to control and manage operations was inhibited when, among other things, firms didn't come to grips with the fact that process definition or redefinition is more problematical than technology installation.

These studies provide enlightening views into the perceptions and experiences of a variety of surveyed companies about process change as mediated by e-business ICT. Nonetheless, more information is needed to fully understand the business rationale and results occurring at the intersection of information system integration and organizational transformation. This is the major impetus for Research Question Two and two of its sub-questions: How has e-business been utilized to implement organizational, process, and information integration? How have pre-existing business and technology infrastructures influenced the evolution of the e-business project? How do the economies of e-business technology enable the management of internal operations? It also sustains the election to include sub-question three associated with Research Question Three: How has e-business affected the level of integration between business processes?

Before departing this discussion of e-operations research literature, there are some additional learning points to be gleaned from the quantitative studies. First, there are recognized internal barriers and inhibitors to the adoption of e-operations (Tsikriktsis et al., 2004). Examples of inhibitors include lack of leadership, insufficient organizational commitment, inability of organizations to adapt (Chen & Chen, 2004), lack of resources and skills, conflict among legacy system standards and open architecture e-business technology, poor process definition, and the scope and scale of transformation attempted (Brews & Tucci, 2003). While all of these inhibitors are important and should be evaluated, the latter two points are especially intriguing. The management advice offered by Brews and Tucci is that e-operational transformation should first focus on internal processes, and then after experience and competence are established, more complex and customer-facing processes can be rendered to e-business. Indeed, this may be what

firms naturally do. Interpreting the qualitative results of Aldin, Brehmer, and Johansson (2004), at least three Scandinavian companies, following the progressive development cycle, focused on internal business processes before entertaining more complex, complicated, wider-scoped external-facing transformation. Hence, sub-question one to Research Question Two is included. How have pre-existing business and technology infrastructures influenced the evolution of the e-business project?

Finally, much more needs to be understood about performance measurements in the e-business environment. Barnes and team (2003) were surprised at the apparent lack of attention to this area. Nemati and Backas (2002) seem to reflect a similar observation when they looked at the utilization of organizational data mining (ODM) within industry. They found very little use of ODM for industrial and manufacturing process optimization but an increasing interest among e-commerce oriented businesses. While ODM is just a subset of the data collection and analysis that can be conducted within organizations to develop operational measurements, more information should be collected on this topic. This is the goal of sub-question three associated with Research Question One.

The extant quantitative research is just beginning to probe at and shed light on the myriad dimensions of e-operations. However, the results of the studies, herein reviewed, offer substantial insight into the creation and justification of the research questions addressed in this research. Using these questions as a vehicle, this inquiry probes, in great depth, into the existing long running IBM Microelectronics Opportunity Management e-business project to provide additional light and knowledge about e-operations.

Summary and Conclusions

Definitions and Objectives

This review had multiple and broad objectives. The first was to establish definitions for e-business, e-commerce, and e-operations that would provide a basis for characterizing the domain of Internet-enabled internal business operations. To that end, the historical and traditional emphasis of commerce on trading and the exchanging of value grounds the definition of e-commerce. It is considered simply to be the use of the Internet and the Web to digitally enable commercial transactions between and among organizations and individuals. E-business was portrayed as an overarching strategic concept incorporating the notions of electronically mediated relationships, links, and integrations across operations and multiple stakeholders. Thus, an e-business is a firm that has made the commitment to configure itself to participate and conduct various activities in the online, electronic environment. The term e-operations was used to denote the use of e-business technology for the digital enablement of processes within a firm. Following this taxonomy, e-business is the blanket term that indicates the use of Internet and associated ICT for business purposes. E-commerce is the subset of e-business that addresses commercial transactions while e-operations is devoted to internal business operations. It was important to make these distinctions in order to clarify the focal point for this research which is the use of Internet technology as applied to internal business operations.

The second objective was to present the Barnes Model for investigating e-operations as a suitable conceptual framework for conducting this proposed research and, in so doing, review the theoretical underpinnings of its various modules. This provides the rationale for and establishes

the importance of strategic context, operational context, business process integration, and information systems integration to the understanding of e-operations.

The third and final objective was to review in detail the status of e-operations illustrative, conceptual, and empirical literature in order to reaffirm the fit of the Barnes Model, highlight the emergent issues and results that make this research more meaningful, and show how the work of other scholars has directly influenced the composition of the research questions.

Research Framework

The conceptual underpinning for the conduct of this research is based on the notions that evaluation of both strategic and operational context builds a picture of the setting, milieu, or environment that shapes a firm's view and ultimately its strategic decisions and operational choices. By understanding the strategic intent, current strategy, and fit or alignment among business strategy, processes, and supporting information and communications technology the researcher is better equipped to interpret the role that e-business operations are playing in the evolution of the business.

Evaluation of business processes that have been impacted, automated, or otherwise integrated through an e-business initiative provides evidence of the choices made by the firm and dictates how work will be accomplished. The same is true of information and communication e-business technology. Investigating this aspect of an e-business setting facilitates understanding of the business process pull and technology push that leads to information technology investment. As well, the investigation of existing and planned ICT infrastructure investment will, again, shed light on the fit between e-business and business strategy.

The Barnes Model for investigating e-operations effectively predisposes the researcher to pose broader, more general, and strategically oriented questions to participants before venturing into detailed operational topics and then to return to the strategic view from time to time. Any interview session or data analysis event, therefore, gathers both contextual data and process details that probe at both the strategic and operational landscape of an e-business initiative. Inspection of the proposed battery of research questions (see Table 2) shows that Research Question One arises from the strategic perspective, Research Question Two considers operational context, and Research Question Three draws from both the process and information systems integration domains.

The Barnes Model implicitly invokes one of Michael Porter's principal notions about the relationship between operations and strategy; that "operational effectiveness and strategy are both essential to superior performance" (Porter, 1996, p. 61). Thus, the Model prompts researchers to seek out the evidence that e-business operations indeed provide a firm with efficiencies, flexibility, and agility. It also promotes research into business strategy; that context setting influence, that makes the e-business project unique, value adding and, perhaps, inimitable.

Research Questions

Research question design was based on a process of understanding and interpreting the progressive evolution of the e-operations research literature. The illustrative literature documented the businesses community's interest in e-operations and the academic community's recognition that scientific research would increase the general understanding and knowledge of contemporary e-operations. This establishes a firm foundation upon which this study is based.

The conceptual e-operations literature re-emphasizes the suitability of the Barnes Model to guide an investigation into the core dimensions of e-operations: strategic and operational context and business process and information systems integration. The Model, thus, provides the broad based architectural blueprint for conducting this study. Since, the Model is broad and flexible, it does not constrain or artificially limit the reaction and contribution of participants or the creativity of the researcher yet it does provide the focus and guidance necessary to keep the research on target and on topic. Finally, the empirical literature presents the detailed facts, interpretations, and commentary that shape the content of each question. This, by intention, provides the opportunity to probe into areas where past information is either tentative or inconclusive.

Research Question One (see Table 2) and its sub-questions, under the umbrella of strategic context, draws attention to the stimuli and motivations that are antecedents to a firm's decision to embrace e-operations. By probing at a firm's strategic intent, aspirations for organizational efficiency, desire for adaptability, reactions to external pressure, or rational plan to achieve competitive advantage it is possible to understand the environment that produced the project and influenced its configuration and evolution.

Research Question Two (see Table 2) and its accompanying sub-questions focus on the operational influences and effects of deploying the e-operations project. It shines the light of inquiry on the issues of end-to-end business process integration, the context created by pre-existing, legacy systems and processes, the interfaces to standardized technology, the complexity of cross-functional process integration, and the philosophies of simple business process automation.

Table 2: Proposed Research Questions Sources and Inspirations		
Question	**Topic**	**Inspiration**
Strategic Context		
Research Question One: Why was the firm motivated to invest in e-business?	Organizational value Competitive advantage	Barnes, D., Hinton, M, & Mieczkowska, S. (2003) Brews, P.J., & Tucci, C.L. (2003) Chen, Q, & Chen, H-M. (2004) Gibson, P.R, & Edwards, J. (2004) Kehoe, D.F. & Boughton, N.J. (2001) Nemati, H.R. & Barko, C.D. (2002) Tsikriktsis, N., Lanzolla, G., & Frohlich, M. (2004)
1) What was the nature of any extra-organizational influence on the decision to adopt e-business?	External pressure	
2) What internally generated factors influenced the organization to adopt e-business?	Organizational efficiency, Strategic intent	
3) What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?	Measurement deficiency, Organizational data mining	
Operating Context		
Research Question Two: How has e-business been utilized to implement organizational, process, and information integration?	End-to-end integration	Aldin, N., Brehmer, P-O, & Johansson, A. (2004) Barnes, D., Hinton, M, & Mieczkowska, S. (2003) Barua, A, Konana,P., & Whinston, A.B. (2004) Brews, P.J., & Tucci, C.L. (2003) Chen, Q, & Chen, H-M. (2004) Grover, V. & Malhotra, M.K. (1999) Tsikriktsis, N., Lanzolla, G., & Frohlich, M. (2004
1) How have pre-existing business and technology infrastructures influenced the evolution of the e-business project?	Legacy systems Legacy processes Progressive development stages	
2) How do the economies of e-business technology enable the management of internal operations?	Complexity, Standardization	
3) How has e-business influenced the automation, creation, or re-design of business processes?	Automation vs. re-design	
Process and Systems Integration		
Research Question Three: What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations?	Implementation difficulty, Business processes and behaviors	Brews, P.J., & Tucci, C.L. (2003) Clegg, W.C., Icasati-Johnson, B., & Bennett, S. (2001) Kehoe, D.F. & Boughton, N.J. (2001) Kriendler, M.I., Maislish, R., & Wang, S. (2004)
1) What practices, under what conditions, proved to be the most and least useful and successful?	Internal barriers, Org. commitment, Scope & scale of transformation	
2) How are the information requirements of operations addressed?	Flexibility, Work environment Adaptability	
3) How has e-business affected the level of integration between processes?	Process definition Information flows Technology installation	

versus process creation and re-design. By attempting to understand these elements of operational context, it is easier to comprehend the specific decisions and approaches that influenced the specific design of the firm's e-operations.

Finally, Research Question Three (see Table 2) addresses the interrelationships and effects of business process and information systems integration. Research attention is initially tuned to the issues of implementation difficulties and barriers, organizational enablement, scope and scale of attempted transformation, and the challenges posed by the interactions between process definition and technology installation and exploitation. This line of questioning seeks to elicit information about the results and experiences of actual project implementation and operational results.

In aggregate, these questions, inspired by the writings of scores of e-business researchers and pundits, provide much needed information regarding the use of Internet and Web technologies and practices to enable a firm's internal transactions and processes. These questions provide information to enrich the existing body of knowledge about the extent to which an established firm, IBM Microelectronics, uses the Internet to conduct its business operations. They also produce information about the factors that affect the adoption of e-business and the subsequent impact of e-business on a firm's internal processes and operations.

CHAPTER 3. METHODOLOGY

"We have to remember that what we observe is not nature in itself but nature exposed to our method of questioning"…..*Werner Heisenberg*

Introduction

This research project was undertaken in order to determine the extent to which an established firm uses the Internet to conduct business, to develop empirical evidence about the factors that affect the adoption of electronic processes in the firm, and to establish the impact of e-business on internal business processes and operations. Very few empirical studies have, thus far, addressed these aspects of e-business, and while they have produced valuable results, more information is needed to fully characterize the e-operations dimension of e-business. Thus, new research featuring a fresh venue and a unique e-business initiative can greatly contribute to enriching the body of knowledge about e-business influences on internal operations.

To make this additional contribution, an inquiry was made into the Opportunity Management e-business initiative of IBM Microelectronics Division (MD). IBM MD, the semiconductor technology supplier to the IBM Corporation and a supplier to the Original Equipment Manufacturer (OEM) markets, has developed and implemented its Opportunity Management project to improve end-to-end internal business operations associated with their ASIC and Foundry businesses. These operations span the globe and involve many thousands of MD employees. This venue offers a rich source of information about the knowledge, experience, and results obtained by real-life practitioners working within an active, evolving project.

Research Methodology

The consistent advice given to researchers is that the selection of an appropriate method of inquiry is fundamental to the success of any research project (Barnes, 2001). Experts in research methodology, such as Creswell (2003) and Robson (2002), recommend that researchers should match their research methodology to the nature of the research problem and the form of the research questions. Thus, it is advisable to review this research's purpose and research questions as a prerequisite for selecting a research strategy.

Research Purpose

The purpose of this study was to investigate the e-business technologies and practices used by and in IBM MD to enable its internal Opportunity Management business processes and operations. This project explored the strategic and operational factors that provided the context and influenced the decision by IBM MD to invest in its Opportunity Management e-business initiative. This study also seeks to describe how this context shaped the design of internal business operating processes and the selection and deployment of e-business Information and Communication Technology (ICT).

Research Questions

The research questions for this project are guided by the intention to discover and understand the firm's e-business evolution. This includes learning about how they are managing their operations, and how they are adapting traditional pre-existing processes, practices, and organization to leverage e-business. Question One draws attention to the stimuli and motivations that are antecedents to a firm's e-business investment decisions, Question Two probes into the operational influences and effects of deploying the e-operations project, and Question Three

addresses the interrelationships and effects of business process and information systems integration.

Research Question One: Why was the firm motivated to invest in e-business?

This question is accompanied by three supporting sub-questions:

a) What was the nature of any extra-organizational influence to adopt e-business;
b) What internally generated factors influenced the organization to adopt e-business; and
c) What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?

Research Question Two: How has e-business been utilized to implement organizational, process, and information integration?

This question is supported by the following sub-questions:

a) How have pre-existing business and technology infrastructures influenced the evolution of the e-business project;
b) How do the economies of e-business technology enable the management of internal operations; and
c) How has e-business influenced the automation, creation, or redesign of business processes?

Research Question Three: What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations?

The following sub-questions can add dimension to the primary inquiry:

a) What practices, under what conditions, proved to be the most and least useful and successful;
b) How are the information requirements of operations addressed; and
c) How has e-business affected the level of integration between business processes?

Qualitative Approach

The statement of research purpose offers several specific indicators that favor the selection of a flexible, qualitative research approach. At first order, this research is exploratory. Creswell (2003) recommends qualitative design when a study is exploratory, particularly when little prior research has been conducted on the topic. The literature review documented in Chapter Two establishes this condition in the case of e-operations research.

Next, this study seeks to grasp the strategic and operational influences that provide context for understanding the e-operations phenomenon. Qualitative methods are generally considered to be most appropriate when the context of an experience is a major element of its nature (Lucasey, 2000; Robson, 2002). This requires a researcher to understand the unit of analysis in its natural setting and to grasp the meaning that people attach to their everyday business experiences (Poggenpoel, Myburgh, & Van Der Linde, 2001). This type of information is best collected through direct interaction with knowledge sources and then documented by some ideographic means wherein the researcher captures the attitudes, opinions, feelings, thoughts, observations, evaluations, and behaviors of those involved in the setting.

Third, operations-related studies, those focusing on internal business processes and practices, are regarded as complex, dynamic, and difficult to understand (McCutcheon & Meredith, 1993;

Voss, Tsikriktsis, & Frohlich, 2002). Understanding these types of situations requires a flexible and holistic research approach that supports an investigator's efforts to comprehend processes and structures, and discern patterns in the information that is obtained (Van De Ven & Huber, 1990; Verschuren, 2003).

Finally, qualitative methods are best adapted for those cases where a researcher must isolate abstract ideas and concepts from raw data (Crowley, Harré, & Tagg, 2002) and understand the socially constructed reality perceived by each participant (Creswell & Miller, 2000).

All things considered, this study appeared to be best served by applying a qualitative, flexible, and emergent design rather than one that was tightly preconfigured. This investigation, whose aim was to understand a relatively new phenomenon, e-operations, within a unique setting appeared more amenable to an approach that allowed ideas and concepts to emerge throughout the course of study as opposed to being limited by existing models or predefined study templates (Martinsuo, 2001). It would have been inappropriate to use a quantitative design that is usually associated with attempts to establish causal relationships between variables or comparisons of groups (Robson, 2002). As Hadjistavropoulos and Smythe (2001) point out, when a researcher seeks to understand and articulate the meanings of people's experience rather than formulate general laws of behavior, a qualitative design is preferable. The qualities and attributes of qualitative research display the flexible nature of the methodology and its ability to accommodate the complex, holistic, natural environment presented by this research project.

Case Study Research Strategy

Robert K. Yin, one of the foremost experts in case study research design, recommends the case study as the "preferred strategy when 'how' or 'why' questions are being posed, when the

investigator has little or no control over events, and when the focus is on a contemporary phenomenon within some real-life context" (Yin, 2003, p. 1). Benbasat, Goldstein, and Mead (1987) find the case study approach particularly appealing when looking at practice-based problems where knowledge of context is crucial to understanding the experiences of participants. Stuart, McMutcheon, Handfield, McLachlin, and Samson (2002) argue that case studies should be favored when examining complex environments while Meredith, Raturi, Amoako-Gyampah, and Kaplan (1989) find case studies to be a robust option for operations research.

The characteristics and profile of this research project correspond with the various conditions highlighted above. First, the research questions are all 'how' and 'why' questions. They are each dedicated to exploring, describing, and probing at the e-operations phenomenon. Second, the IBM MD Opportunity Management initiative is an active project and set of operational business processes. Processes and practices are constantly in review, new ones are being designed and developed, and an on-going stream of project implementations are in progress. Likewise, the existing Opportunity Management systems and functions are a crucial part of MD's active in-process e-operations. There is little tolerance by the business for interrupting or manipulating them for the purpose of research. Much of the data necessary for this project is retrospective in nature; the events have already occurred and must be examined by looking at historical evidence or through the recollections of participants. The case study method with its use of multiple sources of evidence such as historical documentation, interviews, and participant observation (Yin, 2003); therefore, provided a robust vehicle for coping with the unstructured, low control, and highly contextualized Opportunity Management environment.

Other methods within the qualitative repertoire were discounted. Narrative or Phenomenonological research tends to focus on a very small number of participants and does not provide the breadth of information necessary to effectively explore multiple aspects of an organizational event (Creswell, 2003). The prolonged duration, personal resource commitment, and unlikelihood that a business organization would embrace a researcher's presence for a very long period excluded ethnography's applicability (Robson, 2002). Finally, Grounded Theory is used most often in "applied areas of research where the theoretical approach to be selected is not clear or is non-existent" (Robson, 2002, p. 192). This research; however, was guided by the clear theoretical framework provided by the Barnes Model for investigating e-operations. Thus, a Grounded Theory approach was not advantageous or necessary in this instance.

This research was conducted as a single case study of the IBM Microelectronics Division (MD) Opportunity Management e-business initiative. This venue is likely to be similar to many other e-business projects that are implemented within large multinational business organizations but, equally important, this research setting represents an opportunity that in other circumstances would most likely be inaccessible to scientific investigation. However, in this situation, this venue was available and sanctioned for investigation by MD executive management.

The selection of the case study research design is not an unusual option for operations and information systems research. Benbasat, Goldstein, and Mead (1987) have heartily endorsed case study research as an effective method, well-suited to capturing practitioner knowledge. Case study design also has a long history of use and approval within the operations research community (McCutcheon & Meredith, 1993; J. Meredith, 1998; Stuart et al., 2002; Voss et al., 2002) and of course case studies have been used for operations strategy research (Barnes, 2001)

and e-operations research (Aldin et al., 2004; Barnes et al., 2002; Barnes, Hinton et al., 2003; Barnes et al., 2004). This research, then, continues with the well established tradition of case-based research in the operations-related functions of a firm.

Role of the Researcher

The Researcher

Two distinguishing attributes of case study research are that it is conducted by an individual who serves as the primary data collection instrument (Robson, 2002) and as the principal interpreter of the research evidence (Creswell, 2003). Thus, the values, assumptions, experience, preconceptions, and bias of the researcher influence the conduct and presentation of the study. This makes it necessary for the consumer of this research to clearly understand the background, experience, and motivations of the researcher.

This research project was conducted by a long time IBM employee and manager operating within an IBM semiconductor manufacturing and development setting. Over a twenty three year span, the researcher has managed departments, functions, and projects in a wide variety of technical settings: production and inventory control, pricing and competitive analysis, product business operations, strategy formulation, and, most recently, e-business transformation and e-operations implementation. All of these assignments have been in operations intensive environments associated with the production of semiconductor chips, the design and development of customized logic products, or the planning, design, development, and deployment of e-operations. The researcher holds an MBA, has completed several years of advanced study in organization and management, research methodology, the protection of human research subjects, and electronic business. Moreover, the researcher has served as a Naval Flight

Officer in the United States Navy, is a member of the Academy of Management Research Methods Division, and is an adjunct faculty member within the Champlain College Masters in Information Technology and Innovation Management program.

This comprehensive background has enabled the researcher to develop and effectively exercise many of the skills and attributes that are considered essential for the conduct of good research. For instance, Robson (2002) maintains that an open and inquiring mind, ability to attentively listen, and a capability to remain sensitive and responsive to contradictory evidence are important researcher characteristics. Yin (2003) further suggests that a good researcher is adaptable and flexible, has a firm grasp of the issues, is unbiased, and has no preconceived notions. The argument can be made that the researcher, who has adapted and flourished in many and varied assignments, who has been the leader of many scores of IBM employees, and who has had extended and varied professional and academic experiences was well suited to the conduct of this research. However, in the spirit of transparency and openness, it should be noted that the researcher has been considerably influenced by formal education, molded, to a certain extent, by past colleagues and mentors, and benefited from both the travails and exhilaration of day-to-day business life in a major technology corporation. Therefore, throughout this study, measures will be taken to mitigate the effect of innate bias or preconceived notions and attitudes. These measures will be addressed in detail in a following section: Case Study Tactics for Scientific Rigor.

Participant Connections and Access

The spirit or élan of this research was to work with or collaborate with participants to unlock the research evidence contained within their knowledge, experience, opinions, personal

perspectives, and reflections. All prospective participants are personally known to the researcher, some as long as fifteen years and others for four or five years. A cordial and professional working relationship exists with each of these individuals. In fact, a reasonably high level of trust and respect exists with this group of people. This provides a certain advantage to case study research as higher trust tends to beget higher cooperation and concomitantly higher data quality (Irvine, 2003). Further, having pre-existing knowledge and experiences about the research situation and people can be a key determinate of research success (Cooper & Schindler, 2003; Robson, 2002).

Permission to conduct a case study of the IBM MD Opportunity Management e-business initiative was granted by the IBM executive-owner of the project (see Appendix A). Permission was granted to use non-IBM confidential historical documents and to approach employees with a request to voluntarily participate in the research. This endorsement of academic research is consistent with IBM's long standing commitment to support education and learning as long as the proprietary assets and intellectual property of the institution are protected.

Prudence dictated that one should anticipate that ethical issues or dilemmas could arise during the conduct of this research. In all cases, participants were treated as collaborative research partners. Respect was accorded to their valuable time and to their desires for confidentiality and anonymity. It was vitally important that their trust in the researcher not be violated, as the researcher must continue to work with these people long after the research project has become a delightful memory.

Insider Research

Clearly, a unique opportunity existed to delve into the e-operations functions of a premier business organization: IBM Microelectronics. The researcher understands the customs, values, and mores of the IBM Company, in particular, and the high technology engineering culture associated with the semiconductor business in general. The key executives, managers, and project staff are well known, and access to the selected participants was not difficult to attain.

Since the researcher is a member of the organization and the specific unit of analysis, this is obviously an insider research project (Doyle & Brannick, 2003). Many contend that practitioner-led research provides more breadth and flexibility than traditional methods of research (Balogun et al., 2003) and exposes sites and situations to the light of research that might otherwise remain untapped (Doyle & Brannick, 2003). This allows for the researcher-participant relationship to produce scientifically relevant, distinctive contributions, insights, and knowledge about organizations.

Oftentimes, academic research is criticized for being too narrow and removed from the concerns of practicing managers (Coghlan, 2003). This research, conducted by a research-practitioner, is intended to be stimulating to practitioners and purposefully, conceptually, rigorously, and scientifically conducted. Thus, it is hoped that it will be both interesting and well justified, the former being of primary interest to practitioners and the latter to scholars (McFarlin & Chelle, 2005).

Research Design

Unit of Analysis

The goal of defining a unit of analysis is to establish the events, attributes, and activities that are of theoretical interest to a study, and subsequently to focus multiple perspectives on it (McClintock, Brannon, & Maynard-Moody, 1979). The unit of analysis examined during this research was the Opportunity Management e-business initiative that exists within the context of the IBM Corporation and its Microelectronics Division (MD). As previously mentioned, this initiative was launched in order to bring MD's ASIC and Foundry custom logic semiconductor opportunity and design operations into the on-line electronic environment. As such, the concept of physical location has less meaning and relevance to this unit of analysis than does the notion that e-business enables geographically dispersed individuals to collaborate over time and space to accomplish business goals. So while there may be certain physical centers of gravity associated with IBM's Burlington, Vermont and East Fishkill, New York manufacturing and development facilities, those involved with and influenced by the Opportunity Management project are located across the United States, in South East Asia, and throughout Europe.

From a conceptual viewpoint, the Opportunity Management initiative has three dimensions that distinguish who is and is not in the case (Yin, 2003) and define the bounded context of the case (Miles & Huberman, 1994). First, it is the organization of company management and resources dedicated to evaluating, designing, developing, deploying, and administering the project deliverables, the new electronically mediated business processes. Second, it is the e-operations themselves, the aggregate of business processes and technology through which the

business accomplishes its work. Finally, this unit of analysis has a temporal dimension that begins in October 1999 and continues to the present time.

Sample Population

The key task of this research was to devise a sampling approach that would produce a suitable number of participants who were knowledgeable, capable, and willing to provide the information prescribed by this study's conceptual framework and research questions. The sampling approach needed to be flexible in terms of time, money, and ease of access required for contacting and interacting with participants (Miles & Huberman, 1994). In this case, where the goal was to elicit specific information regarding strategic and operational context and business process and information systems, participants needed to have a high likelihood of possessing the requisite knowledge. The researcher's judgment, therefore, played a significant role in identifying the participants. Accordingly, a non-probability purposive sampling plan (Cooper & Schindler, 2003) appeared to be most appropriate for initiating the project.

In actuality, there were three relevant groups of participants. There were executives who commissioned the project, provided the funding, and provided executive oversight throughout the conduct of the project. The second notable group was formed from those key leaders that managed the project through the system lifecycle and provided the technical and organizational transformation locus of control. The final group consisted of those who manage and execute the e-operations business processes. Thus, the sample can be considered both purposeful and stratified as it has the potential to illustrate differences in understanding and experiences between the three groups. It was rational to expect that the executives would be well versed and conversant about strategy and strategic intent related to the e-business project. The project team

leaders were more attuned to the issues of process and systems integration while the business process owners were able to provide information about operational context and business process execution (see Table 3).

Table 3: Data Sources / Data Topics

	Strategic Context	**Operational Context**	**Business Process Integration**	**Information Systems Integration**
Source	**Research Question One**	**Research Question Two**	**Research Question Three**	
Executives	Primary	Secondary		
Business Process Owners		Primary	Secondary	
Project Leaders	Secondary		Primary	Primary
Documentation	Tertiary	Tertiary	Tertiary	Secondary
Degree to which Sources contributed information by Topic				

Having established who should be in the research sample, it was necessary to determine how many should be included. The boundary conditions for this exercise were a bit nebulous. Both Bowman and Ambrosini (1997) and Barnes and colleagues (2003) argue that the information produced by a single participant is probably unreliable because that information may be attenuated by the individual's bias, ignorance of certain facts, or misjudgments of complex issues. On the other hand, Robson (2002) advocates for a sampling strategy that ceases to add new participants only when the addition of new information ceases to add value to the existing pool of information. In other words, the researcher should continue adding participants until the point of information saturation is reached or incremental learning becomes minimal (Eisenhardt, 1989).

Estimating, in advance, the number of participants necessary to achieve saturation appeared to be somewhat of an art form. There are several issues such as the quality of data collected, scope of the study, nature of the topic, quantity of cataloged information, and number of possible

interviews per participant that directly or indirectly influence the optimal number of participants (Robson, 2002). Perhaps the most concrete advice is offered by Morse (2000). In the instances where researchers use semi-structured interviewing techniques and are getting small amounts of data per participant, she recommends thirty to sixty participants. Alternatively, where researchers have access for multiple interviews and are collecting deep, rich data from each participant only six to ten participants may be required.

Given all of these considerations, the participant sample included five each of executives, business process owner management and operatives, and key project leaders, for a total of fifteen participants (see Table 4). This was prudent from two perspectives: 1) with more than fifteen data sources this project could easily have become unwieldy for this solo researcher, there would have been too much data to evaluate and too many combinations and permutations of data to assess (Miles & Huberman, 1994) and 2) there was always the option of adding to the sample during the course of the study if circumstances so dictated. However, given the richness, detail, and interest of the fifteen selected research participants, data saturation was manifestly attained. In aggregate, the sample consisted of twelve males and three females whose ages are estimated to be between thirty and sixty five years.

Table 4: Research Participants

Executives	Project Team Leaders	Process Owners
CIO	Project Manager	Design Center Manager
Project Exec. Owner	Consultant	Customer Relationship Management (CRM) Process Owner.
Design Center Exec.	IT Architect	FAE Process Owner
Field Applications Engineering (FAE) Exec.	Senior Engineer	ASIC Methodology Eng.
World Wide FAE Exec.	Senior Technical Staff Member (STSM)	Tactical Marketing Specialist

Data Collection Methods

Documentation. The prior section concentrated on the issues related to the identification, selection, and size of the participant sample. Ostensibly, this is done as a prelude to a discussion about interviewing strategies. Of course that is true, but it must be remembered that a case study draws upon all available sources of data and information to add depth and texture to the evidence pool. In the case of this research, a six year record of historical documents that chronicle the project's lifecycle was available for analysis. These documents included minutes of team meetings, project reports, presentations, executive and management communications, and operating data from deployed systems. These documents were prepared by various MD employees in real-time so they provide an effective means to cross-check and corroborate interviewee accounts. Therefore, this study should not be defined solely in terms of interview results but more importantly in terms of the integration of all of the available data (see Table 3).

Good documentation, that which has been thoughtfully and attentively produced (Creswell, 2003), is extremely valuable to a study because it is a form of evidence that is not specifically created as a result of the case study (Yin, 2003). It is a stable form of information that is reflective of the issues, concerns, and thinking that was prevalent at the time the documents were created. Thus, as long as the documents are complete, authentic, and accurate (Creswell, 2003), information from them can be used to corroborate and supplement other sources of evidence (Yin, 2003) and perhaps stimulate a participant's fading memories or induce reflections on past events and experiences.

In the course of this study, 294 documents were examined. Two hundred and one were presentations, meeting minutes, reports, and metric documents. Ninety three were executive,

management, and project team communications. Out of this pool of documents, forty six were thoroughly scrutinized for content and specific data points (see APPENDIX E).

Interviews. Interviews were an appropriate and rich source of information for this research. As previously explained, the participants have all experienced the project during various phases of its evolution or have utilized the electronic processes and technologies provided by the project. Therefore, a research mechanism such as interviewing offered the opportunity to capture and document the participant's recollections, perceptions, evaluations, and personal meanings attributed to the events of which they were intimately involved. Interviews are particularly valuable for capturing historical information about a phenomenon (Robson, 2002). They are an adaptable, flexible way of securing data that allows the researcher some control over the line of inquiry (Creswell, 2003). They also give the interviewer the option to adjust or modify the pre-existing questioning plan to target interesting or insightful conversation while it unfolds.

Certainly, there are difficulties with interviewing as a data collection methodology. First of all, they are time consuming (Robson, 2002) and require considerable preparation and post-interview documentation effort. Moreover, the information that participants supply provides only indirect evidence because it has been filtered through their views and may be biased in some way by the researcher's presence (Creswell, 2003). Information could be inaccurate due to poor recall or because of interviewer reflexivity, an attempt on the part of the interviewee to give what the interviewer wants to hear (Yin, 2003). In balance, though, there are countermeasures for these disadvantages, which will be discussed in the following sections, and there is no other

form of information collection that allows for such personal exploration of the meaning of some event or phenomenon.

Each of the fifteen potential participants were asked to engage in sixty to ninety minutes of semi-structured, open-ended questioning, dialog, and guided conversation (Yin, 2003). The line of questioning was based on each research question and associated subordinate questions as these questions were designed to open the topic on a broad scale yet allow the conversation to funnel down toward more specific details. Appropriate probe statements were prepared in advance (see Table 5) to be used in the event that participants needed to be stimulated to answer more completely or relevantly to the line of inquiry (Cooper & Schindler, 2003). Roughly, one third of the interview time was devoted to each research question. The Interview Process Protocol and Case Study Protocol are included in Appendix B.

Fourteen interviews were conducted face-to-face at either IBM's Burlington, Vermont or East Fishkill, New York facilities. One interview was conducted via transatlantic phone call. Although there are several disadvantages to electronic communication, such as lack of social presence (K. Fisher & Fisher, 2001), reduced information richness (Duarte & Snyder, 2001), and difficulty in orienting to task (Lipnack & Stamps, 2000), there are some interesting advantages. The obvious advantage is that it overcomes geographical concerns and allows someone to participate in the research that otherwise could not be included. Further, when compared to personal interviewing, telephone interviews are not subject to bias caused by the physical appearance, body language, and actions of the interviewer (Cooper & Schindler, 2003). This allows the telephone interview to be quite effective and productive. In general, asking questions and stimulating engaging conversation is an art form that can be mastered by a well prepared

researcher. The goal was, as Yin (2003) advises, to follow the line of inquiry while posing questions in an unbiased manner.

In all cases, the researcher, with the permission of the participants, recorded each interview. The interviewer took notes highlighting particularly engaging themes, expressions, body language, and impressions of certainty or veracity of responses. Following each interview, the researcher summarized the high points of each encounter in a contact summary form (Miles & Huberman, 1994) such as the one in Appendix B. Each interview was reduced to a written transcription and presented to the participant for verification before the data was analyzed.

This research project produced thirteen hours of interview recordings which yielded 184 pages of single spaced, twelve point typed transcripts. On average, each interview took fifty minutes to cover the topic material. Process Owner and Executive interviews lasted about forty minutes per session while Project Team Leadership conversations lasted an average of nearly seventy one minutes. In thirteen of fifteen interviews, there was no time pressure that inhibited thorough investigation of the research topics. Two interviews, one with the Owner Executive and the other with the Design Center Manager, were somewhat rushed; however, the topics that were expected to be of high relevance to these individuals was adequately covered.

Observation. Data gathering by direct observation has been a valuable tool in the qualitative researcher's repertoire. Prolonged observation, especially, has been a hallmark of classical anthropological research. In the context of case study research, observation has been a technique whereby the researcher can, in some measure, perceive reality from the viewpoint of someone inside the unit of analysis (Yin, 2003). Through observation, researchers may become better equipped to explain the meaning of the experiences of those being observed (Robson, 2002).

However, in the case of this research, observation was not proposed as a unique, specific research activity. Rather, the researcher, an insider, has had the benefit of years of involvement and association within the research setting and is thus better suited than most to interpret the meanings ascribed by participants to the phenomenon under study, the MD Opportunity Management e-business initiative. Adding specific observation events or activities to this study's research protocol would not have likely produced new insight above and beyond what was already possible. In fact, it could well have been disruptive as it might have compromised the normal flow of decision making events and interactions inherent to the business environment and thus produce what Coghlan (2003) describes as role conflict, role duality, loyalty tugs, and identification dilemmas for the researcher. It can be said, therefore, that observation plays an implicit role in this research as opposed to a direct, event-driven or activity-based role.

Line of Inquiry

One of the purposes of the literature review documented in Chapter Two was to highlight the emergent issues and results of prior studies in order to ensure that this research can be truly meaningful and show how the work of other scholars has directly influenced the composition of this project's research questions. Table 2 on page 58 summarizes the sources and inspirations for the research and subordinate questions. As previously stated, the research question design was based on a process of understanding and interpreting the progressive evolution of the e-operations literature. Illustrative, conceptual, and empirical e-operations works were evaluated and all contributed to the content and focus of the stated line of questioning.

The researcher initiated every interview by introducing the Barnes Model topics: strategic context, operational context, and business process and information system integration and

pointing out the distinctions among e-business, e-commerce, and e-operations. Each line of inquiry was launched by either directly or indirectly asking the primary research question and then followed by the sub-questions as appropriate to the direction and flow of the conversation. The sub-questions are more specific than the principle research questions and tended to stimulate conversation about the more focused dimensions of the general topic. The thematic elements associated with each question were used as probes and stimulators to encourage deeper, richer conversation on each topic (see Table 5a and 5b).

Table 5a: Line of Inquiry

Theme	Research Question	Focus Questions	Probes
Strategic Context	Why was the firm motivated to invest in e-business?	1) What was the nature of any extra-organizational influence on the decision to adopt e-business? 2) What internally generated factors influenced the organization to adopt e-business? 3) What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?	Organizational value Competitive advantage External pressure Organizational efficiency Strategic intent Process and system interactions Measurement deficiency, Organizational data mining
Operating Context	How has e-business been utilized to implement organizational, process, and information integration?	1) How have pre-existing business and technology infrastructures influenced the evolution of the e-business project? 2) How do the economies of e-business technology enable the management of internal operations? 3) How has e-business influenced the automation, creation, or re-design of business processes?	End-to-end integration Legacy systems Legacy processes Complexity, Standardization Automation vs. re-design

Table 5b: Line of Inquiry (Continued)			
Theme	**Research Question**	**Focus Questions**	**Probes**
Business Process and Information Systems Integration	What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations?	1) What practices, under what conditions, proved to be the most and least useful and successful? 2) How are the information requirements of operations addressed? 3) How has e-business affected the level of integration between processes?	Implementation difficulty, Business processes and behaviors Internal barriers, Organizational commitment, Scope & scale of transformation Flexibility, Work environment Process definition Information flows Technology installation

Data Management

Yin (2003) recommends that "every case study project should strive to develop a formal, presentable database, so that in principle, other investigators can review the evidence directly and not be limited to the written case study reports" (p. 102). Miles and Huberman (1994) further suggest that a well formatted, cross-referenced, and indexed database is essential to a high quality study. Both scholars advise that raw data, notes, files, documents, write ups, and transcriptions should be included in the case study database.

Data management for this research has been a completely digital undertaking. All information was captured or rendered to digital form for computer manipulation, transmission, and storage. During the course of the study all data was secured on the researcher's desktop and notebook computers, and on a detachable flash memory storage device. During the research and data analysis phases of the project, backups were made twice a week to the flash memory storage device. Final, data backups were made to CDROM media.

All interview data was captured in the form of digital audio files through the use of a Sony ICD-MS515VTP digital audio recorder. These files were then transcribed into Microsoft Word documents and saved in digital form as well. Opportunity Management documents were all collected in digital form such as word processor or presentation files. All hardcopy documents were scanned to digital form. All supporting documents, analytical materials, and written reports were saved in digital form and periodically backed up to flash storage.

Data protection has been assured via a multilayer and distributed security strategy. Access to each computer has been secured via separate hard drive and operating system passwords. Raw data files contain identifier codes. Code lists and data files were saved in separate directories and the code-to-data reference key has been encrypted and password protected. All data will be retained for no less than seven years.

The goal of the database strategy is to retain and interrelate the various data that forms the chain of evidence that underpins this study and supports its reliability (Yin, 2003). Thus, the database design supports the linking of the case study questions, case study protocol, and specific evidence by source, the analysis, and the case study report.

Data Analysis Plan

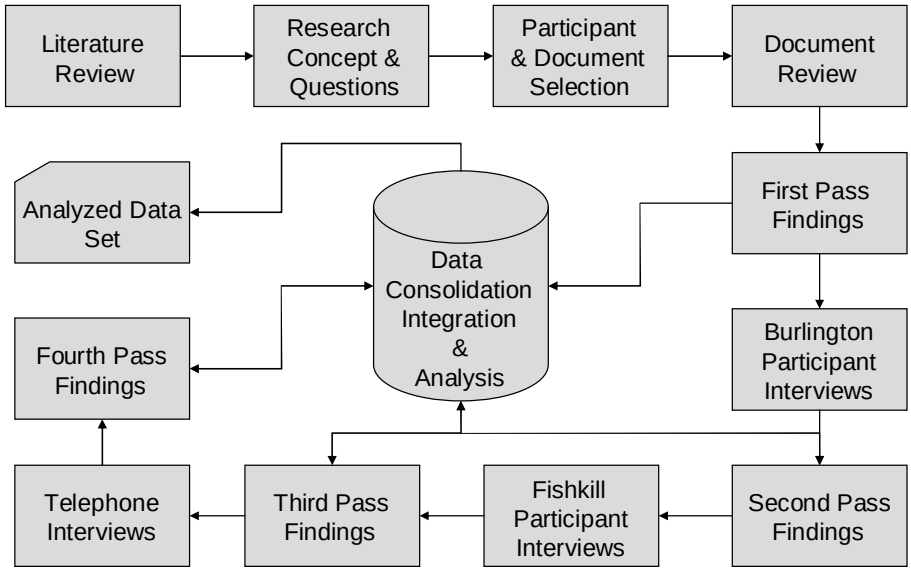
High quality data analysis rests on the ability of the researcher to demonstrate that all of the evidence obtained in a study was given due consideration (Maxwell, 1992), that conclusions were reached only after alternative explanations and interpretations were evaluated and discounted, and the most significant aspects of the case were thoroughly explored (Yin, 2003). To achieve this, an analytical strategy must be implemented that clearly illuminates the rationale, procedures, and chain of evidence that leads to a compelling conclusion.

This research used the generally accepted iterative-parallel or cyclical method of data analysis (Elsworth, 1994; Miles & Huberman, 1994; Robson, 2002; Verschuren, 2003) wherein raw data was reduced to meaningful categories and themes, reflected on and summarized, and then rendered to some form of visual display that supports final inspection, examination, and interpretation. The iterative, cyclical nature of this process is manifested in the practice of constantly comparing new data and new interpretations to the evidence and interim interpretations previously established. The analysis commenced during the data collection phase of the research project and terminated only when additional data ceased to enhance earlier conclusions.

The analytical work for this case study commenced once Opportunity Management historical documents were made available. First pass analysis was conducted on these documents. This initial analysis was scrutinized in light of the first wave of participant interviews and each succeeding wave of interview information was compared to the comprehensive database of information. At each step in the analysis, new information was constantly compared to older data to produce a fluid, evolving set of emergent concepts and interim conclusions until such time that the saturation point was reached and no new information was obtained. Figure 2 provides a summarized flow of the data collection and analytical process.

Figure 2: Overview of Research Implementation

Iterative-parallel Approach



Data reduction activities consisted of selecting, focusing, simplifying, abstracting, and transforming the research data collected from documents, interviews, and interim analysis (Miles & Huberman, 1994). This was accomplished through the process of coding the data (Robson, 2002). At first order, codes or labels were attached to groups of words, phrases, and sentences as an aid in organizing and retrieving them from the total pool of information. At second order, code groups were aggregated into smaller sets or families representing patterns or themes that emerged from the data. This coded data, then, was sorted, compared, contrasted, linked, and decomposed to reveal the relationships from the various sources. As mentioned earlier, during the course of this study thirteen hours of interviews were transcribed to 184 pages of text which were progressively summarized to thirty eight pages of thematic summary and then further

reduced to 16 pages of themes and answers sorted by research question. Additionally, 294 documents were preliminarily scanned for usefulness, applicability, and for significance of content. Of those, forty six were examined in great detail and coded. This produced nine pages of thematic material organized around the three research questions and the associated sub-questions.

To more easily discern the relationships and patterns within the coded data, this research utilized the highly recommended practice of producing displays such as matrices and graphics to visually present the data (Miles & Huberman, 1994). In this manner, data can be systematically presented to enable the researcher to look for regularities, patterns, explanations, and logical similarities in diverse data (Yin, 2003). There are a wide variety of display types. Those used in this study were: 1) an event history diagram that visually depicts the effect of the OM project on the organization as it chronologically evolved, 2) a flow diagram showing the high level relationships between OM processes, 3) content analysis summary matrices, and 4) theme clustering matrices that assist in analyzing the traits and conditions that are associated with the Barnes Model domains of focus and research questions. Miles and Huberman (1994) recommend the liberal use of displays as they find extended, unreduced text to be cumbersome to analyze and through the activity of developing displays researchers become thoroughly connected with and understand their data.

To facilitate the analytical process, ATALS/ti V5.0 qualitative analysis software was employed for this research project. ATLAS/ti, one of the most prominent software tools for qualitative data analysis (Dembrowski & Hanmer-Lloyd, 1995; Robson, 2002), is used by analysts at over 300 universities and research institutions (Scientific Software Development,

2005). This software provided a powerful workbench of tools for automating the management of large quantities of textual data and it supported a more rigorous and fluid research process than was possible using manual methods (Richards, 2002). Historically, qualitative research has been hampered by the sheer volume of data, complexity of analysis, detailed classification work, and boredom associated with time consuming clerical tasks (Dembrowski & Hanmer-Lloyd, 1995). Software, like ATLAS/ti, automates and speeds up the analytical process by providing tools to import and store data, automate the coding process (Robson, 2002), facilitate searches for text segments, stimulate interaction with the data, and support efforts to build data relationships (Richards, 2002; Tallerico, 1991). The software accelerates analysis, encourages efficiency, instills methodological rigor, and helps the researcher cope with bulk data (Richards, 2002). It is the platform that sustains the researcher's efforts to become intimately familiar with each data source while concurrently appreciating the differences between data sources. At the same time, the software helps the researcher develop a wider perspective on the entire data pool that is a prerequisite for abstraction and synthesis tasks such as pattern matching, explanation building, or time series analysis (Gilbert, 2002). Finally, the use of qualitative analysis software makes the analysis more visible and transparent to those who may want to judge the quality of evidence and arguments derived there from (Crowley et al., 2002).

In this research project, ATLAS/ti was used to secure, protect, and systematically manage the database of primary data: documents and interview transcripts. All coding, annotating, data linking and relationship building was done within the ATLAS/ti framework. This allowed the researcher to leverage the search and retrieve, sorting, filtering, and relationship display capabilities of the tool to decipher the concepts and issues emerging from the Opportunity

Management e-business data. The ATLAS/ti workbench provided a comprehensive array of qualitative data analysis processes that were supportive of this research project.

Case Study Mechanisms to Ensure Reliable and Validity

Case study research is endowed with an excellent inventory of procedures, techniques, and tactics to aid the researcher in designing and conducting a scientifically rigorous study. Correctly implemented throughout the planning, preparation, data collection, data analysis, and reporting stages of a research project, these techniques can establish the study's trustworthiness and credibility. By maintaining rigor, the consumer of research can be persuaded that the research was based on sound reasoning and good procedure, that logical relationships were established between facts and assumptions, and that all claims were based on sufficient evidence.

Planning and Preparation Methods

A case study is an interactive and flexible research form wherein many research methodology decisions may have to be made during the course of action. Nonetheless, nothing substitutes for good planning and preparation. To this end, numerous researchers (Martinsuo, 2001; Stuart et al., 2002; Voss et al., 2002) recommend the use of a case study plan (Robson, 2002); also known as a case study protocol (Yin, 2003). This device is essentially an outline or framework that enumerates the details of the data collection procedures to be used in the project; as well as the general rules to be followed.

It encompasses the principal documentation needed to provide the researcher with the necessary focus, organize the visits, and assure that the trail of evidence is thoroughly documented (Stuart et al., 2002).

The case study protocol is a principal tool for increasing the reliability (Yin, 2003), validity (Robson, 2002), and repeatability (Martinsuo, 2001) of the research. Judicious use of the methodology can help the researcher spot flaws in the case study design and the initial definitions of the study questions. It helps the inquirer to assess the scope of the project vis a vis time deadlines and resource availability expectations. It helps to flush out biases, anticipate problems, serve as a prompt for the interview, and as a checklist to make sure that all topics have been covered (Voss et al., 2002). It is a particularly powerful tool for those working within an operations environment as it calls attention to the processes and systems that are being studied, the methods for studying them, and the operating data that is to be collected from them (Voss et al., 2002).

This research was carried out under the specifications of a case study protocol that reflects the research design as described in this document. The case study protocol used in this research is attached in Appendix B.

Techniques for the Data Collection Phase

After constructing a thorough, complete plan for the study, the researcher then enters the field to collect data. During this phase there are a variety of time-proven techniques that the researcher can use to maintain a scrupulous study; among them are triangulation, member checking, prolonged engagement in the field, and proper leveraging of confidentiality agreements.

Triangulation is a validity and reliability enhancing procedure where researchers seek out convergence among multiple and different sources of information to form themes and categories from a study (Creswell & Miller, 2000; McCutcheon & Meredith, 1993). Bowman and

Ambrosini's (1997) work has shown that it is unwise to rely on the data collected from only one individual as a reliable indicator about the situation of an organization. Thus, researchers should seek multiple views particularly where there is likely to be subjectivity and bias (Voss et al., 2002). For that reason, triangulation, made possible by multiple data collection methods, different data sources, a variety of evaluators and perspectives, and diverse types of evidence (Yin, 2003) provides a stronger substantiation of constructs and hypotheses (Eisenhardt, 1989). Triangulation is one of the more effective tactics in that it reduces the threat from reactivity, researcher bias, and respondent bias (Robson, 2002).

Triangulation of information was a major component of this study and was accomplished in at least three ways. First, the researcher executed the prescribed interview plan, meeting with the fifteen participants. The information from these sources was compared in order to ferret out bias and subjectivity and, of course, establish the thematic content. A second triangulation pass was made to contrast the responses provided by each of the three groups from the population sample-executives, business process owners, and project leaders. Finally, participant responses were reviewed and corroborated in light of the evidence collected from the document analysis. These triangulation procedures provide multiple perspectives and cross-checking of themes and concepts arising from the data. Examples of this cross checking can be seen in the analysis provided in Appendix D and in Tables 6 through 8.

Member checking is the practice of taking data and interpretations back to the participants in the study so that they can confirm the credibility of the information and narrative account (Creswell & Miller, 2000). The participants are thus able to add authenticity to the case study by reacting to both the accuracy of the raw data and the final documentation of the account. Like

triangulation, member checking is useful in counteracting reactivity, reflexivity, and the biases of researchers and respondents (Robson, 2002). Member checking was utilized in this project to validate the accuracy of the interview results and subsequently to evaluate interim conclusions, themes, and issues. Each participant was given a verbatim transcript of their interview and asked to comment, amend, or update, as they perceive necessary. In essence, it was the goal of this research to collaborate with the participants to discover and correctly elucidate their experiences, knowledge, and observation of the Opportunity Management initiative. All participants formally validated that their transcript was an accurate representation of the interview conversation. In some cases, the participants edited the transcript to more fully explain their response or to make minor adjustments to certain words or punctuation.

Another method that effectively challenges reactivity and respondent bias is prolonged engagement in the field by the researcher (Creswell, 2003). While in the field, the researcher builds trust with participants, finds key knowledge sources, and establishes rapport so that participants are comfortable disclosing information. As mentioned in a prior section, the researcher has a long history in the IBM Company, is embedded in this research situation, and has the trust and confidence of the participants. This point is reiterated to make note that prolonged involvement can actually increase the threat of researcher bias; either positively or negatively (Robson, 2002). The researcher remained aware of this possibility and scrupulously adhered to the study protocol and used triangulation and member checking to foil this threat. Additionally, Voss and colleagues (Voss et al., 2002) find that recording an interview can contribute towards reduction of observer bias, especially if the evidence is presented verbatim rather than in summary form.

Two remaining techniques that were used in the data collection phase of this study are rather simple and obvious. While engaging a participant, the researcher emphasized the confidentiality of the discussions and guaranteed the participant's privacy and anonymity. This can improve the reliability of the responses. Upon completing the interview, the researcher, a soon as possible, completed documentation of a contact summary sheet (see Appendix B). This is critical to improving method validity and reliability (Martinsuo, 2001).

Combating Threats to Validity and Reliability during Data Analysis

During the data analysis phase of a case study research project there are, again, numerous procedures for combating threats to reliability, bias, and validity. One strategy that markedly increases the reliability of a study is the creation of a case study database (Yin, 2003). A case study database, a centralized, formatted, cross-referenced, indexed, repository (Miles & Huberman, 1994), should contain all case study notes, documents, tabular materials, and transcripts. In tandem with the database, the use of ATLAS/ti qualitative data analysis software (Miles & Huberman, 1994; Robson, 2002), provides facilities for data management, coding and retrieving text, and theory testing (Crowley et al., 2002). The use of this software makes analysis more visible, thereby enhancing transparency, and the quality of evidence and argument put forward by the researcher. Used in synchronization, the case study database and analytical software program establish an audit trail of the entire inquiry process.

Liberally and effectively using data displays is another major avenue of approach to increasing the validity of data analysis (Yin, 2003). A data display, an organized, compressed assembly of information that provides structure for conclusion drawing, improves the quality of data analysis and can augment many of the techniques previously discussed. Miles and

Huberman (1994) point out that data displays aid the visualization of patterns and themes that evolve from the raw data, support efforts to check data representativeness, and evaluate whether or not there are any researcher effects on the case. Additional functions of the data display are: (1) checking the meaning of outlier data, (2) following up surprise results, (3) looking for negative evidence, (4) ruling out spurious relationships, (5) replicating a finding, (6) checking out rival explanations, and getting feedback from participants. Data displays becomes more prominent during the analysis stage of a research project but they also help to focus any parallel or iterative data collection efforts and reassessment as the case proceeds.

Reporting for Credibility and Trustworthiness

Focus on scientific rigor must be maintained throughout the case study and it is vitally important to craft a report that is accurate, precise, sufficient, representative, authorative, and perspicuous (Booth et al., 1995). Providing "thick, rich description" (Creswell & Miller, 2000, p. 128), clarifying bias (R. B. Brown, 1998), and presenting negative or discrepant information (Creswell, 2003) are three practices that can be used to achieve an exemplary report.

Thick, rich description establishes credibility for the study by providing deep, dense, and detailed accounts that create, for the reader, the sense that they have experienced or perhaps could experience the events portrayed in the study (Creswell & Miller, 2000). Yin (2003) strongly urges case study reporters to employ vivid, engaging, enticing, and seductive prose to capture the attention and maintain the interest of the reader. In doing this, the researcher helps the reader to understand that the account is authentic and conceivably applicable to other settings or similar contexts. This sets the standard and challenge for this final research report.

The last tool to be discussed is the practice of highlighting and making visible negative or discrepant information that runs counter to the established themes of the report (Creswell, 2003). These rival propositions allow the researcher to discuss contrary information and thereby add further credibility to their accounts. This practice joins the others already mentioned in reducing the threat of researcher bias (Robson, 2002). It must be noted; however, that this is a difficult process to operationalize because researchers tend to more easily encounter confirming evidence than otherwise (Creswell & Miller, 2000). Thus it takes a disciplined and honest effort to gain the benefit of this practice.

Clarification of bias is the practice of making the entire research process transparent, from design to analysis and of problems encountered therein, so that any bias that cannot be eliminated is openly available to the reader, who can decide to accept, decline or otherwise adjust for this information (R. B. Brown, 1998). This process, called researcher reflexivity, is a self disclosure of underlying assumptions, beliefs, and biases that influences the study's foundation (Creswell & Miller, 2000). Since personal bias can shape what is seen, heard, or recorded (Voss et al., 2002), qualitative case study researchers cannot deny their roles within the research (Winter, 2000) but must present this information to enhance the perceived quality of the study.

The foregoing discourse shows that the qualitative case study strategy presents a wide and rich variety of tactics to redress threats to reliability, validity, generalizability, bias, control, and objectivity. In an encompassing sense, the case study protocol is an indispensable practice and an effective framework that focuses the on collection of data in the field. If rigorously utilized, the protocol positively influences the reliability, validity and repeatability of the research.

Triangulation and member checking are two of the more robust techniques for allaying concerns over various forms of bias and validity. The case study database provides a means of establishing an objective trail of evidence and a charting of the progression of the analysis. This, again, supports good reliability, validity and mitigates bias.

At the core of the research effort, however, it is the researcher's openness, honesty, and professionalism that to a large extent, bestows the control, trustworthiness, and correct level of objectivity on the study. It is the researcher's insight, analytical skill, and knowledge that generates theory and perceives the applicability of analytical generalization. Throughout this account, numerous attempts have been made to clarify and make visible the researcher's roles as a practitioner, insider, and as one who is ardently dedicated to producing a serious, scholarly piece of research. In the end, the consumers of this research will be the ultimate arbiters of its credibility and utility.

Participant Protection and Ethical Considerations

Company Confidentiality

Company confidentiality and protection of IBM's proprietary information is specified and assured under the employer-employee relationship to protect company assets. Additionally, proper performance of business responsibilities is annually addressed within IBM's Business Conduct Guidelines practices. Therefore, to the extent that it is necessary, any references to actual business activities have only been made in aggregate or disguised form, and are devoid of specific technical content.

Confidentiality of Individuals

Individuals participating in this research were fully informed as to its purposes, duration and procedures. Their identities have been protected to the extent that they desire in any future written or oral documentation and reports. The specific methods of separating research data from individual participants has been managed in accordance with the procedures highlighted in the Data Management section of this proposal. Any questions that participants had regarding their role in the research have been explained to their satisfaction. The notion of informed consent was explained, they were advised that they were free to withdraw from the study at any time, that they could at any time decline to answer specific questions, and that they were welcome to offer critique of the interview process as they saw fit. All participants were given adequate time to decide if they wished to voluntarily participate in this study. Permission to record interviews was obtained orally from every participant prior to each interview. Permission to quote any identifiable individual was requested before those quotes were used. A sample confidentiality statement is included in Appendix B.

General Regulatory Adherence

The intention of the researcher was to conduct this study in a manner reflecting the best spirit and principles reflected in The Belmont Report and the Common Rule (45 CFR 46). This research was submitted for review and approval by the Capella University Institutional Review Board (see Appendix C). No actual research commenced until that permission was obtained. There was no use of deceptive practices, utilization of concealed devices, or withholding of complete disclosure from any participant.

Synopsis

This research methodology chapter has outlined the plans and protocols that were implemented when this research project was approved. It is believed that the research design, including sampling plan, data collection techniques, and data analysis methods, was consistent, supportive, and appropriate for achieving the research goals. Those goals being to understand, through the study of the IBM Opportunity Management e-business initiative, the articulation between the strategic and operational factors that provide context for e-operations and how this context shapes the design of internal business operating processes and the selection and deployment of e-business information technology.

CHAPTER 4. DATA COLLECTION AND ANALYSIS

"The most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka!' but 'That's funny'…" *Isaac Asimov*

Introduction

This chapter addresses the three research questions and associated sub-questions by describing the findings regarding motivations, operational reactions, and implementation realities emanating from the IBM Microelectronics Division (MD) Opportunity Management (OM) e-business initiative. These findings provide insight into the articulation between the strategic and operational factors that provide context for e-operations. They also portray how this context shapes the design of internal business operating processes, the importance of data, and the selection and deployment of e-business technology.

The presentation of results will commence with a general description of the nature and character of the MD environment; followed by a depiction of the genesis, evolution, and institutionalization of this e-operations initiative. This illustrates the strategic and operational context that shaped the OM initiative and supports an understanding and interpretation of the research evidence. Next, this study's specific findings are organized, presented, interpreted, and evaluated. This is accomplished by focusing, in turn, on each research question and sub-question; by invoking the words of participants, characterizing the reactions and responses of participants to the research topics, and by drawing upon the documentary evidence to both supplement and complement interview results. Subsequently, a supplementary analysis is presented to address a significant, recurring theme embedded in the research evidence which is the importance of data to e-operations. The chapter concludes with a summary of the findings.

The Opportunity Management Story

The International Business Machines Corporation, Microelectronics Division (MD), has for thirty five years been at the center of the semiconductor development, manufacturing, sales, and service industry. Originally, this division was a captive, internal supplier to other IBM operating units but in the mid-1990s the technological capability of this enterprise was made available to the general electronics industry. Since that time MD has been a successful, industry competitor that has consistently ranked in the upper echelons of semiconductor suppliers. In 2004, MD ranked 20th among chip producing vendors with sales estimated at $3.2 billion (electronics.ca publications, 2005).

A key reason for this industry growth and success has been the extraordinary market acceptance of MD's Application Specific Integrated Circuit (ASIC) product line, Semiconductor Foundry, and design services support model. By bringing robust, leading edge technology and advanced semiconductor design knowledge to the market, MD has established a dominant industry position. This market dominance is illustrated by IBM's five year run from 1999 through 2003 as the number one world wide ASIC supplier (Donovan, 2004).

The ASIC and foundry business practices are intensively collaborative endeavors. Their success rests upon the complimentary expertise of both the customer and supplier. The goal of the business relationship is to create a unique, customer specific semiconductor design; usually a logic chip. The customer develops and provides the proprietary design logic while the vendor contributes varying levels of semiconductor chip development service, manufacturing proficiency, and any necessary intellectual property. The unique characteristic of this business approach is that the chip supplier enables but does not own the function or design content of the

chip that it produces. Therefore a strong relationship based on trust and partnership must be cultivated and nurtured with the customer.

The Microelectronics Division mission is to provide IBM customers with industry leading custom logic design solutions and services appropriately matched to each customer's distinctive requirements. They must ensure low total cost of development and deliver on their industry unique value proposition of accelerated time to market through first time right design practices (IBM Microelectroncs, 2004). In essence, IBM will guarantee to its customers that if they follow the IBM design methodology or protocol and collaborate effectively with IBM engineers then the first semiconductor hardware that is manufactured will perform exactly, precisely as specified by the customer (Dreibelbis & Wilcox, 2000).

Business Problem Assessment

During the rapid semiconductor industry growth years of 1999 and 2000, MD management found it increasingly difficult to locate, assemble, and analyze operational information from its far flung development organization. Rapid growth in the ASIC and Foundry sectors forced many of MD's functional organizations to quickly develop inexpensive ad hoc databases, usually based on Lotus Notes Groupware, to track their key business data. For example, the Field Applications Engineers (FAEs) deployed a mechanism to track customers, customer development project proposals, technical requirements, and potential technical solutions. Marketing operatives developed an application to track customers, projects, and business value potential such as possible manufacturing volumes, prices, and revenue. At the same time, the Design Center organization attempted to track technical implementation data, technical deliverables, schedules, and design status of a customer project.

As MD's business managers attempted to locate and access cross-functional data, they found it increasingly difficult to find current data versions, relate the data from the various sources, and then aggregate that data in a manner that would help them address whatever business problem they were assessing. Of course, by the time they were able to locate, consolidate and characterize the data, the data itself was out of synchronization with true customer and project status. Strangely enough, pervasive access to information technology tools , wide spread enablement of end-user computing, and a general high level of systems expertise within functional organizations exposed the organization to all of the classical risks of end-user computing – loss of data control, security and integrity exposures, inefficient use of information resources, and poorly designed and documented systems (McLeod & Schell, 2001).

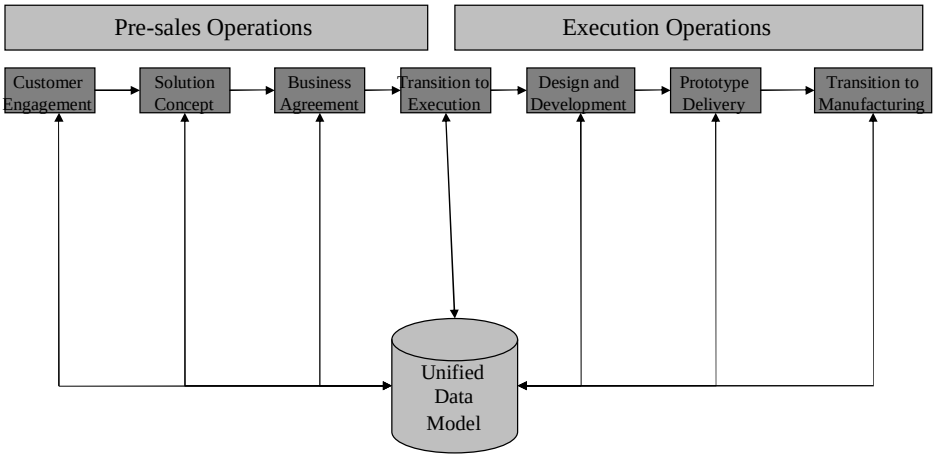
In this manner, over forty applications were introduced across the enterprise. Each of them using different nomenclature, data designs, and data descriptions. So even as the business was growing and prospering into a multibillion dollar a year operation there was no end-to-end relationship of interconnected processes and data with which to manage the organization. In October of 1999, concerned and frustrated with the status quo, several MD executives commissioned a "skunk works" study by a group of senior business and technical professionals and middle management to investigate these business control and data problems.

Solution Concept

In April 2000, after a rigorous analysis of prevailing operating conditions, examination of business processes and data requirements, and collaboration with industry consultants the study group reported their findings which identified a variety of significant problems. Among them were: (1) strategic gaps in the data and information flow in the business value chain that begins

with the identification of a customer's custom logic business opportunity and ends with the release of the corresponding custom logic semiconductor product to the manufacturing processes (This will be referred to as the Opportunity Management Pipeline, see Figure 3), (2) a preponderance of informal processes in the operational environment that were not interlinked and thus not allowing for good upstream and downstream visibility to data flows within the pipeline, (3) organizational data that was inconsistent and often duplicated, and (4) lack of communication and re-use of key organizational knowledge.

Figure 3: Opportunity Management Pipeline Flow



This study group, which eventually became the Project Team Leaders, also made the point that these business problems should be addressed and resolved in context to IBM's evolution into an e-business company. The team reported that the technical characteristics of Web based tools and methods, particularly Web-based Product Lifecycle Management (PLM) software, offered

the most effective and suitable solution platform. The recommendation, therefore, was to engage in a multi-year, cross-functional, e-business initiative to improve the management of MD's data, redesign and link its myriad processes that compose the Opportunity Management Pipeline, and connect its geographically dispersed technical and business functions. This recommendation, supported by a compelling financial business case, was accepted and in the spring of 2000, the Opportunity Management e-business initiative was announced, staffed, and formally launched.

Organizational Support

The motivations for pursuing the Opportunity Management Project were as diverse as the number of executives who supported the project. All of them; however, believed that significant organizational productivity would be achieved, that useful process reengineering would result, and that a Web-based infrastructure would provide the most flexible, state of the art, and quickly deployable technical environment. The Project's management was extremely active in gaining executive commitment. They succeeded in getting the Sr. Vice President of IBM's Technology Group to personally endorse the effort. On the strategic front, the Project's aim point for solving operations problems within the Opportunity Management Pipeline directly aligned and integrated with key components of MD's strategy: expansion of the ASIC and Foundry businesses, the first time right business value proposition, reinforcement of low total cost of development, and the value of accelerated time to market. Additionally, the team gained the understanding necessary to build project network connections in a manner consistent with IBM's Global Web Architecture. With strategic alignment in place, funds to execute a project proof of concept were released in the third quarter of 2000 and the team was given instructions to make progress with all due speed.

General Design

By the end of 2000, the Opportunity Management Project work plan was conceived as a series of multiple functional software releases accompanied by a gradual morphing and interlocking of key business processes. The very act of creating linkage caused many existing work processes to be subtly redefined or completely revamped. This caused considerable organizational perturbation and disruption each time a new phase was implemented. However, by pacing the project release schedule, the organization was given time to react and adjust before the next phase was launched. As the end-to-end linked processes emerged, the various functional organizations–Field Application Engineers, Technical Sales Staff, Marketing Analysts, Applications Engineers, and Design Center Engineering- began to understand their shared interest in these various business processes and the associated data. Further, each organization had to assume new responsibilities in the business flow; not because the new work directly benefited their own operations but because they could see the advantage given to the other organizations and the business as a whole.

From a technical perspective, the Project Team implemented a Web-based infrastructure that provided system access to all users through standard web browsers, Internet Explorer and Netscape Navigator. Process flows were instantiated in the system as a series of Opportunity Management Pipeline lifecycles. In recognition of the need for flexibility and adaptability in the face of continuously changing business processes, the underlying architecture of the system was designed to support dynamic model changes. All of this was built on an IBM technology stack that featured p-Series AIX servers, the DB2® relational database application, and WebSphere® and MatrixOne® middleware.

Since gaining control of organizational data was one of the key motivations for pursuing the OM Project, the team set out to identify, catalog, define, describe and then map out the Opportunity Management Pipeline data. They constructed a data model that encompassed the complete front-to-back aggregation of linked processes and then documented the schema. They borrowed and reused data design and standardization methods from previous initiatives but also created certain aspects of the model that were pertinent to the unique characteristics of the OM Project domain.

Project team members not only wanted to capture and manage basic business data but to provide a centralized venue for projecting business information and capturing the knowledge of MD's widely dispersed work force. Considerable effort was devoted to designing contextual information display pages. For example, page content might be devoted to information regarding customer characterization, project description, business value assessments, technical requirements, or key contacts. By intelligently aggregating various data, the team developed a tool through which management could quickly and easily obtain critical business information about any documented opportunity.

Going beyond data aggregation and display, the system developed by the OM Project Team provided a mechanism to collect certain organizational knowledge and make it explicit. This was particularly effective where judgment and experience enriched the meaning of raw data. For instance, a Field Applications Engineer who has experience with a particular customer's technical proficiency could estimate a design's likelihood of success, odds of meeting an aggressive development schedule, or the confidence of winning the engagement. Thus, the OM

system tools provided an abundant assortment of logs to maintain threaded discussion information and key input fields to collect opinion, estimation, and judgment.

The promise of the OM approach, and the value that is being realized in the business, is that a world wide audience of MD employees can go to one place via their web browser and interact with data, information, and knowledge amassed from their geographically dispersed colleagues. This is speeding up the design processes and is enabling the organization's business community to spend more time analyzing than searching for business data and information.

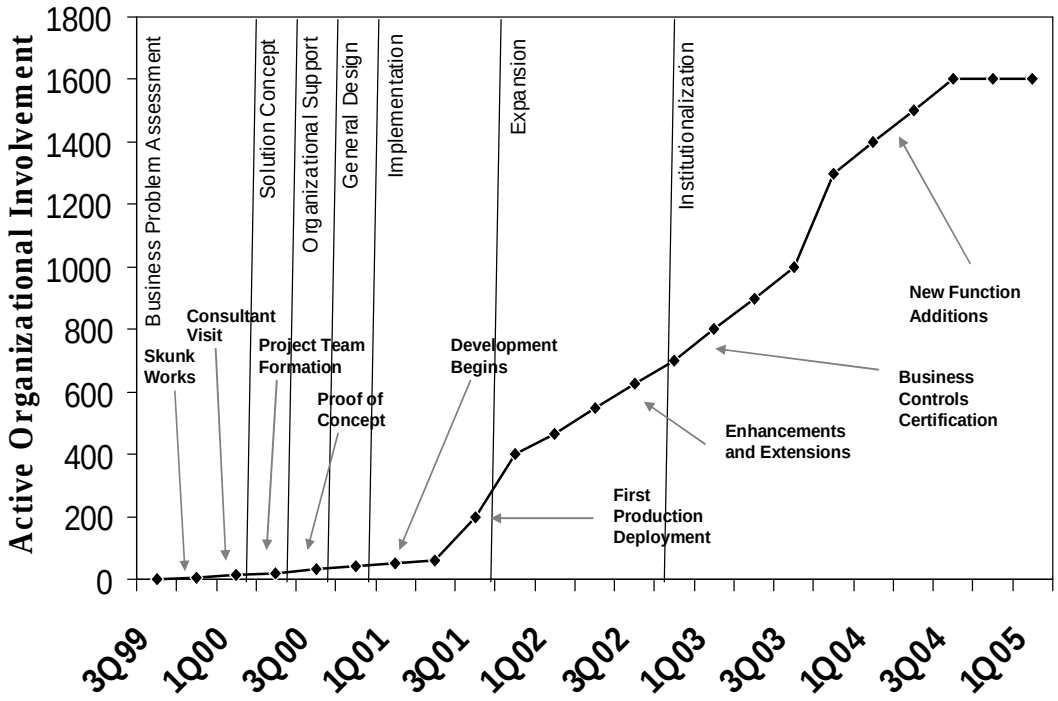
Implementation, Expansion, and Institutionalization

In the first quarter of 2001, the Project Team set out to deploy the new systems and tools. The hardware and software was procured and installed, the data model was designed, and the first sections of the OM Pipeline were specified for automation. By May of 2001, the initial users were educated and given appropriate access and entitlement to use the first production-ready elements of the processes.

During the ensuing months and years, the OM Project Team deployed new function in a fast paced, measured, and segmented manner. They gradually extended and expanded the OM system to accommodate all of the constituents that operated within the OM pipeline environment: FAEs, Tactical Marketing, Design Center Engineering, supply chain operatives, Product Development, and Headquarters staff. They also brought the level of business control to a level that enabled the system to be certified as a trusted source of information by IBM's internal auditing group. What began as a handful of executives articulating a business problem and a score of team members assessing, visualizing, and implementing a solution ended up as a

major operational system, enabled by e-business, and linking together hundreds of users and tracking thousands of opportunities across the world wide IBM MD organization (see Figure 4).

Figure 4: MD Opportunity Management Event History



This OM system allows 24/7 access to opportunity-related information so employees can quickly respond to customer inquires and better track project milestones and revenues associated with ASIC and Foundry engagements. By assimilating disconnected systems into a shared platform, the solution breaks down functional silos and enables much greater collaboration between functional organizations. By consolidating and streamlining its operations through e-business enablement, IBM Microelectronics has reduced pipeline business process cycle time, cut administrative expense, and saved the company many millions of dollars in costs through

improved decision making based on data visibility. This project has provided enough value to the organization that, at this writing, it is still a vital part of the MD business transformation effort.

This long running Opportunity Management story, then, provides the platform, environment, and setting from which to extract information to answer this study's research questions. This story, pieced together from the many documents analyzed in this study and cross checked during the course of participant interviews, appears to be one of a successful organizational endeavor that creatively used e-business to address a business organization and management challenge. Going forward, both document and interview evidence will be used in aggregate to answer each of the research questions and thus describe the motivations, operational reactions, and implementation realities of this e-operations initiative.

Research Question One Analysis

Why was the firm motivated to invest in e-business?

As is often the case, a business problem reveals itself through symptoms and dysfunctional effects on the organization. Only after investigation and thoughtful analysis does the root cause of an organization's difficulties become apparent. Such was the situation in late 1999 at IBM Microelectronics. At that time, several executives were reacting to a shared concern about their inability to get quality, timely information to assess their strategic capacity investment and resource decisions. As the Design Center Executive noted:

> We were sorely lacking any visibility into what our capacity would be in the next time period, the next quarter, the next half year, or the next year. How many designs did we see coming in and, therefore, how much capacity we would need to accommodate those designs. So in my mind whatever data we had was not well coordinated, was not well integrated. We had

> varying sources of data that were conflicting, more often than not. And I just recall back then that the headlights that I had for what was going to happen over the next quarter or five or six months was minimal at best.

The key word in this problem description is headlights. Headlights is the MD vernacular for visibility or insightful information about the future. In the MD context, this refers to the difficulty that the design execution and delivery engineers had in determining the potential load of designs that the technical sales team would be bringing into the business for execution in future time periods. They didn't have visibility into the Opportunity Management Pipeline. The executives, faced with unprecedented growth in the ASIC business and an inability to sustain their rapid staffing ramp, had determined that human resource, human capital, was their primary capacity constraint and that determined how many chip designs they could support during any given period. Therefore, the executives were extraordinarily motivated to get visibility or headlights into the upstream portion of the Opportunity Management Pipeline.

When given their initial skunk works assignment, the assessment team followed the trail from symptoms, as communicated to them by the executives, to the core or root operating problems. The team found a high level of confusion within the operating environment. One of the members of the study group, the Senior Engineer, effectively captured the essence of the problem by observing that:

> There were all kinds of data that were being collected in various different applications and in different peoples notes and it was difficult to keep everybody on the same page with what the big projects was. [There were] multiple organizations, multiple people, and multiple sites and trying to keep everybody on the same page as to what was going on and what were the right things to do and who was doing them [was difficult].

The study group isolated the organization's problem to the succinct observation that the organization's data and business processes were not integrated or coordinated. In most

instances, data was isolated from functional group to functional group. Thus, there were multiple redundant, uncoordinated sources of data. Correspondingly, the organization's business processes were uncontrolled, unconsolidated, and not articulating as a seamless, cohesive, end-to-end entity. In the team's opinion, a combination of actions to integrate and coordinate business processes and data would resolve the visibility problem articulated by the executives.

The IBM Microelectronics motivation to invest in e-business, therefore, arose out the resolve to fix these data and process control problems that inhibited management from understanding operational posture and execution status. Much as a factory manager needs to have visibility to the shop floor, the design operations executives needed to have visibility to the status, load, and incoming demands on the organization's capacity to process new ASIC designs. The executives were willing to invest in e-business if it would help them gain visibility or headlights into opportunity management operations.

Sub-question 1a: What was the nature of any extra-organizational influence to adopt e-business?

The short answer to this question is that there were no extra-organizational or external pressures on MD to embrace e-business. To a person, the executives and project team leaders, those with most visibility and understanding of the early, formulating stages of the project, were focused on the business problem and they had little interest in or awareness of the fact that e-business could or would play a role in the organization's solution. In fact, the CIO remarked, "I don't know that I cared that it was an e-business project." The FAE Process Owner captured the general attitude of organizational operatives claiming that "we would have taken any tool that would have helped us do what we needed to do."

There were; however, certain subtle external influences at play. The executives were uncomfortable with the organization's sluggish responsiveness and its impact on customer satisfaction. Some felt, as did the Owner Executive, that there was "a level of customer dissatisfaction in general around our ability to work with them in a best in class mode at this level of design engagement." Nonetheless, this concern did not explicitly influence the acceptance of the project's design point.

Another indirect external influence on this e-business project was the decision to utilize Web-based Product Lifecycle Management (PLM) software as part of the solution. As the Senior Engineer adroitly stated"

> We knew we needed software, I mean, if the software is e-business then we knew we were getting into e-business but we probably didn't use those words and those notions at the time.

In essence, the decision to engage in e-business was a function of the software selection decision which was, in turn, itself a function of the Project Team's efforts to find the most expeditious approach to solving the business problem.

The reality of this e-business venture is that it was internally and rationally motivated by a desire to improve visibility into the organization's opportunity management operations. Those involved had great hope that by fixing the problems there would be positive influences on organizational responsiveness and, hence, on customer satisfaction. But more interestingly, the project became an e-business initiative as a result of the solution approach decisions as opposed to an explicit decision to join the e-business movement.

Sub-question 1b: What internally generated factors influenced the organization to adopt e-business?

This question really addresses the motives and expectations of various organizational members and groups who hoped to reap value from the Opportunity Management Project. The executives homed in on the need to more effectively use their valuable technical resources: Field Applications Engineers, Design Center Engineers, Development Engineers, and Applications Engineers. As the FAE Executive recalled, "…there was some amazing amount of resource that could be salvaged and saved by properly executing this thing…" They also were much attuned to the proposed solution's ability to handle enterprise-scale security and business controls standards. This was very important given that many hundreds of millions of dollars of opportunities would be managed by the system.

The Project Team opted for the Web-based approach because of the tools, technology, and practices that could be applied to consolidating the data and then leveraging and reusing that data across the enterprise. The OM Project Manager maintained that the e-business approach would allow "…cross functional flow of opportunity data, products, and issues… [and assure that] common data, could be entered once and used many times." The notion was that organizational value could be provided through the effective management of data that was made accessible and available to all constituencies. The organization's business process owners were particularly enamored with this feature of the project. Each of them could benefit from a consolidated, managed data model and repository that would provide fingertip access to common business information. Further, this focus on data access as a lever of improving organizational efficiency was captured and modeled to support the financial business case.

In summary, the internal influences that supported the e-business approach derived from the opportunity to free precious human technical resources from administrative or non-technical activities through the deployment of enterprise-strength data management techniques. This value was captured in the business case as well as in the recognition that organizational risk would be mitigated through effective application of security and business control functions.

Sub-question 1c: What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?

In retrospect, the OM Project was a poster child for project management, project governance, and operational and system measurements. This is the result of several factors. First, the project represented a considerable investment and diversion of scarce resources from other competing projects. Thus, the supporting management team was eager to ensure that the organization would accrue value consistent with the investment. Second, the OM Project was an early adopter of e-business technology for internal operations and the IBM Company was closely scrutinizing projects of this nature to measure their business transformation impact. Third, the project was launched within the context of an engineering and development environment so it was natural to apply project management discipline. Fourth, the project was designed to improve and upgrade visibility and insight into operating activities. The nature of operations is to measure execution progress, compare to plans, and adjust as necessary.

The Owner Executive was clear in stating that "The discipline of project management was applied…the project, itself, was managed for cost, quality, and scheduled deliverables." At project launch, a senior certified project manager was assigned to the leadership team to ensure that the best, contemporary project management techniques were utilized. Overall, the executive team seemed pleased with the Project Team's performance. The CIO thought "The project was

well run from a project management standpoint. It was rigorous and therefore…highly predictable of what would be delivered." This reaction was shared by the WW FAE Executive:

> …the management and prioritization of the development activities as well as the reporting that was provided to all stakeholders, the identification of key interfaces to all of the major functions involved in the OM project, and the weekly if not daily tracking with all of the stakeholders was very well managed…

These reactions are consistent across the groups that were interviewed for this study. The project was highly formalized, professionally managed, and scrutinized closely and frequently. In fact, the Project Manager and IT Architect maintained that the project had more visibility and scrutiny than was the IBM norm.

Another part of the measurement and oversight system was the use of an executive steering committee to provide cross-functional guidance to the Project Team. During the interview process there was considerable discussion about the steering committee role and function. The interviews clearly cross reference the existence of and the ongoing role of the committee. In fact, twenty steering committee status and progress presentations were reviewed during the document analysis phase of the project. Thus, there is ample evidence for the long-term role of the committee in this project.

There are; however, differing opinions as to the effectiveness of the committee. The executives, for the most part, appeared to be happy with the committee role and function, particularly in the launching phases of the project. The general consensus was that they "probably had the appropriate governance for the project as an IT project including the budgeting, the funding, the arbitration and so forth. That was not lacking…" and "the committee was effective early on and that is when you need it the most because you are really trying to get

some decisions made." These comments capture the feeling from the executives that the steering committee was stronger in the earliest stages of the project but degraded as the project progressed.

On the other hand, the Project Team Leaders and business process owners seemed generally satisfied with steering committee performance. The Consultant believed it was quite effective at time by observing that:

> When we got to the releases and they made some mandates when necessary about following the process and that this was going to be the golden source of data and that anything that was not in there would not be considered a part of the process.

This demonstrated that the steering committee helped to manage the organizational transformation dimensions of the project. Given the Consultant's experience with other companies, this probably reflects favorably on the MD Project's steering committee.

Finally, the CRM Process Owner, as an example of the business process community, felt that the steering committee forum was most effective:

> …you had a real diversity of people involved and having those people represented in a steering committee [was important] so they could understand the progress, the challenges, and the goals. I think it has been well orchestrated.

As previously noted, since the intent and purpose of the OM project was to shed light and understanding about the OM operational pipeline, it is intuitively obvious that a great deal of focus would center on operational and systems measurements and metrics. The Owner Executive characterized this rather pointedly:

> It is by design…a work flow management tool of sorts, with requirements placed on people, more metrics placed on the performance of people…in their window to measure time to performance and that type of thing and also …on the design center, the execution side.

The presence of the system and the end-to-end linkage of organizational processes and data allowed management to produce metrics and then evolve a set of targets that were needed to drive the business. At its simplest, the system is able to capture information about customer ASIC design plans, commitments made between IBM and its customers, outlooks on when key milestones would be completed, and actual dates when these events occurred. The general cadence of business is illustrated by the ASIC Methodology Engineer:

> [The system notifies us about] what is going on. Is it going to be on schedule, early, or late? What are the actual dates of meetings and checkpoints? And that gives us a preview of whether or not we are actually going to hit the date when we are supposed to release the masks and get them into the manufacturing flow.

Finally, several documents reviewed during the course of this research showed that the Project Team kept ongoing metrics of the number of users, the active users, connect time by users, and other useful metrics to measure and gauge system status and performance conditions. See Appendix E, documents D41, D43, and D45, as examples of system measurement documents.

Research Question One and Sub-question Summary

IBM's motivation to engage in e-business was the result of a rational assessment to solve data and process control problems. It was motivated by the inability of organizational members to ascertain the status or outlook of opportunity management operations. There was no direct external pressure on MD to embrace e-business, rather they were internally motivated to gain organizational efficiencies and improved security and business controls from the initiative. The strength of the financial business case further prompted them to take action. Once the project was launched, MD implemented a series of controls, measurements, and oversight actions to

ensure project success. Project management discipline was applied to the project. A cross-functional executive steering committee served as the governance mechanism that regularly examined cost, quality, and scheduled deliverable performance. The artifact of the project, the OM systems and processes all produce operational metrics and measurements to serve the evolving needs of the organization.

A Research Question One and Associated Sub-questions Response Summary can be found in Tables 6a and 6b. This table summarizes the response and documentation evidence themes by group and by question and sub-question. Appendix D, Section One, shows the chain of logic that derives the basic themes from the participant responses and documentation sources.

Table 6a: Research Question One and Associated Sub-questions Response Summary

Sources	Why was the firm motivated to invest in e-business?	What was the nature of any extra-organization influence to adopt e-business?	What internally generated factors influenced the org. to adopt e-business?	What types of project and operational measurements have been used?
Documentation	Achieve better control of business data Gain tighter control of business processes	No evidence to suggest any external pressure Improve organizational responsiveness	Reduce administrative workload and increase operating efficiency Attractive financial business case	Formal project measurements reporting Project governance hierarchy System operation metrics
Executives	Need to integrate isolated, redundant data sources Make processes visible to entire organization (headlights)	No outside pressure Desire for project to improve organizational responsiveness	Need to more efficiently use technical resources Need for enterprise-scale security and business control standards	Project was managed for cost, quality, and deliverable schedules Cross functional executive steering committee Operational measurements

Table 6b: Research Question One and Associated Sub-questions Response Summary (Continued)				
Sources	**Why was the firm motivated to invest in e-business?**	**What was the nature of any extra-organization influence to adopt e-business?**	**What internally generated factors influenced the org. to adopt e-business?**	**What types of project and operational measurements have been used?**
Project Team	Organizational data not integrated and coordinated Organizational processes not integrated and coordinated	No e-business pressure Recommended an e-based PLM solution software package	Requirement to improved efficiency of people's time Data reuse efficiencies	Project was well run and highly scrutinized Steering committee governance Operational metrics
Process Owners		Focus on project function delivery	Data consolidation and reuse Enhanced business controls	Outstanding measurements and results Steering Committee arbitration Operational milestones, metrics, and analysis
Researcher Summary	Organization was motivated to resolve data and process control problems that inhibited members from understanding operational posture and execution.	There was no extra-organizational pressure to make this project an e-business initiative. It became an e-business project as a result of solution approach decisions.	Significant focus on freeing up technical people from administrative work, strengthening business controls, and efficiently utilizing data. Supportive business case.	Significant management oversight and control via Project Management, Steering Committee, Operational measurements, and system utilization metrics

Research Question Two Analysis

How has e-business been utilized to implement organizational, process, and information integration?

Among the many questions asked in this research, this question elicited the most intriguing responses. It was reasonably expected that participants might dwell on the various features and

functions of the Opportunity Management e-business system that proved beneficial to the performance of processes or the integration of data. What was surprising; however, was the assertion by some executive participants that e-business technology was overtly used in the OM project as a forcing function to drive organizational transformation. Therefore, this section of the analysis will first address process and information integration and then investigate the organizational transformation versus technology dimension of the evidence.

At first order, the Project Team put their attention to understanding the business processes and data needs of the organization. The Design Center Executive watched this approach rather closely and generally concluded that:

> They [the Project Team] weren't going after technology for technology's sake; they were really trying to understand what the business processes should look like and then put the right tools in place to facilitate that business process.

This reinforces the notion that the project was driven by a desire to solve business problems as opposed to just driving a new technology into the business. The technology did; however, have some fundamental characteristics that facilitated the team's progress. Team members highlighted that the e-business technology puts less technical burden on the team and there was less unique infrastructure to support than other, similar but non-e-business projects. The CIO, who had previous experience with a SAP implementation, reaffirmed this:

> Well, you didn't have to do a major upgrade on clients and all that. With SAP that was a major problem and it's a big problem in the [manufacturing] fabricator. The fact that you only had to worry about the server side technically made it go easier. There were less people affected at their desk. You still had to train them but you didn't have to take on the whole job of getting them a new piece of equipment.

The Senior Technical Staff Member (STSM) was particularly delighted with the e-business approach as "…it put the computational load back on the server…[and therefore]…enabled the team to focus on the problem and not on the IT."

The other benefit of this technology, as perceived by the Project Team is that they didn't have to necessarily restrict their process designs to fit into a tightly preconfigured and inflexible framework. Given the characteristics of their e-PLM software, they were free to define any process that they wanted and then implement it within the tool. In many ways, this enabled the team to freely describe and model the OM Pipeline in whichever manner that made sense to the organization.

Constituent users found great value in this process model as well. The FAE Process Owner conceded that:

> …putting the whole OM sort of pipeline in a logical format was a good thing. [Previously], we didn't have a lot of written processes; we had a lot of individual processes that didn't necessarily match each other.

The CRM Process Owner was rather blunt in asserting, "…the process flow was virtually defined by the tool." The data collected in this research project clearly demonstrates a high regard by all associated with this project for the detailed process integration work done in this project and the role played by technology in enabling it.

Implementation of relational database technology also greatly empowered the user community. Marketing and Design Center operatives benefited from the technology's capacity to feed them information almost instantaneously based on simple pre-configured views [screens or presentations] and queries that leveraged the relationship between data objects and their attributes. The Tactical Marketing Specialist recognized the power of consolidated data by

noting, "Now with [the OM system]…I can go in and at my fingertips I can see the client's design and see the scheduling and the dates and the process." The Design Center Manager reacted similarly:

> …when you bring up the tool, there are preprogrammed views, and that's cool because that is what I use as a manager…I can pull from that database anything and everything that's in there…

These reactions, almost testimonials, reflect positively on the integration power of relational database technology, the capacity to associate a variety of related data, and present them in a form that makes sense to users and that supports their decision making.

Another feature that had great value to business operatives, eased their computing burden, made it just a little bit easier for them to interact with the system, and ostensibly removed a barrier to conformance and participation, was the use of the Internet Lightweight Directory Access Protocol (LDAP). This feature allowed the OM system to recognize a user's IBM Internet ID and password from a corporate directory. Thus, users didn't have to create another set of IDs and passwords to use the OM system. The Design Center Manager commented, "I think when you guys set it up for us to use the IBM Internet password and ID that was a very good enablement for us." The CRM Process Owner similarly remarked, "..but what is good about the tool is that you guys, at one point, put in the fact that you make it consistent with your intranet ID and logon…" These brief comments illustrate the simple, but effective, directory technology that users found beneficial in their OM working environment.

All of the foregoing features either directly influenced the process and data designs or assuaged the concerns of users about interacting with the system. In either case, they played a

role in moving the organization towards interacting in an end-to-end, integrated process and data environment.

As earlier mentioned, there was a rich discussion by participants about the effects of the OM e-business project on the organization. Many examples were given about how the new processes and system tools enabled new ways of working or created new roles and responsibilities patterns. The Customer Relationship Management (CRM) Process Owner thought the system helped to enhance organizational teamwork and make "organizational structure virtually transparent." The Design Center Manager and the ASIC Methodology Engineer cited specific instances where new jobs had been created or roles dramatically altered over time because of OM process influences.

Some; however, thought that the technology was deliberately implemented to force organizational change:

> So I think OM is an example where technology was probably intentionally used as a vehicle to force a transformation and to force discussion and reflection before the process was fully understood. This forced the organization to learn to change, it forced process management to emerge where it did not exist before.

This comment by the WW FAE Executive is insightful in many ways and probably rests on a couple of years of reflection and interpretation. The Owner Executive, CIO, and FAE Executives all made comments that, although less explicit than that made by the WW FAE Executive, suggest that the technology and the project design forced transformation. The Owner Executive noticed that the OM system has "…pushed more responsibilities out to the edges [of the organization] in terms of timely input of data, the completeness of the data and the maintenance of the data." The CIO characterized it from another angle:

> …we spent quite a bit of money just to do enhancements. That may have pointed out, perhaps, that we had the wrong people doing stuff.

> By deploying OM maybe we got the job to the right people and then they didn't know how to do it.

Finally, the FAE Executive thought that the OM system had "…taken on a bigger life of its own than [he] had anticipated." Taken in aggregate, these reflections, all made by executives, speak to the significant role of the technology and the project in catalyzing fundamental organizational change within MD. Interestingly, the perspective of technology induced change is only articulated at the executive level. Neither the Project Team Leaders nor the Business Process Owners touched on this dimension of change. Clearly, though, all participants validated and verified that the initiative created an environment of change and that significant transformation has occurred in organizational structure, collaboration style, and reconfiguration of roles and responsibilities, among other things.

With several years of experience and observation to call upon, the participant interview data and document evidence shows that e-business technology infrastructure and features applied through the OM project have enabled the desired business process design and data integration. This, in turn, has affected organizational and personal roles and responsibilities and enhanced the collaboration capacities of the business.

Sub-question 2a: How have pre-existing business and technology infrastructures influenced the evolution of the e-business project?

This question was designed to focus participant attention on the operational context surrounding the implementation of the OM project. As it turns out, it draws attention to two distinct rudiments of context: 1) the elements of the pre-existing environment that created barriers to project implementation and 2) the organizational methods and practices that needed to

be embedded in the newly created e-business processes and systems. These will be discussed in turn.

As was repeatedly highlighted throughout all of the interviews and reinforced by document review, the state of MD's data infrastructure was the most debilitating obstacle facing the business. In many ways that situation is easily understood. As the IT Architect sagaciously noted, "…if I stop and think about the constituency, they are far less often served by traditional IT applications than are manufacturing and supply chain parts of our business." This reality contributed to the pre-existing environment which was characterized by the widespread utilization of multiple, isolated, unconnected, and under performing applications. This condition, endemic to all the organizations, was enacted through the development of ad hoc, home grown data applications, typically instantiated through Lotus Notes Groupware. While there is nothing innately or inherently wrong with Notes, the magnitude of the data and process control issues was well beyond the technical capacity of Groupware.

The best descriptions of the environment are provided by the FAE Process Owner and the Tactical Marketing Specialist:

> So what we found was that there were pieces of an opportunity listed in those forty different databases and none of those databases talked to each other. In a lot of cases we didn't know all of the information that was in them nor did others know what was in ours.

> I'd ask for a piece of information and they would say go to this Notes Application and I would have to go get it on my desktop and that would be about 25% and then I'd say well what about this, then they would say go to that Notes application and that would be another 10% and so before I knew it I had quite a collection of databases and I was accessing them each individually.

Both of these statements paint a picture of the unsustainable operating environment that, of course, was to be rectified by the integration design point of the OM e-business initiative.

While having too many data places represented a problem to be resolved as part of MD's e-business evolution, there were other elements of the operating context that needed to be comprehended in the overall solution design. The most notable were the ASIC Design Methodology, the Sales sell cycle activities, the impact of the factory metaphor, and the importance of business controls and audit readiness requirements.

Incorporating the necessary elements of the ASIC Design Methodology and the Sales sell cycle activities were relatively straight forward tasks of understanding the flow and goals of these processes and then properly fitting them into the overall OM Pipeline. The significance of the Design Methodology is that it is the tracking method that engineers use to assure the development of first time right designs, a key value proposition of the IBM ASIC business. Similarly, the sell cycle activities and deliverables, another tracking and control methodology, needed to be aligned and mapped into the OM pipeline.

The notion of the factory metaphor is a bit more abstract than the other operational influences. Essentially, it is the recognition that most members of the organization are closely associated and familiar with the end product of semiconductor operations which is the manufacturing of chips. Almost all employees are trained to understand the flows and controls used to fabricate semiconductors. Hence, some of the same concepts used to describe manufacturing processes were utilized within the OM Pipeline of business processes. The language of process flow, designs in process as analogous to work in process, input and output control, and other similar terms were used to convey the idea that the OM Pipeline was essentially a factory for

transmogrifying customer requirements into potential solutions and then into final data sets and part numbers that could be physically manufactured. The use of this metaphor made it easier for users to visualize and comprehend the scope and function of the OM system and the pipeline of interrelated processes and practices.

Because certain aspects of Sales Force compensation were tied to the status and progression of opportunities through the OM Pipeline, adequate business control assurance was a necessary function and design point for the OM system. The FAE community needed assurance that the new OM pipeline would incorporate sufficient business controls to ensure that, as the FAE Process Owner explained, "there was separation of duties and that there isn't a conflict of interest or that somebody who is getting paid is not signing off on an opportunity." This has become even more important since the inception of the Sarbanes-Oxley Financial and Accounting Disclosure regulations. Likewise, the CRM Process Owner relies heavily on the system to mediate and control the Customer Relationship Management (CRM) facets of the process:

> I have learned over time about what we have to demonstrate to show that we have a process under control. But the fact of it is that without the infrastructure…and what it forces from a process flow perspective… you could not do a satisfactory job.

In summary, various organizational methods and practices were embedded into the newly designed OM pipeline. This allowed the entire organization to see the interrelationships of the various processes such as the ASIC Design Methodology, the Sales sell cycle, and business controls requirements. The factory metaphor served as an effective mechanism to portray the concepts of information flow through the end-to-end process and the processing of opportunities. As well, the pre-existing condition of multiple, redundant, disjointed data applications was the principal debilitating legacy infrastructure that needed to be overcome.

Sub-question 2b: How do the economics of e-business technology enable the management of internal operations?

Of the participants in this study, the CIO and the Project Team Leaders had the best grasp of how the OM project leveraged value from e-business technology. They cited standardized function, browser technology, and varying aspects of networking as the significant value added elements of the e-business approach. The Project Manager, who had prior experience on a SAP implementation, volunteered that:

> …it certainly was less expensive to do it in an e-business context where all that stuff was supplied…we didn't have to develop all of the function associated with the browser and the middleware…[and] we reduced overhead to support it.

By using standardized Internet middleware and standardized functions, the team was able to minimize its concentration on the technical aspects of project deployment. They could realistically assume that basic Internet-related functions, such as the capability to interpret html tags, download and execute java applets, and the functionality to interpret Java Server Pages, would be available on user workstations. This afforded lower development expense to the project through reliance on ubiquitously available standard Internet functions.

The most frequently mentioned economies were those associated with the Web browsers. As mentioned earlier, the Web browser, typically a free application or one bundled with Personal Computer Operating System Software, provided the most recognizable values. The list of advantages, as articulated by participants is significant: 1) Lower total cost of development due to free or very low cost browsers and thus no requirement to license and install unique client software, 2) Ease of distribution with no requirement to be concerned about standards and protocols across the world wide Microelectronics geographic profile, 3) Much reduced training

expense as most users were already familiar with browser functions. They only needed instruction on how find, access, and navigate the OM application, 4) Browser technology allowed the system to more efficiently target function to individual people as the system could control the end-user presentation and enable them to transact on only those functions for which they were entitled. This reduced education and training expense and diminished the opportunity for users to inadvertently perform undesired transactions, and 5) since Web applications are platform neutral, there was a much reduced hardware budget.

In aggregate, then, the browser technology provided tremendous advantage to the project in terms of cost avoidance as compared to the client-server model of computing. Browser technology helped to reduce training and education expenses, it enabled faster speed of implementation and roll out, and it eliminated any preoccupation with software distribution logistics.

One other economic advantage recognized by the Project Team Leaders was the synergy and value afforded by the network of users. Certainly, leveraging the Internet and intranet infrastructures enabled the instantaneous distribution of information. That was vitally important, but equally so was the positive effects of long distance, asynchronous collaboration. The Senior Technical Staff Member (STSM) articulated this best by highlighting that:

> …organizations came on board from a synergistic point of view over time… and what's happening is that each one of these groups has incrementally improved the data quality and the breadth of the data.

In reality, two phenomena appear to have occurred. As each additional organization joined the community of users on the OM system it became more valuable for all of the other organizations to embrace the system. It became imperative to join the system in order to become

aware of what was going on in the OM Pipeline. The Design Center engineers were the first to participate, ASIC Methodology experts then joined in order to synchronize with the Design Center. Later, FAEs joined the system to communicate their activities to their Methodology and Design colleagues. Next, the Tactical Marketing representatives, Intellectual Property Development engineers, and supply chain team joined in order to take advantage of the existing system and to supply their information and knowledge. Finally, the headquarters staff began to embrace the system to mine data and gain overview perspective on the entire pipeline. Then, as the STSM noted, with all of these different organizational perspectives and all of the extra "eyeballs" scrutinizing the data and with management attempting to manage from the data, the information started to incrementally improve in terms of quality, timeliness, and quantity.

The economic value of all of this synergy is realized through the quality of business decisions that each member of the community of users is called upon to make. The OM measurement and metrics records show numerous instances where quality data has resulted in hundreds of thousands or millions of dollars in savings, costs avoidance, and incremental revenue additions.

In summary, the Internet model, network, and browser kept OM project costs much lower than would an equivalent client-server approach. Over time operating costs have been positively influenced through networking synergy.

Sub-question 2c: How has e-business influenced the automation, creation, and redesign of business processes?

With the exception of two interesting responses that will be discussed in some detail, the general consensus of all participants is that very high end business process reengineering and organizational process change was enacted through the OM project. The Executive Owner of the

project, who had many years of experience with other operations-related transformation projects noted:

> It was a fundamental transformation in that we…were certainly not satisfied in automating the status quo…the opportunity was to fundamentally restructure the work and work flow to get cross-enterprise linkages built.

As the CIO put it, "[It was] halfway between high- and lowfalutin' reengineering." These executive viewpoints recognize the transforming effect of the project and are not inconsistent with the responses recorded earlier on the topic of organizational, process, and information integration. From this viewpoint significant change was mediated through the OM project.

The Project Team Leaders expressed a wider range of opinions about the extensiveness of business process redesign. The Project Manager, IT Architect, and Consultant were confident that the project induced fundamental, innovative, and profound change to the organization. On the other hand, the Senior Engineer and STSM maintain that there was very little, if any, fundamental redesign. Process Owner perceptions, it seems, were squarely in the midst of this range.

The IT Architect believed that the project's effects on processes were "clearly innovative and probably in many ways midway between innovative and revolutionary." That is a strong statement and paints a picture of "highfalutin reengineering", using the CIO's words. The Consultant, who, again, had multiple experiences with various companies, sustains the contention that significant reengineering was accomplished. The Consultant noted that, "the whole lifecycle management thing, to me is a profound change in the way you guys did business here and it has a great benefit in terms of efficiency and throughput."

On the other side of the equation, the STSM stated that,

> In general, I would say that we have not changed processes. We didn't change our processes fundamentally; we understood why the customer was failing and pushed back with some new capability, education, training, and tools…

The Senior Engineer said essentially the same thing. So why was there a seeming disparity of responses between Project Team Leaders? The answer is that it depends on your perspective. The Sr. Engineer and STSM were being rather literal when responding to the question. In their views the various process components were already at play in the business albeit uncoordinated and poorly enabled and executed. To them, identifying, naming, organizing, connecting, and enabling the processes didn't qualify as business process redesign but rather characterized business process enablement. They viewed it as, perhaps, novel integration and enablement of existing processes. One could argue; however, that those enablement contributions constituted significant reengineering.

The Business Process Owners perspective helps to complete the picture and shows the importance of perception. In general, the Process Owners considered the Project to have definitely performed reengineering tasks and some "fine tuning" tasks. The CRM Process Owner articulated this theme best:

> …we did take the best knowledge we had of the way that we felt the process would flow and work properly and use that as a starting point. Once that base was put in place then it became a process of fine tuning and tweaking it so it becomes more and more effective.

This succinctly defines the continuous improvement modus operandi of the OM Project Team.

One last point that shows the importance of perception to the resolution of this question is the different views of just how much redesign was done when the Design Methodology component

was implemented in the overall OM process. Project team members used the term "mapping" when they talked about that process. That creates a vision of process automation with little or no redesign component. However, when asked the same question about redesign the ASIC Methodology Engineer, the owner of the Methodology process, responded with, "…we certainly did some reengineering to the Design Methodology process. It wasn't simple mapping of questions into Opportunity Management." Apparently, one person's mapping exercise is another's business process reengineering project.

On balance, the overall evidence points to a project that significantly changed the organization and its business process structures. Many participants in this study saw the redesign component as extensive and profound while some were more conservative and less willing to don the cloak of business process engineer. From an observation perspective, it appears that the entire participant pool would be comfortable with the notion that they applied significant redesign where appropriate and necessary and mere automation when suitable and cost effective. In other words, they contingently applied the necessary dose of redesign and reengineering as circumstances dictated.

Research Question Two and Sub-question Summary

E-business technology, infrastructure, and features directly and, in some cases, implicitly enabled the desired process and data design objectives of the OM Project Team. The ability to model and express the end-to-end breadth of the OM pipeline is the foremost example. It did not exist in explicit form before the Project created it. Deploying the pipeline concept was either the result of organizational transition or the forced outcome of technology and process deployment,

depending on the perspective of the participant. Nonetheless, organizational design, roles, responsibilities, and methods of collaboration were altered in light of the OM e-business project.

Pre-existing, legacy artifacts, organizational methods, and business practices influenced the OM project and in all cases represented elements of operational context that the project needed to comprehend and absorb. The newly designed OM pipeline inculcated the practices of ASIC Design Methodology; Sales sell cycle activities and deliverables, and business control requirements that were essential to the organization. It drew upon the factory metaphor as a means to create understanding and conceptualization of the OM system and its goals. Finally, the project, as a part of its principal mission had to contend with the widespread practice of functional organization's using Groupware to instantiate and manages their various data applications.

The project received extraordinary benefit from embracing the Internet model. Deployment costs were kept in check through the use of standardized Internet functions and protocols and reliance on the Web browser as the application interface software. This afforded several avenues of cost avoidance: cheap or free browser software, ease of use, reduction in roll out and education costs, avoided expense for hardware, and better control over data presentation and hence higher system performance and reduced exposure to incorrect transactions.

Overall, the project gets high marks from participants for its depth and quality of business process reengineering. Although some argue that the enablement portion of the mission was more notable than process redesign, the majority of participants professed a solid case for the situation dependent or contingent view of process reengineering. Said differently, the Project Team redesigned, reengineered, or just automated where necessary and appropriate.

A Research Question Two and Associated Sub-question Response Summary can be found in Tables 7a and 7b. This table summarizes the interview responses and documentation evidence themes by group and by question and sub-question. Appendix D, Section Two, shows the chain of evidence and logic that derived the basic themes from participant interview responses and document sources.

Table 7a: Research Question Two and Associated Sub-questions Response Summary

Sources	How has e-business been utilized to implement organizational, process, & information integration?	How have pre-existing business & technology infrastructures influenced the project?	How do the economics of e-business technology enable the management of internal operations?	How has e-business influenced the automation, creation, or re-design of processes?
Documentation	E-business infrastructure supports integration Application features support integration	Existing operational methodologies: Design Methodology, Sales Method, Corp. business controls, factory mentality Standalone application dysfunction	No special client software Use company's existing IT infrastructure	Integrated business process reengineering and e-business enablement concepts
Executives	Business process design enabled by technology Technology induced fundamental transformation Organizational collaboration	Sell cycle phases and activities Plethora of standalone data applications	Networking Leverage inexpensive browser	Fundamental restructuring Process reengineering

Table 7b: Research Question Two and Associated Sub-questions Response Summary (Continued)				
Sources	**How has e-business been utilized to implement organizational, process, & information integration?**	**How have pre-existing business & technology infrastructures influenced the project?**	**How do the economics of e-business technology enable the management of internal operations?**	**How has e-business influenced the automation, creation, or re-design of processes?**
Project Team	Business process analysis Technology enabled implementation flexibility and low user overhead	Without dedicated automation they relied on numerous, isolated, underperforming applications Excellent response time and degrees of freedom through	Easier world wide deployment Web presentation layer provides control and efficiencies Low cost thin client advantage Data improvement via organizational synergy Lower development expense due to reliance on Internet standards	Significantly reengineered processes Novel integration of existing processes and enablement
Process Owners	Relational database enabled information integration Process definition prescribed the integrated pipeline Easy consistent system access and enablement Information integration effects Organizational change Synergy of integration	ASIC Design Methodology Factory Metaphor Control requirements Desire to integrate Too many data places	Contemporary compelling technology Ease of use equates to less training	Some reengineering and fine tuning of processes
Researcher Summary	E-business technology, infrastructure, and features enabled the desired process design which in turn affected organizational role, responsibilities, and collaboration style.	Organizational methods and practices embedded into the newly designed processes while numerous legacy applications were impediments to building an end-to-end system	Internet model, network, & browser kept costs lower than client-server model. Operating costs go down thru networking synergy	Generally, a high level of business process reengineering, nothing mapped as is. Enablement through e-business technology.

Research Question Three Analysis

What were the overarching difficulties and roadblocks that were encountered while attempting to apply e-business to internal operations?

What is most remarkable about the interview responses to this question is that not one technology issue or concern percolated up to the level of being considered an overarching roadblock or difficulty. This is despite the fact that several technology and technical problems are described in various documents, particularly steering committee status presentations. There are references to data migration difficulties, lack of technical resources, difficulty configuring and tuning relational databases, system performance deficiencies, user interface problems, and travails associated with software version upgrades. Oddly, none of these issues were discussed or even mentioned during the interview process. In fact, only one pseudo-technical issue was discussed and that was an executive perspective on the difficulties associated with getting the project business case approved and sustaining the funding for the project over the long haul. The preponderance of conversation centered on the variety of problems presented by numerous forms of organizational resistance to change. Clearly, all participants felt that the challenge of getting the various parts of the MD organization to conform and "play together" consistent with Project vision was the seminal roadblock.

Organizational resistance was manifested in several forms. In some cases, the resistance was subtle and enacted as a polite skepticism toward the viability of the project vision. As characterized by one of the Project Team Leaders, "I think people were very reluctant to buy into the whole notion of OM because they didn't believe that it could be successful, that it would die of its own weight." Many people adopted a wait and see attitude. They believed that the project vision was too complex, involving too many variables, data elements, and process requirements.

Others just had a difficult time "comprehending the bigger picture." They remained attached to their narrow parochial views and interests and wedded to a functional silo mentality wherein they had, as the Senior Engineer commented, "…their own processes and ways of doing things and it may be very efficient for them…but it may not be very efficient for the overall end-to-end process…" For the most part, the participants generally concluded that lack of cooperation, fear of change, and other manifestations of organizational resistance were natural and to be expected. The Consultant reflected that, "The number one issue, and it is every where, is resistance to change…that's just the way people are…people just don't like to change…they get comfortable with their jobs." The Tactical Marketing Specialist captured this same notion in a slightly different way, "People are in a comfort zone…so I get what I need, I do my job this way. I don't need to embrace this. I'm doing just fine, thank you."

One other difficulty, one that is related to organizational resistance, is the difficulty that the Project Team had in getting designated parts of the organization to formally and unambiguously accept ownership responsibility for certain processes and data. It was, at first order, difficult to determine who the logical owner should be, and at second order it was frustrating for Project implementers to not have a designated, single, end-to-end process owner who was empowered with clarifying and arbitrating authority. The Project Manager best illustrated this problem:

> …lack of owned documented and enforced cross-functional processes and associated with that is the lack of recognition of a need for them and for the benefits of them…the entire organization has to recognize the business processes and they have to have people responsible for them.

Given the Project's long running history and broad organizational impacts already described, it is apparent that these obstacles were surmounted. This was no doubt due to the combined efforts of the project team, support from the executives, and belief in the Project vision by more

organization members than those who did not. What is most interesting is that the organizational travails were foremost in the minds of participants to the exclusion of the documented technology and technical hurdles. Perhaps that is due to the fact that technology issues were acute, yet short duration problems, whereas organizational issues were chronic and ongoing. Additionally, the lack of comment or concern about technology issues reflects positively on the ease of implementation made possible by e-business technologies.

Sub-question 3a: What practices, under what conditions, proved to be the most and least useful and successful?

The participants in this research described three practices utilized by the executive team and several project management procedures used by the Project Team as being particularly useful and effective.

The executives made an interesting decision during the launch phase of the initiative to situate the Project Team within the operations hierarchy of the business organization as opposed to placement within the IT organizational infrastructure. This kept the project close to the user community and allowed the Project Team to draw upon the operations functions for resources to staff the project. In doing this, they needed to find the most neutral organizational spot for the team. As the Owner Executive explained:

> …because we had so many constituents and stakeholders, I think the logic of putting it [the OM Project] in neutral territory was that it was a cross-enterprise application and business process that if owned by a singular stovepipe [functional silo] the human tendency would be for the optimization to be around that particular area as opposed to across the enterprise.

In this case, neutral territory was deemed to be within the Business Operations, Plans, and Controls organization. This group typically coordinated the plans and operations of all the groups within the operational arena. The Executive Owner was given full authority for project

execution on behalf of the operational staff. This allowed for a somewhat unbiased and hopefully balanced approach in addressing cross-organization deployment issues.

Another decision made by the Executives that had far reaching effects on the strength and credibility of the project was their selection of very senior, seasoned, experienced, Project Team Leaders. One Project Leader stated:

> …we had among all of us, cross-functional experiences…so we were able to integrate things…we recognized that this was indeed a cross-functional entity that we were dealing with and not only did we have different flavors in terms of our backgrounds, we had in-depth background in the very areas we were working in…the other thing of interest is that all five folks had executive access…they had good reputations as contributors and as people who would talk straight…the leadership folks had been around for some time…that's what allowed them to have enough experiences to be the leadership team.

This group of leaders had, among them, approximately 150 years of IBM Microelectronics experience in a variety of management and non-management capacities, they had strong ties to the user communities that they were attempting to serve, and some of them had participated in other major process and software development projects in previous assignments. It was the opinion of executives and business process owners that the business was being well served by the OM Project leadership team.

The final executive practice that appeared to be a useful tactic was that of forcing all business decisions to be based on information sourced from the OM system. It was their contention that the quality of data in the OM database would improve as a function of consistent use of that source of data. The Design Center Executive stressed:

> …you can't have competing sources of information so that means if you have decided to use repository one for information then that's the only one you are going to use…the only way to improve the integrity and quality of data in a database is to use it to make business decisions. If

> the data quality is poor or suspect but you use it to make business decisions the affected parties will quickly improve the quality of the data.

The essence of this practice was to put all subordinates on notice that the only acceptable source of information about opportunities would be the OM system; therefore, if the subordinates wanted to advocate for particular decisions based on data analysis, then it was incumbent on them to use the data from OM. The premise and subsequent reality was that the data would get progressively better over time because it was in everyone's best interests to ensure that the data was of high quality.

Over the years, the Project Team experimented with many practices and procedures to effectively manage the project and effectively replicate positive deployment experiences. As was mentioned earlier, the team made good use of Project Management disciplines. This was especially important during the first several months of the project. During the early phases of the project, rigorous techniques were used to plan, stage, and execute each business process redesign and software release. This helped to coordinate the efforts of a team that was learning the capabilities of the technology, wrestling with organizational resistance, and coping with the pressures from management to make swift progress.

Faced with these challenges, the team adopted a strategy of breaking the entire project into small, relatively easy to manage "bite sized" chunks, instituting a standardized development and release process, and attempting to release new function frequently and rapidly. As the Senior Engineer observed:

> If we had tried to build an end-to-end process all at once and deploy it, it would have failed of its own weight. The business, I don't think, would have been patient enough to wait for it and the people who use it wouldn't be willing to make such big changes at once.

Thus, a phased process and software deployment rhythm, that featured multiple, rapidly deployed modules addressed the executive direction to make due haste. It also accommodated the organization's ability to absorb a new operating process methodology. Further, as explained by the STSM, "…the [overall] problem was so big that we ended up using a gradualist approach, sometimes we would focus on just getting one data attribute in control then we would go on to the next [one]."

One other learning point worth noting was the decision by the Project team to embrace a standardized, structured, development and release process. The Consultant best articulated the value of this choice:

> …we decided to implement a standard [development] process. I think that led us into a higher probability of success of moving forward. I also think that every release that you actually finish adds to the success of the next release…it's one of those exponential things where the first one is hard because no one has done it, no one knows what they are doing or where it will all end.

This approach enabled the team to effectively manage multiple release cycles, progressively learn and fortify team knowledge through several iterations, and, at the same time, keep a fast paced delivery schedule.

Overall, the research findings indicate that placing the project within a neutral, yet operational, part of the business organization structure was conducive to driving a balanced, pan-organizational view of project deployment. Rigorous management of rapidly deployed project phases or process subcomponents by an experienced team provided a good balance between speed of implementation and organizational ability to digest new tools, processes, and functions. Finally, by forcing the organization to use the new processes and data, the executives promoted a

decision making style that forced utilization of the new infrastructure and subsequently a systematic improvement in data quality.

Sub-question 3b: How are the information requirements of operations addressed?

The pattern of responses to the above question is manifested in the following questions that the users predictably ask: 1) How fast and efficiently can I get access to the application that has the information that I need? 2) How easily can I find what I'm looking for? 3) Will all the data I need be available? 4) Will I be able to analyze the data? The OM system addressed these information requirements by ensuring ease of access to the system, providing powerful search function utility, guaranteeing information thoroughness, and installing capabilities to analyze the information.

The e-business qualities of the OM system greatly enhanced its accessibility. Being an e-business application, it was platform independent. In other words, it didn't matter what computing platform a user was utilizing. As long as they had Internet access, a logon ID, and a password, a user could reach the application within the IBM intranet. This enabled those working in the field to use the system to gain access to the OM pipeline data whenever and wherever they might be. This speaks to the ubiquity feature of Internet technology.

Once admitted into the system, the user needed to efficiently and quickly get to the desired data. Thus, rapid, high performance, and easy to use data search capability was much prized. This was particularly important to those who used the system in an impromptu manner and under stressful conditions. A typical scenario presented by participants was as follows:

> …so I'm sitting here and a customer calls up and says 'my design is late, why?' and within 25 seconds or so, less than a minute, I can have that design up in front of me with who is working on it, what the commit dates were and are, and what technology it is in…everything that deals with the business issues.

After querying the database the user then needs to see all of the appropriate data consistent with the type of topic they were investigating. In the majority of cases, information about the status of an opportunity, particularly with regard to progress towards design milestones, was extremely important information. As explained by the ASIC Methodology Engineer,

> So we have visibility there to the state of the design and what's going on. Is it going to be on schedule, early, or late? What are the actual dates of meeting the checkpoints? And that gives us a preview of whether or not we are actually going to hit the [commitment] date.

These are the typical questions that a person working within an operations environment would ask. They are all directed at understanding how business functions are executing their responsibilities.

The final information requirement that is necessary for operations is the capability and tools to analyze data. In the case of the OM system, data aggregating and reporting functions were provided as part of the delivered software. This allowed them to "massage" the data and model business scenarios. More importantly, the information provided by the OM system was presented in context to the OM pipeline thereby enabling the users to visualize the data in temporal sequence.

The succinct answer to this sub-question, then, is that easy, rapid, ubiquitous access to data in conjunction with powerful search functions addresses the requirement of organizational members to stay abreast of operations schedule and status information.

Sub-question 3c: How has e-business affected the level of integration between processes?

The responses to this question tended to center on two main themes: the relationship between data and integrated business processes and the benefits realized by the organization from the OM e-business initiative. The relationship between data and business processes is fascinating. The Senior Engineer said it best:

> Business processes and data are so intertwined it's hard to sort it out. What are business processes based on? They are based on data. It is the lifeblood of the business processes…the data.

Clearly, the e-business tools and technologies previously discussed enable the management, coordination, dissemination, and control of organizational information. This information, in turn, enables business processes.

The OM Project Team discovered that access to and availability of "golden" data produced a powerful incentive for personnel and organizations to participate in the OM project. They came to understand that without quality, controlled data their processes and systems were confused and inefficient. Further, they recognized that business decision making was sub-optimized in the absence of a complete information picture. An excellent example was produced by the FAE Process Owner:

> If in fact, we only have a piece of the data and somebody else has a piece of the data and those two pieces never come together, how can anybody really make the correct tradeoff calls if you don't have the right picture?

Given this near universal interest in information and data, the Project Team implemented the concept of "required data" as a mechanism to regulate the flow of opportunities in the OM pipeline. Essentially, each opportunity type was assigned a required data profile. This profile described what key information needed to be supplied over time to ensure unencumbered flow of

an opportunity through the end-to-end processes. The STSM, one of the originators of this concept, explained:

> The thing that proved the most useful…was the concept of required data. It was a carrot and stick approach. The carrot is, if you supply all the required data you can move forward [in the process]. The stick was if you don't supply the right data you can't move forward.

This describes a process wherein the e-business infrastructure mediates the management of data and the rules and practices associated with the input and updating of data as a means to regulate integrated process flows.

With its process and data infrastructure in place and operating over several years, the OM participants were able to articulate the benefits realized by the organization. The executives were delighted to achieve better access and visibility to process data and higher performing linkages between components of the end-to-end processes. They also reaped the benefit of more efficiency as they were able to free up and reduce the number of people needed to work the processes.

The Project Team and Business Process Owners believed that multifunctional cross-organizational processes, integrated into an enterprise-wide network ensured data availability to all. As the FAE Process Owner succinctly put it, "OM is an unbelievable tool in terms of the data that is available at your fingertips." Again, the system enabled them to increase their efficiency, reduce redundancy, and get a clear view into the opportunity pipeline.

Research Question Three and Sub-question Summary

Various forms of organizational resistance overshadowed technical and technology issues as the principle overarching difficulties faced by the OM project. It was a complex project with a vision that many in the organization found to be too ambitious. Nonetheless, the project was

launched and guided under the stewardship of a senior, widely experienced, project leadership team within the operating organization. This team devised methods to partition the project into smaller, more easily managed components, which were released on a fast-paced cadence using a standardized, repeatable methodology. The executives supplemented the technical elements of project release by insisting that the new platform be used to collect all data that would be used for decision support purposes.

Overall, the business gained the most operational advantage from the e-business system through ubiquitous access, high performance search capability, a vast array of schedule, milestone and progress information, and through use of robust data analysis software. In reflection, the key glue holding processes together is the business data. All constituents desired access to high quality data in order to manage the business. This was the single most important motivating force for joining the system. Use of the required data concept was the principle mechanism through which process flow was mediated.

A Research Question Three and Associated Sub-questions Response Summary can be found in Tables 8a and 8b. This table consolidates the responses and documentation evidence themes by group and by question and sub-question. Appendix D, Section Three, shows the chain of analysis that derives the basic concepts and themes from the participant responses and documentation sources.

Table 8a:Research Question Three and Associated Sub- questions Response Summary				
Sources	**What were the overarching difficulties and roadblocks encountered?**	**What practices, under what conditions, proved to be the most and least useful?**	**How are the information requirements of operations addressed?**	**How has e-business affected the level of integration between processes?**
Documents	Pockets of organizational resistance Process ownership misunderstandings	Move quickly Segment project Use modified project management techniques	Search and view vital business and technical information High performance search function Plan, commit, outlook, and actual schedule information Data aggregation and reporting functions	A "golden repository" aides process integration Required data for pipeline movement Multifunctional, cross-organizational processes can be integrated into an enterprise-wide network
Executives	Parochial organizational interests Fear and resistance to change Business case development Lack of high level process ownership	Manage project from a neutral operations area Business decision making from a single data source improves quality of data	Real-time design schedule information	Better access and control over integrated process pipeline It freed up people within the processes
Project Team	Unwilling to change or cooperate Skepticism of vision Functional silo thinking Unambiguous process and data ownership	Frequent cross-organizational status and progress reviews Phased process deployment and data improvement Use a standardized, repeatable development process and churn out releases as quick as possible Assign experienced, seasoned team members	Mobility and access	Required data Business processes and data are intertwined Increased the efficiency of many organizations

Table 8b:Research Question Three and Associated Sub-questions Response Summary (Continued)				
Sources	**What were the overarching difficulties and roadblocks encountered?**	**What practices, under what conditions, proved to be the most and least useful?**	**How are the information requirements of operations addressed?**	**How has e-business affected the level of integration between processes?**
Process Owners	User skepticism Lack of cooperation Lack of understanding the bigger picture Very complex project Funding shortfalls		Ubiquitous, real time access to pipeline information Rapid, impromptu searches for data Internet and Web delivered high performance Schedule performance to key project milestones Strategic pipeline analysis and modeling	Coordinated, integrated data enables analysis and decision making Data availability supports all operational processes and activities
Researcher Summary	Organizational resistance overshadowed technical difficulties. Lack of "buy in" to vision and belief that it was possible and ownership.	Rigorous management of quickly deployed project segments by an experienced team. Force use of new process and data to embed desired behaviors.	Rapid, ubiquitous access in conjunction with powerful search function to provide schedule and status information serves operating teams.	Data and e-business data technology is the glue that holds the processes together and is the incentive that motivates constituents to participate.

It Is All about Data

Of the topics examined during the course of this research, none seemed as widely important or as thoroughly scrutinized as that of data and information. Every interview examined data and information in some manner. In fact, the original motivating force for embracing the project was the concern on the part of executives that they didn't have adequate access- headlights in their vernacular-to information about the opportunity management pipeline. The World Wide Field

Applications Engineering Executive and Field Applications Engineering Executive, those responsible for staffing and deploying the technical sales support team, needed information about how their operatives were performing in the field while the Design Center Executive needed information from the field in order to efficiently plan design execution capacity. In certain terms, these executives sponsored the OM project in order to provide themselves and their organizations with valuable data and information. They were not stimulated to take action by worries about process performance, dissatisfaction with their Information Technology, or by concern about organizational efficiency. They wanted data and information.

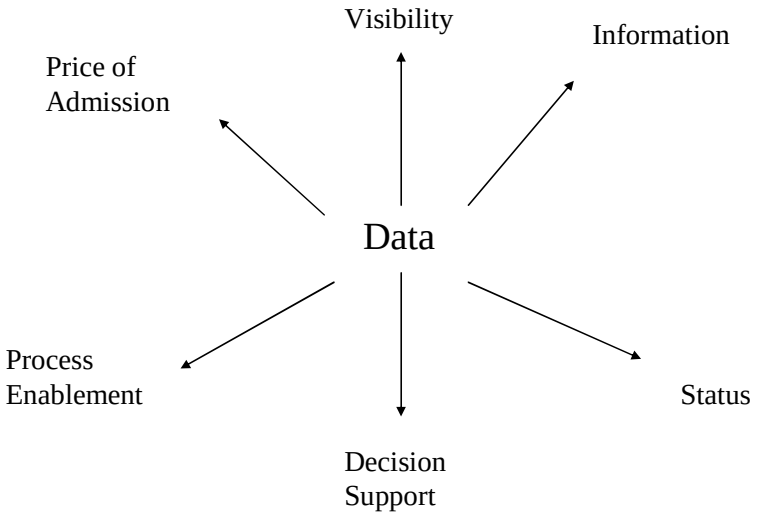
At the Project Team level, observations about the dysfunctions of the operating environment were framed in terms of the health of the organization's data management practices. They found disorganized, disjointed, and uncoordinated data, multiple, redundant data locations, and lack of an architected data model. Even the recommended solution concept, the OM pipeline, was conceived to provide context for data collection, interaction, and analysis.

Business Process Owners were equally focused on the value of data. At first order, the incentive to participate in this project was a function of the perceived value of data to organizations and individuals. The FAE Process Owner, Tactical Marketing Specialist, and Design Center Manager all extolled the value and virtue of readily accessible "data at your fingertips." The CRM Process Owner and ASIC Methodology Engineer recognized value through the ability to extract, track, and analyze data that was pertinent to their interests.

As Figure 5 depicts, data is the central and unifying commodity, bartering item, and unit of exchange that attracted commitment and participation in this e-business project. Data creates the

information that provides the visibility, headlights, status, decision support, process enablement, and price of admission to the Opportunity Management pipeline of e-business processes.

Figure 5: Central Role of Data in e-Operations



Summary

This research set out to find the answers to three principle questions from within the context of IBM's Microelectronics Division Opportunity Management e-business initiative. Question one, directed at providing information about strategic context and intent, probed into the motives that the organization had for pursuing e-business. The data, in terms of interview results and document inspection, shows that the organization's members were rationally disposed to resolve data and process control problems that inhibited the successful execution of operations. There was no external pressure on the organization to embark on this project, let alone make it an e-

business initiative. However, there were expectations that the project would free up technical people from administrative drudgery to focus more intently on technical assignments and upgrade the organization's business control posture. Further, the project was tightly controlled, scrutinized in detail, and measured in abundance. Ostensibly, this was done to assure results, measure organizational value and return on investment, and minimize organizational risk. All of this evidence paints a picture of a strategic initiative, aimed at addressing fundamental issues that were diverting the organization's ability to deliver on its strategic mission.

Question two, arising from the desire to frame operational context, seeks to uncover how e-business was used to implement organizational, process, and information change. Research findings show that e-business technology, infrastructure, and technology features enabled the desired end-to-end process design. The implementation of this design profoundly affected and changed certain organizational roles, responsibilities, and collaboration style. Most participants observed change as a function of the enabling characteristics of the process design and technology components whereas some believed that change was forced through the use of technology. Whether enabled or forced, operational change did occur. As well, the legacy operational environment influenced the shape and design of the OM processes. Several organizational practices and methods were embedded in the OM pipeline and the difficulties presented by the ad hoc use of Groupware applications had to be contended with during project implementation. Users gained operational advantage from the OM environment primarily through the use of the Internet browser technology and the synergy enabled by network connectivity. Generally, a high level of thoughtful business process redesign was applied where appropriate in the course of the project. Overall, then, the operating context of IBM MD, the

nature of the semiconductor business, and the legacy practices of the organization influenced the final design of the OM pipeline and systems.

Research question three examined the business process and system integration aspects of the e-business project by highlighting the difficulties, useful practices, and actualized use and value of the deployed system. Surprisingly, organizational resistance to project vision and mission overshadowed both technical and technology difficulties. This may indicate that e-business technology has eased the technical burden on implementers or just reemphasizes that that organizational transformation is a part of every major process and systems initiative and it is inherently hard work. The project was rigorously managed by a team of experienced, senior team leaders. They employed a standardized, repeatable deployment process and attempted to provide new function to the business on a rapid, fast-paced cadence. Management supported project deployment by overtly insisting that business decisions be based on OM system data. Users gained value from the system through its easily accessible Web interface and by using powerful search functions. This allowed operations people to find and react to that most valuable commodity-data.

Finally, the thread that binds this project from conception, through deployment, and into operational execution, is the value of data. It is the central and unifying element that produced visibility, enables processes, and acts as the headlights that illuminate the operational status of the OM pipeline.

CHAPTER 5. RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

"It matters not what goal you seek
Its secret here reposes:
You've got to dig from week to week
To get Results or Roses" *Edgar Guest*

Introduction

This research examined in detail the contemporary use of Internet and Web technologies and practices that enable a firm's operating processes. The research was conceived to extend knowledge and understanding about the extent to which an established firm used the Internet to conduct business operations, establish the impact of e-business on internal business processes, and provide empirical evidence of the various factors that affect the adoption of electronic processes in firms. It commenced with the premise that internal operations cases were scarce and underrepresented in the e-business literature. Thus, an e-business, but not e-commerce, research venue was selected as a means to isolate attention on and impart an undistorted view of the e-operations phenomenon.

This e-operations case study, therefore, investigated the context, technologies, and business practices experienced within the IBM Microelectronics Division's (MD) Opportunity Management (OM) e-business initiative. The research explored the strategic and operational factors that provided the context and influenced the decision by IBM MD to invest in its OM project. It also describes how this context shaped the design of internal business operating processes and the selection and deployment of e-business Information and Communication Technology (ICT).

This chapter offers an overview of the research findings and connects them to the conceptual framework introduced in Chapters One and Two. It further discusses the findings in light of

previous research and it elaborates on the contributions and implications of the findings. Finally, limitations and potential avenues for related research are considered.

Overview of Findings

Guided by the theoretical framework for investigating e-operations, the Barnes Model (Barnes et al., 2002), the research questions guiding this project probed at the strategic context for the MD project, the operational context inherent in the MD semiconductor development and manufacturing environment, and the realities encountered during the deployment of processes and ICT.

Strategic Context

The strategic imperatives of IBM MD were clearly described and manifest. They were aiming to expand their ASIC and Foundry semiconductor businesses by offering leading edge technology coupled with the promises of low total cost of development, accelerated time to market, and first time right chip functionality. While in the throes of executing this strategy, the business found that its Opportunity Management processes and data control posture were not suitable or scalable to the level of operations required to meet strategic objectives. What was first articulated as a "lack of headlights" or "lack of pipeline visibility" issue was really a complex problem involving disjointed, disconnected processes, uneven data flows, and multiple, redundant data repositories. Faced with these facts, the business, unilaterally and without external pressure, invested in an e-business initiative to establish an integrated Opportunity Management process and data control platform.

Aside from the goal of establishing control over OM data and processes, the business expected to accrue several collateral benefits from this initiative. Technical management

expected that new tools would relieve engineering resources from non-value-adding administrative tasks and thus gain an incremental, no cost capacity boost. Business operations management expected to gain a higher level of control, accountability, and security over the OM environment. Marketing projected that this new, modern infrastructure would enable the organization to be more flexible, agile, and responsive. This, in turn, was expected to positively influence customer satisfaction.

Interestingly, the OM initiative was not originally conceived to be an e-business project. It became one only after a thorough investigation of software alternatives and a determination that an Internet enabled Product Lifecycle Management solution would be most appropriate. While completing their due diligence to arrive at this decision, the Project Team grasped the power, value, and economic advantages of e-business that could be leveraged to assuage the business problem. The project, as an entity and befitting its strategic alignment, was scrutinized and managed closely with regard to cost, quality, and schedule.

Operational Context

Semiconductor development and manufacturing operations present the milieu or setting for the MD Opportunity Management initiative. This is an engineering intensive environment wherein practices, methods, and procedures are used to govern and assure the successful completion of technical and production activities. Important components of the organization's business process infrastructure were incorporated into the suite of integrated OM business processes. Modules to govern and moderate the administrative aspects of MD's ASIC Design Methodology and Sales sell cycle activities and deliverables were embedded in the system. Additionally, the system's architectural design point provided for a high degree of security,

business process control, and auditability to meet the corporation's objective of assuring that the platform was a trusted source of data. As an aggregate of tools and processes, the OM system accommodates and is a product of important organizational business practices and the highly technical engineering environment. The OM Pipeline and its supporting computing and communications technologies, thus, provide suitable context for the organization's efforts to collect the myriad data elements that characterize each customer opportunity.

The OM system and processes profoundly influenced the organization. E-business tools and practices have catalyzed changes in organizational roles, responsibilities, communication style, and methods of collaboration. Internet open standards and the Web browser were particularly instrumental in providing easy to use low cost access to the e-business enabled OM application. Moreover, it serves as a platform that promotes the organizational synergy that develops when multiple parties connect, collaborate, share data, and work together. Finally, it is important to note that the overall OM Pipeline and the various processes that abut and articulate with it are not the result of simple IT automation. New processes have been invented, old processes re-designed, existing practices reengineered, and some processes modestly adjusted or fine tuned before being incorporated into the end-to-end family of OM processes.

Business Process and ICT System Integration

The work products, artifacts, or deliverables of an e-operations initiative are the sets of processes, ICT systems, and practices that an organization adopts to conduct its operations. Although these new artifacts sit within and are, ideally, aligned with the organization's strategy and reflect the operational context of the business, it is a challenge to deploy and implement

them. The mission of integrating systems, data, and processes is a substantial and difficult organizational undertaking.

An interesting finding from this case study was that organizational members deemed organizational resistance to change to be a more persistent, overarching problem than either technical or technology deployment difficulties. This is most intriguing as there was a well documented history of technical issues that had been addressed and overcome throughout the duration of the project. Senior management; however, assisted in mitigating the severity of organizational resistance by insisting that business decisions be based on data that had been accumulated within the system. This put pressure on the organization to use and improve the quality of the newly deployed processes and data.

Once the organization's personnel embraced the new platform, they derived considerable value from e-business technology. Ubiquitous system availability and access, high functionality data search capability, and a data model that linked and related key information elements for clear, complete presentation, enabled organization members to more easily perform their operational assignments.

The initiative was managed by a senior, cross-functionally experienced team of professionals that employed project management discipline to maintain control of costs, schedule, and quality. Once the implementation team gained enough experience and knowledge and became confident with the rhythm and flow of release operations, they instituted a standardized, repeatable software and process deployment protocol. This enabled them to provide new function to the user community on a rapid, fast-paced cadence.

Importance of Data

The findings from this research emphasized the central importance of data to the e-operations initiative. The quest for information about the status and outlook of the business processes constituted the key motivating force to launch the project. The desire by all constituents to gain access and value from an organization-wide pool of accurate, complete, and context-based information induced them to accept and participate in the processes. Data was also used as a tool to mediate the flow of activities in the processes. By using the concept of required data, the system was able to detect the presence or absence of critical data and either deny or permit certain flow transactions. This assured that operatives provided essential information to their colleagues and the business at the proper time.

Interpretation of the Findings

The findings from the IBM Microelectronics Opportunity Management case study are interesting and informative in an absolute sense. However, to fully appreciate and interpret the ramifications and significance of these results they need to be examined relative to past, similar research. Since the Barnes, Hinton, and Mieczkowska (Barnes et al., 2002; 2003, 2004) research team has heavily influenced and, to some extent, inspired this case study, it seems entirely appropriate to compare their results with the OM findings. Furthermore, comparisons can be made with other empirical studies that have addressed the e-operations topic.

E-operations and E-commerce Operations

In their paper, *Competitive Advantage through E-operations* (2003), Barnes and team summarized their findings as a set of emergent issues. These issues were: 1) investment in e-commerce is primarily technology driven, 2) investments in e-commerce are tending to

automate, rather than re-design existing processes, 3) e-operations are run as a discrete set of processes, 4) there is a lack of formal performance measurements in e-commerce, and 5) legacy systems and a lack of industry standards are major encumbrances to information systems integration.

The findings of the OM case study, for the most part, do not synchronize with these emergent issues (see Table 9).

Table 9: OM Case Results versus Barnes Emergent Issues

Issue	Barnes Results	OM Results
Investment Motivation	Investment in e-commerce is primarily technology driven, spurred on by a fear of being left behind by competition.	Investment in e-operations is driven by a rational intent to improve business performance.
Scope of Process Change	Investments in e-commerce are tending to automate, rather than re-design existing process.	Investment in e-operations invoke classical reengineering and re-design practices as well as automation contingent on the nature and scope of the business process problem.
Level of Process Integration	E-operations are run as a discrete set of processes.	E-operations are integrated and connected to formerly disjointed and isolated business processes.
Measurements	There is a lack of formal measurement in e-commerce.	Internal e-operations are highly scrutinized, measured, controlled, and evaluated.
Legacy System and Industry Standards	Legacy systems and a lack of industry standards are major encumbrances to Information Systems Integration.	Legacy systems are a major encumbrance to Information Systems Integration. No results relative to industry standards.

The investment in e-operations by IBM was preceded by a rational, business case validated examination of a set of internal business process and data dysfunctions. The problems were evaluated, organizational requirements assessed, and then appropriate technologies selected to best ameliorate those problems. Even the happenstance that the project became an e-business initiative was a second order result of a software tool selection decision that was based on matching required function to the nature of the business problem. Investment in the OM e-

operations project was clearly not technology driven. It was propelled by sensible, internal objectives to improve organizational performance.

The OM investment motives align more closely with those observed by Chen and Chen (2004) and Cao and Schniederjans (2004). These studies indicated that firms engage in e-operations as a result of the organization's intent to achieve tangible and intangible business benefits and to improve operations. What is most useful in these various results is that they establish the range of motivations for investing in e-operations rather then identifying a single reason. Perhaps, Tsikriksis, Lanzolla, and Frohlich (2004) have it best characterized through their empirically supported assertion that external pressures, among them competitive technology adoption pressure, as well as internal expectations of increased firm performance can be effective motivators to embrace e-operations projects.

The second emergent issue, that investments in e-commerce are tending to automate, rather then re-design existing processes, also does not easily juxtapose with the Opportunity Management experience. While it took some probing to fully understand all of the participant views, it is clear that, in aggregate, significant business process reengineering and advanced process enablement was accomplished in the IBM project. In some cases, new processes were invented, in other cases they were refined, fine tuned, and linked in new ways. This indicates a contingent application of process improvement techniques as befitting the nature and severity of the problem. Interestingly, even in instances where one person or group considered simple mapping or automation to have occurred, others looking at the same instance believed that notable reengineering was accomplished. In its totality, the OM evidence is weighted towards significant business process re-design of the type espoused by advocates of business process

reengineering and redesign (Davenport & Short, 1990; Hammer, 1990) but it does not discard consideration of simple automation if that practice is good enough to meet business demands. Thus, the following proposition is offered:

> Proposition 1-E-operations projects contingently apply business process redesign and simple process automation as appropriate to the problem situation.

As in the aforementioned comparisons, the evidence collected from the OM case study does not align with the third emergent issue; that e-operations are run as a discrete set of processes. In contrast, the OM e-operations were conceived, designed, and deployed to enable end-to-end business process integration. Consequently, the OM aggregate of processes and system functions either replaced or interfaced with legacy systems and processes to create an interconnected network of collaborating colleagues. There was no intention to build and maintain an isolated, stand-alone platform.

The Barnes team found, somewhat to their astonishment, that there was a lack of formal performance measurements in e-commerce. They would; however, not be surprised by OM results. As has already been amply described elsewhere in this document, the OM project was formally, rigorously, and even vigorously measured and scrutinized from its inception to the present day. Moreover, the deployed processes were specifically designed to enable management's capacity to measure, analyze, and predict process performance and health.

The final emergent issue states that legacy systems and a lack of industry standards are major encumbrances to information systems integration. This is the issue where OM and Barnes results finally coincide. Legacy systems were a major nuisance to information systems integration within IBM Microelectronics. The prime example in the OM case was the confusion,

and disarray caused by the proliferation of numerous Lotus Notes Groupware data applications. As it progressed, the OM project had to overcome this legacy IT reality and subsume data requirements from repositories that had been created and operated by numerous functional organizations. This was an essential and principle mission of the project. On the other hand, the OM project was relatively immune from the industry standards dimension of the emergent issue. Given that IBM uses its own products internally and is a major contributing participant to industry standards bodies, there was relatively little concern about hardware and software compatibility, protocol specifications, or network interconnectivity.

The obvious question that arises from this comparison of OM results and Barnes emergent issues is why don't they coincide? This is especially notable since the OM case study was fashioned on a framework pioneered by Barnes and his colleagues, used the same qualitative research methodology, and was ostensibly focused on the same general topic. There are some possible explanations for this. First, while the Barnes team draws attention to the notion of e-operations and builds an outstanding, compelling case for studying operations, their primary focus is on e-commerce. They have been aiming at understanding the operations of e-commerce. This is particularly evident in their sample of firms. All of the firms that they investigated (Barnes, Hinton et al., 2003) have utilized e-business to enable some form of B2B or B2C e-commerce to engage customers, suppliers, or partners. This OM study, on the other hand, was selected and configured to focus on a purely e-operations venue. In other words, there is no e-commerce dimension to the OM case study. It is fundamentally different than the cases examined in the Barnes research. The disparity between Barnes and OM results suggests that

pure e-operations projects have a different motivational signature and a different focus. They are integrated differently, and measured differently. Thus, the following proposition is tendered:

Proposition 2-The e-operations and e-commerce phenomena are fundamentally different types of e-business projects.

Second, given that the OM case investigated the internal operations of the MD organization, those that are associated with the management of processes that develop the organization's semiconductor goods and services, it is by nature and setting isolated from direct influence or pressures from external sources. Thus, the primary locus for investment and change would most likely emanate from those familiar with, involved in, and experiencing difficulties within the preexisting internal operating environment. Once the impetus for change has been accepted, it follows that processes and operations would be disturbed and reformulated only in the belief that they could be significantly improved and integrated to produce some form of performance improvement or competitive advantage. Before, departing this point it must be remembered that the OM study did identify some subtle, indirect external influences. There was concern about organizational responsiveness and its concomitant influence on customer satisfaction. There was also some influence from the Product Lifecycle Management (PLM) industry that prodded the OM Project Team to investigate e-PLM solutions. On balance, though, it appears that internal considerations are at the root of e-operations initiatives. Thus, it is proposed that the primary incentives to pursue e-operations emanates from internal sources.

Proposition 3- E-operations initiatives are primarily motivated by agendas to improve operational data and processes.

Third, the fact that the OM case originates within a large multinational corporation such as International Business Machines, Corp. influences the case results. This may be most apparent in the evidence gathered about formal performance measurements. IBM, stating the obvious, has a large and formidable IT infrastructure and is in the business of managing leading edge technology projects, both for itself and in service to customers. Since IBM uses professional project management discipline to manage projects, it would be somewhat surprising and inconsistent to find a lack of measurements and metrics associated with a major business process transformation initiative such as the OM e-business project. As the evidence shows, the OM project was actually heavily scrutinized, even by IBM standards.

Organizational Transformation and Change

In addition to the Barnes, Hinton, and Mieczkowska comparisons, there are others to be made. The relationship between the adoption of e-operations and its subsequent impact on fundamental organizational change is of particular interest. The observation by Grey, Katircioglu, Bagchi, Shi, Gailego, Seybold, and Stefani (2003) that "much of the value associated with e-business initiatives comes not only from the improvements to Information Technology (IT) infrastructure, but also from business transformations that impact an organization's people and processes" (p. 484) seems to presage the OM findings. The evidence from this OM study indicates that profound changes are catalyzed that go far beyond the mere definition, adjustment, and modification of business processes. New roles are created, organizational responsibilities realigned, and new methods of interaction and collaboration formulated. This is similar to the empirical results reported by Kriendler, Maislish, and Wang

(2004). They also found that e-operations had positive effects on formal communications, information flows, and the processes of organizational design, redesign, and change.

The salient message in these results is that a bounded exercise in e-business process deployment can easily escalate into a cross-organizational reassessment of fundamental business practices. Evaluation of data requirements forces review of business process flow and interaction. Data model and process reformulation induce various functional organizations to rethink their methods, personnel assignments, and structure. This, in turn, forces inter-organizational reconsideration of basic business operating practices. Said differently, the total organization reestablishes what is important, what is not, and how the important work will be accomplished.

This point was not lost on one of the OM participants who conceded that, "It has kind of taken on a bigger life of its own than I really anticipated it taking on in some respects." In the OM case, the project had its genesis in an executive concern and requirement for better operational information. Upon evaluation by the Project Team it took on the additional mantle of a process re-design, integration, and technology implementation initiative. In the course of implementing and deploying the system, significant changes were induced. New jobs were created, existing ones were altered and better enabled, and job responsibilities were shifted around the organization as a result of e-business. Change that was first initiated at the data level quickly transcended that focus and expanded to include operational activities, processes, and organizational structure. This prompts inclusion of the following proposition:

Proposition 4-The business process focus of e-operations projects precedes a wider reassessment of organizational roles, responsibilities, communication styles, and structures.

As was noted earlier, and with some surprise, organizational resistance was deemed to be more of an overarching and difficult problem than were technical or technology problems. Perhaps this should not have been considered a surprising outcome. While outlining their research into the role of the Internet within the manufacturing supply chain, Kehoe and Boughton (2001) anticipated that "the barriers lie with the business process rather than the technology" (p578). Subsequently, Brews and Tucci (2003) found that the use of the Internet to control and manage operations was inhibited when firms didn't come to grips with the fact that process definition or redefinition is more problematical than technology installation. Nonetheless, to observe that participants unanimously gravitated to the various manifestations of organizational resistance while bypassing the record of several striking technology and technical problems is somewhat of an enigma. One reason for this could be that technology and technical problems are acute, and in the context of time, isolated disturbances. A technical problem is discovered, personnel are assigned to assess and resolve it, then the project moves on. If another technical problem arises and it has the same signature as a previous one, the lessons learned are quickly revisited and then applied to the new problem. If the new problem is unique, the resolution process is invoked until it is resolved. The technical problems may be difficult, confounding, and complex but they have definite starting and ending points.

On the other hand, organizational change and resistance problems have many manifestations and are chronic in nature. They show up as lack of acceptance, repudiation of a new idea or

vision of the future, passive resistance, and even outright refusal to comply with the revised or newly installed processes. Thus, the exposure to organizational resistance is a long-term issue that consumes months and years of project time and resources and many times requires management intercession to smooth the way. In contrast, exposure to technology or technical problems is typically measured in days and weeks and primarily involves technical personnel rather than management.

The data actually bears this out to a certain extent. The documentary evidence shows a series of OM technical problems that occurred over time. However, each new technical issue that crops up is significantly different than its predecessors or those that follow. For instance, the OM chronology shows that the Project Team had to overcome hardware and software installation and configuration problems, operating system transition issues, and database performance difficulties among others. These problems are described, primarily in steering committee reports, and are tracked to resolution. On the other side of the equation, organizational barriers show up repeatedly over a span of years: lack of resources, user complaints, and struggles to secure user participation and conformance. Overall, there are about six references to organizational barrier issues for every one technical issue. This prompts the addition of the following proposition:

> Proposition 5-Technical problems tend to be acute and relatively short-term while organizational resistance is a chronic, long-term problem for e-operations projects.

E-operations Research Framework

While it is not wise to be over exuberant, especially with regard to research evidence based on one highly contextualized case study, the recurring OM theme about the importance of data is difficult to ignore. Data, access to it, the ability to add, define, or change it and the capacity to analyze it, has exerted significant influence on all aspects of the OM e-business initiative. As earlier noted, executives were motivated to make the investment in the OM project to secure access to operational information with the expectation that it would better enable them to plan strategic resource capacities. Business process owners considered data to be an indispensable commodity that helped them understand operational activities. They placed great value on having swift, unencumbered access to information. Project team members discovered the sad state of the business' data and they were given the first priority task of "getting control" of that data.

During the course of the project, the deployment team recognized the importance of the interactions between the data, processes and systems. Thus, they devised the overall Opportunity Management Pipeline to serve as an end-to-end process that would provide opportunity lifecycle context for data collection. As well, the required data concept was conceived on the notion that the presence or absence of data could serve as mechanism to mediate the flow of opportunities through the process. Data, in effect, became a trigger mechanism. Further, the design of the data model directly influenced how data could be represented in visual form in the system, how graphic user interfaces would be designed, and what analytical tools would best serve user interests.

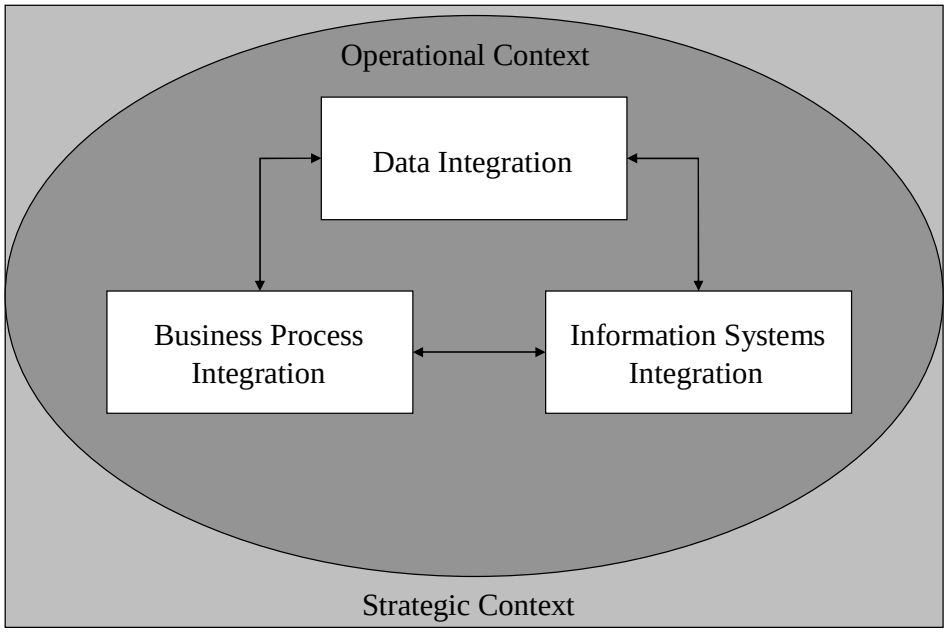
Data also served as a commodity. Access to this commodity induced users to join the system and participate in the processes. By joining the system, the new users typically had to agree to supply new pieces of data or participate in the monitoring and management of existing data. Additionally, management demanded that the data be used to make business decisions. All of these forces, then, served to create a network effect (Eisenmann et al., 2002; Laudon & Traver, 2002) based on access to data. All new participants received value from the fact that everyone used the same system and the addition of each new user added value to those already using the system.

The indications from this study are that data integration is as important to research understanding as process and system integration. This study calls attention to the complexity of data, the seemingly catholic desire to have access to data, and the interrelatedness of data, processes, and systems. If this researcher were to undertake another e-operations study, that study's conceptual framework would place a much higher priority on data-related investigation than does the Barnes model (Barnes et al., 2002). There would be emphasis on pursuing data issues with the same vigor as that applied to strategic and operational context and business process and systems integration. This research model (see Figure 6) would focus on the interrelatedness of data, process, and system integration within the operational and strategic context of the case being investigated. This is only a slight modification to the Barnes model but this adjustment provides more clarity about the important data dimensions that may be endemic to pure e-operations studies.

The inclusion of data integration into an e-operations research framework operationalizes the following proposition:

Proposition 6-Data integration along with business process and information integration are essential focus elements in e-operations research.

Figure 6: Revised Model for Investigating E-operations



Implications for Practice

Practitioners are always interested in learning about the practices of others, especially practices from successful initiatives and those that have withstood the test of time and repetition. It can be argued that the IBM Microelectronics Opportunity Management project has been a

success and it clearly has endured over a significant period of time. The company has continued to invest in the project for over five years and the user community continues to expand into the thousands. As well, the project team regularly receives numerous suggestions and requests for enhancements and expansion of the basic function. That is a clear indicator that users see value and want to build upon it. What, then, are the key learning points from the OM experience that might be of use to the business community at large? The evidence from this research suggests that there are four worthwhile learning points. First, e-business technology is an entirely suitable platform and choice for enabling internal e-operations projects. Second, a rapid paced, phased, and tightly managed deployment cadence is the preferable approach. Third, experienced leadership, governed by a cross-functional steering committee and situated within the line organization keeps the project responsive to users. Fourth, the required data tactic can be a powerful mechanism to induce compliance with process objectives.

The experience of the OM project indicates that Internet and Web technologies can be effectively leveraged for internal e-operations purposes and, as validated by Barua, Konana, Whinston, and Yin (2004), enhanced business value can be produced through end-to-end digitization of a company's value chain. This is worth mentioning because many practitioners continue to believe that these e-business technologies are aimed at e-commerce and thus are not appropriate for operations initiatives. The OM experience with e-business has been overwhelmingly positive and has delivered myriad benefits: 1) Lower total cost of development due to free or very low cost browser technology. Projects using Internet browsers avoid the costs of licensing new client software and installing and maintaining them on the user's workstations. As well, browser, middleware, and server functionality enable the system to control the end-user

presentation and entitlements. This diminishes the opportunity for users to inadvertently engage in undesirable system interactions. 2) Ease of distribution and little to no concern about protocols and standards. This enhances a deployments team's ability to cope with world wide geographically dispersed organizations. 3) Since Web applications are platform neutral, there are lower hardware budgets for a deployment team to evaluate, plan, and deploy. Certainly, there are significant concerns with the implementation of Web and Database servers and all of the backend software but those are localized issues, generally managed from a centralized location and represent a much less daunting task than managing the desktops of thousands of distributed employees. 4) Finally, the more abstract but equally appealing benefit of Internet and Web technology is that it supports a more flexible, agile approach to business automation. The OM experience falls in line with that expected by Gunasekaran (2002) and Kumar (2004). The flexibility of e-business systems and infrastructure provides significant value to implementations by enabling teams to quickly and economically adapt to changing business requirements.

As the OM Project Manager stated, "the whole message in business is speed, speed, speed." For this reason, the Project Team adopted a rapid paced, phased, and tightly managed deployment cadence as its preferred implementation approach. The team found several advantages to this style of managing the project. By emphasizing speed of delivery, the team was required to break the project into small, more easily managed "chunks." This enabled them to keep the complexity of each phase of the project in check and as Lord (2000) earlier recommended, automate the business piece-by-piece in order to gain organizational efficiency in phases. Both Brews and Tucci (2003) and Aldin and colleagues (2004) highlight that a strategy of focusing on internal processes is a preferable starting point before venturing off into more

complex, wider-scoped external facing processes. Since incremental phases of the project were scaled for rapid development and delivery, the organization benefited by receiving new functions earlier and by becoming accustomed to absorbing small doses of change frequently rather than enduring large, potentially serious disruptions. The Project Team also benefited from this practice. By experiencing multiple cycles of requirements generation, specification documentation, development, integration testing, education delivery, and software cutovers, they became more knowledgeable, experienced, and capable of dealing with a variety of problems than they would have under a slow paced deployment cadence. Essentially, they benefited from the learning curve (Lapre & Van Wassenhove, 2001; Moore & Hendrick, 1977) phenomenon that allowed them to "shake out" the bugs in their standardized release methodology and establish a repeatable, predictable, standardized project management process. This is not inconsistent with advice from e-business implementation experts (Lientz & Rea, 2001), that supports the notion of modified yet rigorous project management approaches to e-business projects.

This next point may seem to be a restatement of the obvious but there is no substitute for good teams and good team leadership (Duarte & Snyder, 2001; K. Fisher & Fisher, 2001; Hill & Farkas, 2001; Lipnack & Stamps, 2000). In the OM case, team members and executives appeared to collectively believe that the project was well served by the very cross-functionally experienced and senior leadership team. They liked the positioning of the project management within a neutral line organization, and they thought that the cross-functional steering committee was a value added adjunct to the management and governance of the project. This process seems to have worked for the IBM Microelectronics OM initiative and should serve as another data

point for the effectiveness of these management practices and the value of keeping this type of project close to the ultimate users.

The final OM useful practice that merits consideration by a wider community is the required data tactic. Over the years, its use within the OM project has proven to be a powerful mechanism to induce compliance with process objectives, reduce exposure to programming rework associated with overly tightly specified workflow designs, and to build consensus about the most important, critical business information. As already mentioned, the required data concept is built upon the notion that there is key data that is mandatory for the business to know and understand at each stage of the business process. The presence of required data serves as a signal to the system and all users that suitably endowed opportunities can continue to progress through the OM Pipeline. If not, flow through the system is stopped until someone supplies the required data. A valuable ramification of this practice is that it greatly simplifies and abridges the need to hardwire rules within the system to govern workflow. Essentially, phases of the process are enabled by the presence of certain data and considered complete by the inclusion of additional specified data. The activities that go on in the process of collecting the data are left to the operatives that must execute them. This saves on programming costs, workflow design, and the rework that often accompanies this type of development when users realize that their real work processes do not really juxtapose with a system model. On the other hand, this required data tactic forces all users to participate in the design of the data model and thoroughly understand what data is needed and when it is needed in the process.

With these results in mind, two more propositions can be added:

Proposition 7-Internet technology and applications are as suitable and cost effective for internal operations systems as they are for e-commerce uses.

Proposition 8-The required data concept is an effective tactic for inducing process compliance and avoiding programming rework from overly specified workflow design.

Limitations and Future Research Opportunities

Research into a highly contextualized venue such as IBM Microelectronics Division's Opportunity Management e-business initiative is obviously subject to a number of limitations. Some of these limitations were addressed in the design of the study; however, there are a few topics that will benefit from additional reflection and discussion.

The choice of studying a unique e-business project within a single organization might be seen as a limitation since a small non-probabilistic sample can be problematic from the standpoint of research generalizability. Is it reasonable to assume that patterns of behavior described in IBM Microelectronics Division (MD) can be rationalized to be representative of those that might be found in other business organizations? Perhaps not entirely; however, the study of a single organization offered practical and theoretical advantages that should offset any concerns about generalizability. Foremost, the focus on the MD project offered the opportunity to investigate a purely e-operations initiative within a situation that would not normally be accessible to researchers. Access to the internal operating activities of a firm is not easily obtained. In fact, the mere existence of a project like the OM e-business initiative would be difficult to detect by someone not intimately connected to the organization. By focusing on one case it was possible

to dig deeply into the history and events of the case while not being distracted by external factors that might have obscured the meanings and interpretations of various pieces of evidence.

By focusing on a purely e-operations initiative it was possible to detect what may be unique and different about them as compared to e-commerce projects. In a sense, this research may be considered to be a good pilot case for wringing out the approach for further studies on e-operations. This study prompts the recommendation that research, perhaps an industry-wide survey, be conducted to find additional instances of e-operations projects. Once new e-operations instances have been identified, additional analysis could be conducted to develop the body of knowledge about internal operations and how they have been influenced by e-business. It would be interesting to know what types of business problems the e-operations projects have addressed, how the technology has influenced them, and what additional lessons may be extracted from their implementation and deployment experiences. Further, it would be useful to compare and contrast these results to the e-commerce emergent data, such as that provided by Barnes and colleagues, to see if the results continue to be as divergent as those developed in this study.

Another limitation of the research approach was its reliance on data acquired from retrospective data collection techniques. Some consider retrospective data to be susceptible to biases and rationalization after the fact (Huber & Power, 1985). In reality, some hints of this post hoc revisionism are observable in the interview data collected in this study. As described in Chapter Three, the design of this study attempted to minimize, by a number of means, the threats to construct validity presented by response bias. These means included triangulation, not only between participant accounts, but also between historical documents and interview results. This

proved to be an extremely effective tactic for validating the accuracy of the whole body of information and applying perspective to rationalized responses. Given, the experiences of this research, it is highly recommended that future e-operations investigators give serious consideration to attracting participants that represent all facets of a project's influence on an organization-executive decision makers, supervisors and managers, staff members, and operatives. The variety of perspectives provides a much deeper understanding of the phenomenon in question than can be gained by, for instance, focusing on senior management or executive perceptions of what is going on in an organization.

The results of this study have motivated the researcher to suggest a slight modification to the Barnes Model of investigating e-operations. This is done with the clear understanding, as Eisenhardt (1989) reminds us, "that building theory from cases may result in narrow and idiosyncratic theory" (p. 54). It is entirely possible that the data-centric nature of the OM environment may be unique and peculiar to IBM or maybe even IBM Microelectronics. On the other hand, it may be an attribute of pure e-operations as opposed to e-commerce derived operations. So while there is no intention to suggest that the Barnes Model should be revised, there is ample reason to approach new e-operations research with a framework that focuses an eye on the potential importance and central role of data.

Closing Thoughts

In general, the modest objectives of this research have been accomplished. The study has produced a variety of useful findings that characterize the e-operations phenomenon, shed light on a novel application of e-business technology, and examine practices used in the deployment of a complex, long-lived e-business initiative. It provides a glimpse into a dimension of e-

business that has been overshadowed by a prevailing preoccupation with e-commerce. By uncovering some interesting and actionable information about e-operations, this study enriches the knowledge base that will support future students of e-business and it provides a reference point for practitioners who may be considering their own e-operations adventure.

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APPENDIX A

Communications

This Appendix contains key communications that will play a role in this research:

1. Letter of authorization to conduct research within IBM Corporation
2. Letter of support from IBM Management to IBM colleagues

Hudson Valley Research Park
2070 Route 52
Hopewell Junction, NY 12533 6531

March 14, 2005

To Whom It May Concern:

Subject: E-business research

This is to inform you that Victor Stone is authorized to conduct his Doctoral Dissertation research into the IBM Microelectronics Division Opportunity Management e-business initiative. He will be granted access to non-IBM Confidential documents and system archive data pertinent to this study. He is also authorized to approach selected individuals with invitations to contribute their knowledge, experience, and perspectives on this research topic. Participation; however, is solely at the personal discretion of each individual. It is expected that this research will commence on or about April, 2005 and conclude no later than July, 2005.

While IBM endorses the conduct of this academic study and hopes that it will contribute to the body of knowledge about electronic business, IBM will play no official role in its conduct or outcomes. The analysis, results, and conclusions will be strictly those of the researcher

Regards,

Barbara E Wesolowski

Barbara Wesolowski
Vice President, Business Information and Transformation
IBM Microelectronics Division
Server and Technology Group

Hudson Valley Research Park
2070 Route 52
Hopewell Junction, NY 12533 6531

March 14, 2005

Subject: E-business research

Dear Colleagues,

This is to inform you that Victor Stone, a doctoral candidate at Capella University in Minneapolis, Minnesota, will be conducting research into the IBM Microelectronics Division Opportunity Management processes, practices, and systems. Opportunity Management may be better known to most of you as the Design In Win project. This research will be aimed at understanding the strategic and operational context that underpins this project and influences the deployment of internal electronic operations.

Victor is authorized to access and use non-IBM Confidential documents and system archive data pertinent to this study. He is also authorized to approach selected individuals with invitations to contribute their knowledge, experience, and perspectives on this research topic. Participation; however, is solely at the personal discretion of each individual. It is expected that this research will commence on or about April, 2005 and conclude no later than July, 2005.

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Regards,

Barbara E Wesolowski

Barbara Wesolowski
Vice President, Business Information and Transformation
IBM Microelectronics Division
Server and Technology Group

APPENDIX B

Research Guidance Documents

This Appendix contains various documents used to maintain rigor and control over the MD Opportunity Management research project:

1. Case Study Protocol
2. Contact Summary Form
3. Document Summary Form
4. Interview Invitation Letter
5. Interview Process Protocol
6. Informed Consent Form

Case Study Protocol

Overview

Purpose

The purpose of this study is to investigate the e-business technologies and practices used by and in IBM MD to enable its internal Opportunity Management business processes and operations. This investigation will explore the strategic and operational factors that provide the context and influenced the decision by IBM MD to invest in its Opportunity Management e-business initiative. This study will also seek to describe how this context shaped the design of internal business operating processes and the selection and deployment of e-business Information and Communication Technology (ICT).

Research Questions/Framework/Relevant Readings

The research questions for this study, and others that are bound to arise, are guided by the intention to discover and understand the firm's e-business evolution. This includes learning about how they are managing their operations, and how they are adapting traditional pre-existing processes, practices, and organization to leverage e-business. Question One draws attention to the stimuli and motivations that are antecedents to a firm's e-business investment decisions, Question Two probes into the operational influences and effects of deploying the e-operations project, and Question Three addresses the interrelationships and effects of business process and information systems integration.

Research Questions Sources and Inspirations		
Question	**Topic**	**Inspiration**
Strategic Context		
Research Question One: Why was the firm motivated to invest in e-business?	Organizational value Competitive advantage	Barnes, D., Hinton, M, & Mieczkowska, S. (2003) Brews, P.J., & Tucci, C.L. (2003) Chen, Q, & Chen, H-M. (2004) Gibson, P.R, & Edwards, J. (2004) Kehoe, D.F. & Boughton, N.J. (2001) Nemati, H.R. & Barko, C.D. (2002) Tsikriktsis, N., Lanzolla, G., & Frohlich, M. (2004)
1) What was the nature of any extra-organizational influence on the decision to adopt e-business?	External pressure	
2) What internally generated factors influenced the organization to adopt e-business?	Organizational efficiency, Strategic intent	
3) What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?	Measurement deficiency, Organizational data mining	

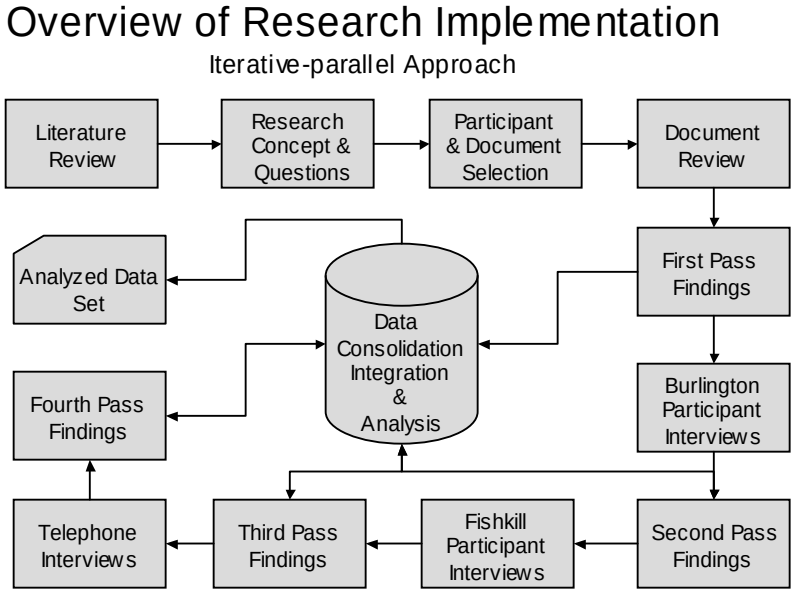
Research Questions Sources and Inspirations (Continued)		
Question	**Topic**	**Inspiration**
Operating Context		
Research Question Two: How has e-business been utilized to implement organizational, process, and information integration?	End-to-end integration	Aldin, N., Brehmer, P-O, & Johansson, A. (2004) Barnes, D., Hinton, M, & Mieczkowska, S. (2003) Barua, A, Konana,P., & Whinston, A.B. (2004) Brews, P.J., & Tucci, C.L. (2003) Chen, Q, & Chen, H-M. (2004) Grover, V. & Malhotra, M.K. (1999) Tsikriktsis, N., Lanzolla, G., & Frohlich, M. (2004
1) How have pre-existing business and technology infrastructures influenced the evolution of the e-business project?	Legacy systems Legacy processes Progressive development stages	
2) How do the economies of e-business technology enable the management of internal operations?	Complexity, Standardization	
3) How has e-business influenced the automation, creation, or re-design of business processes?	Automation vs. re-design	
Process and Systems Integration		
Research Question Three: What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations?	Implementation difficulty, Business processes and behaviors	Brews, P.J., & Tucci, C.L. (2003) Clegg, W.C., Icasati-Johnson, B., & Bennett, S. (2001) Kehoe, D.F. & Boughton, N.J. (2001) Kriendler, M.I., Maislish, R., & Wang, S. (2004)
1) What practices, under what conditions, proved to be the most and least useful and successful?	Internal barriers, Org. commitment, Scope & scale of transformation	
2) How are the information requirements of operations addressed?	Flexibility, Work environment Adaptability	
3) How has e-business affected the level of integration between processes?	Process definition Information flows Technology installation	

Field Procedures

Access: Authorized via letter from Barbara Wesolowski, Vice President, Business Information and Transformation, IBM Microelectronics Division, System and Technology Group

Estimated duration of data collection efforts: Commencing April 2005 and Concluding July 2005. Documentation review and analysis will be completed first. Conduct interviews in Burlington, Vermont during first phase, travel to East Fishkill, New York for second phase then complete phone interviews in second phase. Revisit documentation evidence at conclusion of interview phase.

Figure 2



Prospective Participants:

Executives: CIO, Project Executive Owner, Design Center Executive, World Wide Field Applications Engineering Executive, and Field Applications Engineering Executive

Business Process Owners: Field Applications Engineering Process Owner, Customer Relationship Management Process Owner, Design Center Manager, ASIC Methodology Engineer, and Tactical Marketing Specialist

Project Leaders: Project Manager, Senior Technical Staff Member, IT Architect, Consultant, and Senior Engineer

Equipment: One laptop computer for note taking and data storage while in the field, one desk top personal computer for consolidated data management, Sony ICD-MS515VTP digital audio recorder for interview documentation,

Interview preparation: See attached Interview Process Protocol. See attached Interview invitation letter

Case Study Questions

Table 4

Line of Inquiry

Theme	Research Question	Focus Questions	Probes
Strategic Context	Why was the firm motivated to invest in e-business?	4) What was the nature of any extra-organizational influence to adopt e-business? 5) What internally generated factors influenced the organization to adopt e-business? 6) What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?	Organizational value Competitive advantage Adaptability External pressure Organizational efficiency Strategic intent Process and system interactions Measurement deficiency, Organizational data mining
Operating Context	How has e-business been utilized to implement organizational, process, and information integration?	4) How have pre-existing business and technology infrastructures influenced the evolution of the e-business project? 5) How do the economies of e-business technology enable the management of internal operations? 6) How has e-business influenced the automation, creation, or re-design of business processes?	End-to-end integration Legacy systems Legacy processes Complexity, Standardization Automation vs. re-design
Business Process and Information Systems Integration	What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations?	4) What practices, under what conditions, proved to be the most and least useful and successful? 5) How are the information requirements of operations addressed? 6) How has e-business affected the level of integration between processes?	Implementation difficulty, Business processes and behaviors Internal barriers, Organizational commitment, Scope & scale of transformation Flexibility, Work environment Process definition Information flows Technology installation

Case Study Report

Will be in standard Capella University dissertation format.

Chapter 1: Introduction to the Study
Chapter 2: Literature Review
Chapter 3: Methodology
Chapter 4: Result
Chapter5: Analysis and Conclusions
References
Appendices

Contact Summary Form

Contact Type:		Site:	_____
Visit-	_____	Contact date:	_____
Phone-	_____	Today's date:	_____
	(with whom)	Written by:	_____

- What were the main issues or themes that struck you in this contact?

- Summarize the information you got (or failed to get) on each of the target questions you had for this contact.

Question Information

- Anything else that struck you as significant, interesting, illuminating, or important in this contact?

- What new (or remaining) target questions do you have in considering the next contact with this site?

Document Summary Form

Site: _____
Document: _____
Date received:_____

Name or description of document:

Event or contact, if any, with which document is associated:

Significance or importance of document:

Brief summary of contents:

Interview Invitation Letter

Mr. or Ms.
Street
City, State, ZIP

Dear Mr. or Ms.

I am a doctoral candidate at Capella University in Minneapolis, Minnesota working towards a PhD degree in Organization and Management. To complete the degree work, I must conduct an original piece of research- a doctoral dissertation- that adds to the body of academic knowledge and understanding about some contemporary business phenomena. To that end, I have been investigating the latest trends in electronic business operations.

My dissertation research is specifically aimed at understanding the strategic and operational context that motivates and sustains an organization's decisions to pursue electronic business and the influence this context has on the deployment of operational business processes and information technology. A case study of the IBM Opportunity Management Project (also known as the Design In Win initiative) has been determined to be a rich source of information for this research project. Further, IBM Microelectronics Management has graciously consented to let me conduct the desired research within the venue created by the Opportunity Management Project. Please note the letters of introduction from IBM and Capella University that have been attached for your reference.

A key component of the research process is the gathering of information from selected individuals who have knowledge, experience, perspective, and opinions about the MD project. Hence, I am inviting you to participate in an audio-recorded interview, lasting between sixty and ninety minutes. The questions that I plan on asking are attached for your reflection before the interview itself. Your participation is completely voluntary. I will not reveal, under any circumstances, your participation or lack of participation; in addition I will not reveal nor directly attribute to you any comments that you make during the session unless I have specific release from you to do so.

I do hope you will consent to join this research as you have unique perspectives and knowledge that can contribute to the e-business body of knowledge. I will contact you by phone or e-mail within the next several days to determine your availability for this project. At that time we can schedule a date and time for the interview.

Thank you for your consideration to participate in this research project.

Sincerely,

Victor J. Stone

Attachments: Authorizations from IBM, Introduction from Capella, Research Questions, Informed Consent Form

Interview Process Protocol

Initial Contact

- Contact potential participants via letter of introduction to the research to request their consideration to participate
- Contact potential participant via phone or e-mail to determine if he or she is interested and available
- Relate dissertation purpose and indicate why the participant's experiences are needed
- Tell potential participant about how they will be protected in the study
- Suggest that participant review the research questions prior to the interview
- Obtain business information for future reference and contact before the meeting
- Establish time, date, and place or phone number for meeting
- Leave researcher's name, e-mail address and home and work telephone numbers with participant
- Confirm interview appointment via e-mail

Pre-meeting Preparation

- Create a person-specific data folder in research database
- Prepare Contact Summary Sheet
- Test digital recording device and assure adequate storage capacity in storage media

Meeting

- Arrive early
- Thank participant for his or her valuable time, sharing of ideas, and trusting the researcher
- Validate business information with participant
- Remind participant of the research purpose and objectives
- Reiterate the voluntary nature of research participation
- Introduce the Informed Consent form and obtain the participant's and researcher's signatures
- Provide copy of the informed Consent form
- Remind participant about the desire to record the interview and obtain permission
- If in agreement, place recorder within easy reach of participant.
- Monitor recorder to ensure that all information is captured
- Proceed through interview questions, focus questions, and probes as necessary
- Allow approximately 20 to 30 minutes per thematic topic
- End interview on time and ask if there are any questions
- Advise that a transcript of the interview will be provided for validation

Post Meeting

- As soon as possible after the interview complete the Contact Summary Sheet
- Send thank you note to participant before the end of the day
- Review recording and any notes to ensure clarity of ideas
- In any problems are discovered, follow up immediately with the participant to ensure complete understanding or to revise data validation plan
- Render voice file to data transcript and send to participant

An E-business Case Study
Opportunity Management Operations at IBM Microelectronics

Informed Consent

Title of Study: An E-business Case Study: Opportunity Management Operations at IBM Microelectronics

Mentor: Dr. Sheila Fournier-Bonilla

Researcher: Victor J. Stone

In an effort to investigate the strategic and operational context that underpins and influences the deployment of the business processes and information technology of the IBM MD Opportunity Management e-business initiative, I would like to invite you to participate in a research project for my doctoral dissertation. A significant part of the research consists of in-depth interviews with individuals who are or were associated with the initiative during its five year history. You have been selected to participate because of your association with the MD Opportunity Management Project. The interview questions are intended to generate discussion and conversation about your experiences, knowledge, actions, ideas, and perceptions of the project. The interview take no longer than 90 minutes.

The interviews will be audio recorded to make the interview experience meaningful for both of us and to capture your ideas accurately. The recordings will held securely under my control. All data collected in this study will be confidential and all person-identifiable data will be coded so that you cannot be identified.

There are not foreseeable risks or discomforts to you. There are no costs to you other than your investment of time for the interview and any subsequent follow up.

Your participation is completely voluntary. You may withdraw from the study at any time and for any reason, without explaining your rationale. In addition, you may decline to answer any question posed to you during the interview. The researcher will not report to anyone about your participation or non-participation. There are no tangible benefits to be accrued from participation in this research. There is; however, the chance to contribute to the scholarly understanding of a unique phenomenon of our time, electronic business.

This study is being conducted by Victor J. Stone, a doctoral candidate at Capella University. He may be reached at home on 802-899-2849 or at work at 802-769-6548 or via e-mail at victor.stone2@verizon.net for any question or concern regarding this research. Mr. Stone's mentor and dissertation committee chairperson is Dr. Sheila Fournier-Bonilla, who may be reached on 954-977-5060 or via e-mail at Sheila.FournierBonilla@capella.edu. You may also contact Capella University's Business School Dean at 1-800-987-2282 x 5326, if you have any questions or comments regarding your rights as a participant in this study.

This interview is to be used only for the purposes of this doctoral study.

Our signatures below indicate that we both understand your participation to be completely voluntary and under your control

Print _____

Signature: _____ Date _____
Participant

_____ _____
Victor J. Stone, Researcher Date

APPENDIX C

IRB Form

CAPELLA UNIVERSITY

Institutional Review Board
225 South 6th Street, 9th Floor
Minneapolis, Minnesota 55402

Institutional Review Board Application

(When this IRB application is completed, it is to be submitted with the research proposal for the next stage of review. The Provost, or designee, gives final approval. See the checklists at the end of this form to verify that you have completed all of the information for this application.)

Name (e.g., Learner, Faculty Employee, Consultant, Directed Employee/Agent, Independent Contractor, Adjunct Faculty) ___Victor Stone_____
Date____March 22, 2005_____
Address____24 Alpine Dr. , Jericho, Vermont 05465-2070_____
_____
Phone (Work) _802-769-6458_____ (Home) ___802-899-2849_____
Email Address(es) ___victor.stone2@verizon.net_____
_____
Field of Study _Organization and Management_ Degree Program __PhD_____

Supervisor Name _Dr. Sheila Fournier-Bonilla_____
Supervisor Title (e.g., Mentor, Instructor, Practicum Supervisor, Internship Supervisor, Staff Position, etc.) _Mentor and, Chair General Management PhD Program, School of Business, Capella University_____
Address_____222 South 9th Street 20th Floor, Minneapolis, MN 55402_____
_____
Phone (Work) _954-659-1749_____ (Home) _____
Email Address(es) __Sheila.FournierBonilla@capella.edu_____
_____
Provost ____Karen Viechnicki_____

_February 23, 2005_____Fill in date you successfully completed the online IRB Training required modules and optional modules appropriate to research topic

1. **Project Title**: (Use same title as Final Proposal)

_An E-business Case Study: Opportunity Management Operations at IBM Microelectronics
_____

2. **Inclusive dates of project**: _April 2005__ **through** _July 2005_____
3. **Abstract**
Describe your research, including research questions and methods to be used (research question, hypothesis, and methodology). Describe the purpose of the research and explain what the research subjects/participants will be asked to do. Please use language that can be understood by a person unfamiliar with the area of research. Avoid area-specific jargon as much as possible. If you must use area-specific jargon, also include an explanation of its meaning. If using existing data or records, describe the sources of the data and your means of access to the data. If you are not using human participants, clearly indicate the nature of data collection.

Attach abstract. See checklist to verify that you have completed the abstract.
See Attachment A: Abstract

4. **Participant/Subject Population (or Final Sample to be selected)**

a. Number: Male _12__ Female __3___ Total _15___

b. Age Range: _35_ to _65__

c. Location of Participants:
(Check all that apply)

__X_ business

____elementary / secondary school

____outpatient

____hospital / clinic

____university / college

____other special institution / agency: specify_____

d. Special Characteristics:
(Check all that apply)

_X_adults with no special characteristics

___Capella University learner, faculty, and/or staff

___inpatients

___outpatients

___prisoners

___students

___other special characteristics:
specify _____

If research is conducted through organizations or agencies, written documentation of approval / cooperation from each agency (e.g., business, school, hospital, clinic) must accompany this application.
See Attachment B: Letter of Authorization

e. Recruitment of Participants/Subjects
Describe how participants/subjects will be identified and selected for recruitment. Attach recruitment information (e.g., advertisement, bulletin board notices, recruitment letters)
The key recruitment objective will be to attract a suitable number of participants who are knowledgeable, capable, and willing to provide the information prescribed by this study's conceptual framework and research questions. In this case, where the goal is to elicit specific information regarding strategic and operational context and business process and information systems, participants must have a high likelihood of possessing the requisite knowledge. Accordingly, a non-probability purposive sampling plan appears to be most appropriate for initiating the project. In actuality, there are three relevant groups of potential participants. There are executives who commissioned the project, provided the funding, and provided executive oversight throughout the conduct of the project. The second notable group is formed from those key leaders that managed the project through the system lifecycle and provided the technical and organizational transformation locus of control. The final group consists of those who manage and execute the e-operations business processes. Thus, the proposed sample can be considered both purposeful and stratified as it has the potential to illustrate differences in understanding and experiences between the three groups. It is proposed that the initial sample of participants includes five each of executives, business process owner management, and key project leaders, for a total of fifteen participants. The proposed sample consists of twelve males and three females whose ages are estimated to be between thirty and sixty five years.

Attach description and examples of information as it will appear to potential participants.
See Attachment C: Interview Invitation Letter

f. Approval for Use of Records
If participants/subjects are chosen from records (e.g., email address list, postal address list, telephone number list, patient charts, student grades), indicate who approved use of the records. If records consist of medical, student, or other private records, provide the protocol for securing consent of the participants/subjects in the records and approval from the custodian of the records. If appropriate, specify how Standards for Privacy of Individually Identifiable Health Information (the Privacy Rule) under the Health Insurance Portability and Accountability Act of 1996 (HIPAA) have been observed.
See website found at http://privacyruleandresearch.nih.gov/
Attach description. Not Applicable

g. Initial Contact with Participants/Subjects
Who will make the initial contact with participants/subjects? Victor Stone Describe how contact will be made.
Attach description.

The fifteen prospective participants will initially be contacted by personal and confidential e-mail or by hardcopy letters if appropriate. They will be informed of the scope, nature, and purpose of the research. They will be advised that IBM management has authorized the researcher to conduct the study (see Attachment B); that the researcher is a doctoral candidate at Capella University, and that participation in the proposed research is solely at their discretion. See attachment C. Within three or four days of sending the Initial e-mail or mail, each prospective participant will be contacted by phone to more thoroughly introduce the topic, respond to questions or issues relating to participation, and ask for an appointment to conduct the interview.

h. Inducements or Rewards to Participants/Subjects
Will participants/subjects receive inducements before, or rewards after the study? Include this information in your assent/consent documents. See checklist at the end of this form to verify that you have completed the informed assent/consent documents or the cover to an anonymous questionnaire.
Attach description. Not Applicable

i. Activity for Control Group
If some of the participants/subjects are in a control group, describe in detail the activity planned for that group. (This information must be included in the consent/assent forms.)
Attach description. Not Applicable

5. **Confidentiality of Data**

a. Describe what provisions will be made to establish and maintain confidentiality of data and who will have access to data. If anonymous surveys are distributed, provide all the information that would have been given in an informed consent form as a cover to the survey (see the checklist at the end of this form to verify that you have completed the cover to the survey).
Attach description.
Data management for this research is anticipated to be a completely digital undertaking. All information will be captured or rendered to digital form for computer manipulation, transmission, and storage. During the course of the study all data will be secured on the researcher's desktop and notebook computers, and on a detachable flash memory storage device. Periodic data backups will be made to CDROM media. It is expected that all interview data will be captured in the form of digital audio files through the use of a Sony ICD-MS515VTP digital audio recorder. These files will be transcribed into Microsoft Word documents and saved in digital form. All supporting documents, analytical materials, and written reports will be saved in digital form and periodically backed up to CDROM. Data protection will be assured via a multilayer and distributed security strategy. Access to each computer will be entitled via separate hard drive and operating system passwords. Raw data files will contain identifier codes. Code lists and data files will be saved in separate directories and the code-to-data reference key will be encrypted and password protected.

b. Where will the data be stored and for how long? Whatever media (e.g., audiotape, paper, digital recording, videotape) are used to record the data, explain who will have access and how long the media

will be retained. It is required that data be stored for a minimum of seven years after publication of results (such as a dissertation). If data will be destroyed, describe the secure method for destroying the materials that will maintain confidentiality.
Attach description.
All data will be retained for no less than seven years. The goal of the database strategy is to retain and integrate the various data that will form the chain of evidence that underpins this study and supports its reliability. Thus, the database design will support the linking of the cases study questions, case study protocol, specific evidence by source, the analysis, and the case study report. This data control strategy will be under the direct control and management of the researcher.

All documents relating to ethical treatment of human participants/subjects which will be used in the course of the research must be attached to this form. These documents include consent forms, cover letters and other relevant material.
See Attachment C: Interview Invitation Letter
See Attachment D: Informed Consent Form

See checklist at the end of this document to verify that the application form has been completed.

Submit completed checked checklists with this application form to your school's designated IRB reviewer.
See Attachment E: Checklists

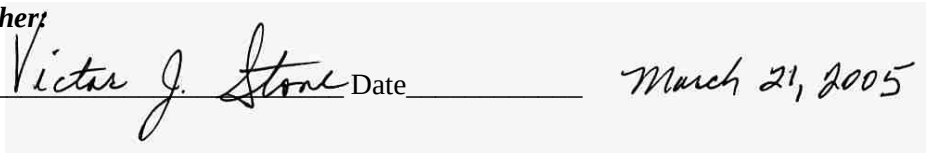
Signature of Researcher

As a Researcher (e.g., Learner, Faculty Employee, Consultant, Directed Employee/Agent, Independent Contractor, Adjunct Faculty) you certify that:

- The information provided in this application form is correct and complete.
- You will seek and obtain prior written approval from the Committee for any substantive modification in the proposal.
- You will report promptly to your Supervisor any unexpected or otherwise significant adverse events in the course of this study.
- You will report to the Supervisor and to the participants/subjects, in writing, any significant new findings which develop during the course of this study which may affect the risks and benefits to participation in this study.
- You will not begin the research until final written approval is granted.
- You understand that this research, once approved, is subject to continuing review and approval by your Supervisor. You will maintain records of this research according to Supervisor guidelines. Substantive change requires submitting an addendum to a previously approved application. An addendum is a totally new application form with attachments. The cover letter with the addendum describes the changes that were made from the originally approved application.

If these conditions are not met, approval of this research could be suspended.

Signature of the Researcher:



Signature of Supervisor

As a Supervisor (e.g., Mentor, Instructor, Practicum Supervisor, Internship Supervisor, Staff Supervisor) you certify that:

- The information provided in this application form is correct and complete.
- You will review and provide prior written approval to your Supervisee for any substantive modification in the proposal. You will inform the committee members appointed to oversee the research and its results.
- You will receive reports from your Supervisee about any unexpected or otherwise significant adverse events in the course of this study. You will inform the committee members appointed to oversee the research and its results.
- You will review research records maintained by your Supervisee until the final written document is produced and approved by you and the oversight committee.
- You will inform the oversight committee about the progress of your Supervisee from the time of developing research questions, through the proposal, IRB application, collection of data, writing results, and completing the documentation of the research.
- You will contact the Lead Subject Matter Expert (e.g., Chair of the Specialization, Faculty Director) if additional review is needed.
- You will make sure that this application has been completed by your Supervisee including all accompanying attachments before signing your name for approval.
- You assume responsibility for ensuring that the research complies with University regulations regarding the use of human participants/subjects in research.

If these conditions are not met, approval of this research could be suspended.

Signature of the Supervisor:

Name ___ Date: March 28, 2005
Title: Faculty Chair, General Management, PhD O&M Program

Signature of Provost or Designee
As Provost, or designee, I acknowledge that this research is in keeping with the standards set by the university and assure that the researcher has met all requirements for review and approval of this research.

Signature of Provost or Designee

Name _____ Date_____

Completed forms should be sent as email attachments. Scan signature pages and attach as files. Send email messages with attachments to the designated IRB reviewers in one of the following schools representing your specialization affiliation:

Harold Abel School of Psychology
School of Business
School of Education
School of Human Services
School of Technology

Attachment A

Abstract

- The application is for the use of human participants in research

- A qualitative case study is proposed as a vehicle to investigate the IBM Microelectronics Division Opportunity Management e-business initiative. The proposed study will ascertain how and why IBM has pursued the implementation of e-business technologies and practices within these internal operating processes. This research project is motivated by a desire to fill in gaps in the relatively sparse research that has heretofore been conducted into the internal operating processes of e-business organizations. This proposed investigation will explore the strategic and operational factors that provided the context and influenced the decision by IBM to invest in this e-business initiative. It will also seek to describe how this context shaped the design of internal business operating processes and the selection and deployment of e-business technologies. The research questions are - Why was the firm motivated to invest in e-business? How has e-business been utilized to implement organizational, process, and information integration? What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations?

- While e-business coverage has become significantly more comprehensive during the past few years, information regarding the contemporary use of Internet and Web technologies and practices to enable a firm's internal transactions and processes is still confusing, scarce, and under reported. This has been emphasized by Feeny (2001), Tsikriktsis, Lanzolla, and Frohlich (2004), Brews and Tucci (2003), Rust (2001) and in numerous articles by Barnes, Hinton, and Mieczkowska (Barnes et al., 2002; 2004; Barnes, Mieczkowska et al., 2003). These scholars argue that more academic research should be conducted to understand the extent to which established firms use the Internet to conduct business, develop empirical evidence of the different factors that affect the adoption of electronic processes in firms, and establish the impact of e-business on internal business processes and operations. Therefore, an academic, scientific, empirical study that draws upon the experiences, knowledge, and learning that an established business organization has gained through the application of e-business to its internal operating processes can add value to the body of knowledge about electronic business. Specifically, this type of study could produce much needed understanding about the extent to which established firms use the Internet to conduct business, develop empirical evidence of the different factors that affect the adoption of electronic processes in firms, and establish the impact of e-business on internal business processes and operations.

- It is anticipated that each participant will be asked to engage in sixty to ninety minutes of semi-structured, open-ended questioning, dialog, and guided conversation. The line of

questioning will be based on each research question and associated subordinate questions as these questions are designed to open the topic on a broad scale yet allow the conversation to funnel down toward more specific details. Appropriate probe statements will be anticipated (see Table 1a and 1b), in case participants need to be stimulated to answer more completely or relevantly to the line of inquiry. Roughly, one third of the interview time will be devoted to each research question. If additional or follow up interviews are needed they will be requested.

Table 1a

Proposed Line of Inquiry

Theme	Research Question	Focus Questions	Probes
Strategic Context	Why was the firm motivated to invest in e-business?	What was the nature of any extra-organizational influence to adopt e-business? What internally generated factors influenced the organization to adopt e-business? What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?	Organizational value Competitive advantage Adaptability External pressure Organizational efficiency Strategic intent Process and system interactions Measurement deficiency Organizational data mining
Operating Context	How has e-business been utilized to implement organizational, process, and information integration?	How have pre-existing business and technology infrastructures influenced the evolution of the e-business project? How do the economics of e-business technology enable the management of internal operations? How has e-business influenced the automation, creation, or re-design of business processes?	End-to-end integration Legacy systems Legacy processes Complexity Standardization Automation vs. re-design

Table 1b			
Proposed Line of Inquiry (Continued)			
Theme	**Research Question**	**Focus Questions**	**Probes**
Business process and information systems integration	What were the overarching difficulties and road blocks that were encountered while attempting to apply e-business to internal operations?	What practices, under what conditions, proved to be the most and least useful and successful? How are the information requirements of operations addressed? How has e-business affected the level of integration between processes?	Implementation difficulty Business processes and behaviors Internal barriers Organizational commitment Scope and scale of transformation Flexibility Work environment Process definition Information flows Technology installation

- The key task of this proposed research is to propose a sampling approach that will produce a suitable number of participants who are knowledgeable, capable, and willing to provide the information prescribed by this study's conceptual framework and research questions. In this case, where the goal is to elicit specific information regarding strategic and operational context and business process and information systems, participants must have a high likelihood of possessing the requisite knowledge. Accordingly, a non-probability purposive sampling plan appears to be most appropriate for initiating the project. In actuality, there are three relevant groups of potential participants. There are executives who commissioned the project, provided the funding, and provided executive oversight throughout the conduct of the project. The second notable group is formed from those key leaders that managed the project through the system lifecycle and provided the technical and organizational transformation locus of control. The final group consists of those who manage and execute the e-operations business processes. Thus, the proposed sample can be considered both purposeful and stratified as it has the potential to illustrate differences in understanding and experiences between the three groups. It is proposed that the initial sample of participants includes five each of executives, business process owner management, and key project leaders, for a total of fifteen participants. The proposed sample consists of twelve males and three females whose ages are estimated to be between thirty and sixty five years.

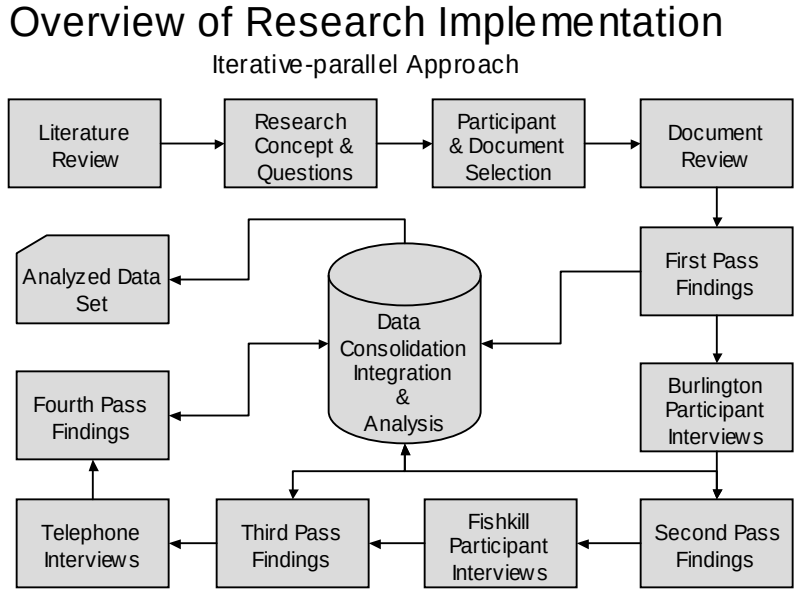
- The fifteen prospective participants will initially be contacted by personal and confidential e-mail or by hardcopy letters if appropriate. They will be informed of the scope, nature, and purpose of the research. They will be advised that IBM management has authorized the researcher to conduct the study (see Attachment B); that the researcher is a doctoral

candidate at Capella University, and that participation in the proposed research is solely at their discretion. See attachment C: Interview Invitation Letter. Within three or four days of sending the Initial e-mail or mail, each prospective participant will be contacted by phone to more thoroughly introduce the topic, respond to questions or issues relating to participation, and ask for an appointment to conduct the interview.

- The nature and concept of informed consent will be explained to each potential participant during the introductory telephone call, calling the participant's attention to the informed consent form that was attached to their introductory letter. The first order of business during the interview will be to review, in detail, the requirement for informed consent, its implications, and seek approval of the participant. As well, the processes and procedures for assuring confidentiality and anonymity will be explained. See attachment D: Informed consent form

- This proposed research will use the generally accepted iterative-parallel or cyclical method of data analysis (Elsworth, 1994; Miles & Huberman, 1994; Robson, 2002; Verschuren, 2003) wherein raw data is reduced to meaningful categories and themes, reflected on and summarized, and then rendered to some form of visual display that supports final inspection, examination, and interpretation. The iterative, cyclical nature of this process is manifested in the practice of constantly comparing new data and new interpretations to the evidence and interim interpretations previously established. The analysis commences during the data collection phase of the research project and terminates only when additional data ceases to enhance earlier conclusions. Data reduction activities will consist of selecting, focusing, simplifying, abstracting, and transforming the research data collected from documents, interviews, and interim analysis (Miles & Huberman, 1994). This is accomplished through the process of coding the data (Robson, 2002). At first order, codes or labels will be attached to groups of words, phrases, and sentences as an aid in organizing and retrieving them from the total pool of information. At second order, code groups will be aggregated into smaller sets representing patterns or themes that emerge from the data. This coded data, then, will be sorted, compared, contrasted, linked, and decomposed to reveal the relationships from the various sources. To facilitate the analytical process, ATALS/ti V5.0 qualitative analysis software will be employed for this proposed research project. ATLAS/ti, one of the most prominent software tools for qualitative data analysis (Dembrowski & Hanmer-Lloyd, 1995; Robson, 2002), is used by analysts at over 300 universities and research institutions (Scientific Software Development, 2005). This software provides a powerful workbench of tools to automate the management of large quantities of textual, graphical, audio, and video data and supports a more rigorous and fluid research process than is possible using manual methods (Richards, 2002). An overview of the proposed research process is shown in figure 1.

Figure 1



- Data management for this research is anticipated to be a completely digital undertaking. All information will be captured or rendered to digital form for computer manipulation, transmission, and storage. During the course of the study all data will be secured on the researcher's desktop and notebook computers, and on a detachable flash memory storage device. Periodic data backups will be made to CDROM media. It is expected that all interview data will be captured in the form of digital audio files through the use of a Sony ICD-MS515VTP digital audio recorder. These files will be transcribed into Microsoft Word documents and saved in digital form as well. If possible, Opportunity Management documents will be collected as digital files such as word processor or presentation files. Any hardcopy documents will be scanned to digital form. All supporting documents, analytical materials, and written reports will be saved in digital form and periodically backed up to CDROM. Data protection will be assured via a multilayer and distributed security strategy. Access to each computer will be entitled via separate hard drive and operating system passwords. Raw data files will contain identifier codes. Code lists and data files will be saved in separate directories and the code-to-data reference key will be encrypted and password protected. All data will be retained for no less than seven years. The goal of the database strategy is to retain and interrelate the various data that will form the chain of evidence that underpins this study and supports its reliability. Thus, the database design will support the linking of the cases study questions, case study protocol, specific evidence by source, the analysis, and the case study report.

- It is believed that the proposed research design, including sampling plan, data collection techniques, and data analysis methods, is consistent, supportive, and appropriate for achieving this proposal's goals. Those goals being to understand, through the study of the IBM Opportunity Management e-business initiative, the articulation between the strategic and operational factors that provide context for e-operations and how this context shapes the design of internal business operating processes and the selection and deployment of e-business information technology. The research questions are synchronized to the conceptual framework underpinning this study and thus are expected to produce information relevant to each domain of the framework. Results from this study will provide a perspective on the e-operations robustness of the framework and as well they can be compared and contrasted to results from other studies.

Attachment B

Letters of Authorization

Hudson Valley Research Park
2070 Route 52
Hopewell Junction, NY 12533 6531

March 14, 2005

Subject: E-business research

Dear Colleagues,

This is to inform you that Victor Stone, a doctoral candidate at Capella University in Minneapolis, Minnesota, will be conducting research into the IBM Microelectronics Division Opportunity Management processes, practices, and systems. Opportunity Management may be better known to most of you as the Design In Win project. This research will be aimed at understanding the strategic and operational context that underpins this project and influences the deployment of internal electronic operations.

Victor is authorized to access and use non-IBM Confidential documents and system archive data pertinent to this study. He is also authorized to approach selected individuals with invitations to contribute their knowledge, experience, and perspectives on this research topic. Participation; however, is solely at the personal discretion of each individual. It is expected that this research will commence on or about April, 2005 and conclude no later than July, 2005.

While IBM endorses the conduct of this academic study and hopes that it will contribute to the body of knowledge about electronic business, IBM will play no official role in its conduct or outcomes. The analysis, results, and conclusions will be strictly those of the researcher

Regards,

Barbara E Wesolowski

Barbara Wesolowski
Vice President, Business Information and Transformation
IBM Microelectronics Division
Server and Technology Group

Attachment C

Interview Invitation Letter

Mr. or Ms.
Street
City, State, ZIP

Dear Mr. or Ms.

I am a doctoral candidate at Capella University in Minneapolis, Minnesota working towards a PhD degree in Organization and Management. To complete the degree work, I must conduct an original piece of research- a doctoral dissertation- that adds to the body of academic knowledge and understanding about some contemporary business phenomena. To that end, I have been investigating the latest trends in electronic business operations.

My dissertation research is specifically aimed at understanding the strategic and operational context that motivates and sustains an organization's decisions to pursue electronic business and the influence this context has on the deployment of operational business processes and information technology. A case study of the IBM Opportunity Management Project (also known as the Design In Win initiative) has been determined to be a rich source of information for this research project. Further, IBM Microelectronics Management has graciously consented to let me conduct the desired research within the venue created by the Opportunity Management Project. Please note the letters of introduction from IBM and Capella University that have been attached for your reference.

A key component of the research process is the gathering of information from selected individuals who have knowledge, experience, perspective, and opinions about the MD project. Hence, I am inviting you to participate in an audio-recorded interview, lasting between sixty and ninety minutes. The questions that I plan on asking are attached for your reflection before the interview itself. Your participation is completely voluntary. I will not reveal, under any circumstances, your participation or lack of participation; in addition I will not reveal nor directly attribute to you any comments that you make during the session unless I have specific release from you to do so.

I do hope you will consent to join this research as you have unique perspectives and knowledge that can contribute to the e-business body of knowledge. I will contact you by phone or e-mail within the next several days to determine your availability for this project. At that time we can schedule a date and time for the interview.

Thank you for your consideration to participate in this research project.

Sincerely,

Victor J. Stone

Attachments: Authorizations from IBM, Introduction from Capella, Research Questions, Informed Consent Form

Attachment D

Capella University

225 South 6th Street

9th Floor

Minneapolis, MN 55402

Informed Consent

Title of Study: An E-business Case Study: Opportunity Management Operations at IBM Microelectronics

Mentor: Dr. Sheila Fournier-Bonilla

Researcher: Victor J. Stone

In an effort to investigate the strategic and operational context that underpins and influences the deployment of the business processes and information technology of the IBM MD Opportunity Management e-business initiative, I would like to invite you to participate in a research project for my doctoral dissertation. A significant part of the research consists of in-depth interviews with individuals who are or were associated with the initiative during its five year history. You have been selected to participate because of your association with the MD Opportunity Management Project. The interview questions are intended to generate discussion and conversation about your experiences, knowledge, actions, ideas, and perceptions of the project. The interview take no longer than 90 minutes.

The interviews will be audio recorded to make the interview experience meaningful for both of us and to capture your ideas accurately. The recordings will held securely under my control. All data collected in this study will be confidential and all person-identifiable data will be coded so that you cannot be identified.

There are not foreseeable risks or discomforts to you. There are no costs to you other than your investment of time for the interview and any subsequent follow up.

Your participation is completely voluntary. You may withdraw from the study at any time and for any reason, without explaining your rationale. In addition, you may decline to answer any question posed to you during the interview. The researcher will not report to anyone about your participation or non-participation. There are no tangible benefits to be accrued from participation in this research. There is; however, the chance to contribute to the scholarly understanding of a unique phenomenon of our time, electronic business.

This study is being conducted by Victor J. Stone, a doctoral candidate at Capella University. He may be reached at home on 802-899-2849 or at work at 802-769-6548 or via e-mail at

victor.stone2@verizon.net for any question or concern regarding this research. Mr. Stone's mentor and dissertation committee chairperson is Dr. Sheila Fournier-Bonilla, who may be reached on 954-977-5060 or via e-mail at Sheila.FournierBonilla@capella.edu. You may also contact Capella University's Business School Dean at 1-800-987-2282 x 5326, if you have any questions or comments regarding your rights as a participant in this study.

This interview is to be used only for the purposes of this doctoral study.

Our signatures below indicate that we both understand your participation to be completely voluntary and under your control

Print _____

Signature: _____ Date _____
Participant

_____ _____
Victor J. Stone, Researcher Date

Attachment E

Checklists

Checklist: Form Completed

Use this form to verify that an application has all the necessary information completed in the Institutional Review Board (IRB) Application

1. _X___ all items answered (use NA where item is Not Applicable)
   - _X___ demographics of learner and supervisor
   - _X___ #1. Project Title
   - _X___ #2. Dates of Project
   - _X___ #3. Abstract (see checklist)
   - _X___ #4. Population
     - _X__ #4.a. number
     - _X__ #4.b. age range
     - _X__ #4.c. location of participants/subjects
     - _X__ #4.d. special characteristics of participants/subjects
     - _X__ #4.e. recruitment of participants/subjects
     - _NA_ #4.f. approval for use of records
     - _X__ #4.g. initial contact with participants/subjects
     - _NA_ #4.h. inducements or rewards to participants/subjects
     - _NA_ #4.i. activity for non-participants/non-subjects (e.g., control group)
   - _X__ #5. Confidentiality of data
     - _X__ #5.a. establish, maintain confidentiality, access to data
     - _X__ #5.b. storage/destruction of data
   - ____ signatures
     - _X___ researcher
     - ____ supervisor
2. _X__ application attachments (use NA where item is Not Applicable)
   - _X__ approval from institution housing participants
   - _NA_ approval from institution housing records
   - _NA_ assent form for minor participants (see checklist)
   - _NA_ checklist for extracting information from files or records
   - _NA_ consent form for parent/guardian/adult participant (see checklist)
   - _NA_ cover letter for mailed consent form
   - _NA_ cover letter for mailed questionnaire
   - _NA_ cover information for questionnaire (see checklist)
   - _NA__ instrument(s) to elicit responses from participants
   - _X__ questions to be asked during interviews
   - _X__ script/letter/email message to recruit participants
   - ____ other _____
3. ____ IRB Application complete

action: forward to School designee to review for approval
date of action _____

Checklist: Abstract

Use this form to verify that item #3 has been completed on the
Institutional Review Board (IRB) Application

1. The application is for
    a. use of human participants in research (including record review) – answer items below and submit to Capella School IRB reviewer
    b. use of animal subjects in research (including record review) – contact Capella University IRB Committee before completing application
    c. other type of research (specify _____) – contact Capella University IRB Committee before completing application

2. Describe what the proposed research is about, and the research design to be used.
(state, in one or two sentences, the research question to be answered, and any hypotheses to be tested)
(research design choices include: historical, descriptive, developmental, case/field study, correlational, causal-comparative, experimental/quasi-experimental, action)

3. State the research topic; describe what research has previously been done related to this topic; and restate the research question in terms of the implications from the results that are expected to be found.

4. Describe how the data will be collected through one or more of the following:
a. using standardized tests with human participants,
b. interviewing human participants,
c. asking human participants to complete questionnaires,
d. reviewing files containing information about human participants, or
e. some other procedure _____).
(NOTE: attach the tests, interview questions, questionnaire, checklist for record review, or summary of other procedures)
(NOTE: attach documentation from officials who give authorization to access participants, files, or other sources that will provide the data)

5. (Omit for record review)
Describe how the participants will be recruited, and the characteristics of the population that is represented.

6. (Omit for research using human participants)
Specify the characteristics of the records that will be selected.

7. Describe how the sample will be selected.
(specify the type of sampling, such as convenience, periodic, random, snowball, or systematic),
(explain how the process will be conducted),

(specify the number of participants or records in the sample), and
(specify the characteristics of the sample, such as sex, age, and other variables to be studied).

8. (Omit for record review)
Describe how participants will be contacted for recruitment as a participant.
(describe how participants will be identified),
(describe how participants will be approached), and
(describe how participants will be recruited).
(NOTE: attach advertisement, bulleting board notices, recruitment letters, script for telephone call, script for announcement at gatherings, or other documentation supporting the descriptions and explain any inducements to be offered to participants)

9. (Omit for record review or mailed questionnaires)
Describe how informed consent will be provided.
(specify the process of obtaining consent from adults, assent from minors, and/or consent from guardians of minors).
(NOTE: attach the form(s) that will be used to obtain consent and/or assent)
(NOTE: attach the cover letter if mailing the request for the form(s) that will be used to obtain consent and/or assent)

10. (Omit for record review or when informed consent is required)
Describe how the participant will participate.
(specify how participants will have the following information: what they are expected to do, how long their participation will take, who is conducting the research, the topic of the research, the reason for conducting the research, why they were selected, how anonymity will be protected, how data are kept confidential, and how to contact those who will have answers to any questions about the research, i.e., the researcher, the faculty mentor, and Capella University).
(NOTE: attach the cover letter that will accompany the questionnaire)

11. Describe how the data will be analyzed.
(specify the type of quantitative analysis or qualitative analysis, and include a variable code sheet where appropriate).

12. Describe how the data will be stored, for what length of time, who will have access to the data, how it will be available to others, how the data will be destroyed, and how the confidentiality of the data will be maintained.

13. Describe how the results will be interpreted in terms of answering the research questions.

Checklist: Informed Consent/Assent Form

for Participants to Sign

Use this form to verify that a consent form has all the necessary information, if a consent form is to be attached to the Institutional Review Board (IRB) Application.
If the participant/subject is a minor, both an assent form for the participant/subject and a parent/guardian consent form are required.

_X__ 1. name of researcher

_X__ 2. title of researcher

_X__ 3. location of researcher

_X__ 4. reason for conducting research

_X__ 5. title of research project

_X__ 6. reason person was selected to participate

_X__ 7. explanation of how person was selected to participate

_X__ 8. description of what participant is to do

_X__ 9. length of time participation will take

_X__ 10. how anonymity of participant will be protected

_X__ 11. how data collected will be kept confidential

_X__ 12. benefits to the participant, including any rewards

_X__ 13. risks to the participant, including protections from those risks

_X__ 14. assurance of voluntary participation

_X__ 15. assurance that withdrawing from the research has no consequences

_X__ 16. request that participant print name

_X__ 17. request that participant sign name and date signature

__X_ 18. make provision that participant will receive a copy of the form

_X__ 19. provide the name of the researcher and contact information for questions or concerns

_X__ 20. provide the name of the supervisor and contact information for questions or concerns

_X__ 21. provide the name of Capella University as a contact for questions or concerns using the designated IRB reviewer's contact information

_X__ 22. print the form on letterhead of the organization authorizing the research, or use the header of Capella University, 225 South 6th Street, 9th Floor, Minneapolis, MN 55402

__X_ 23. refer to the person as "participant" rather than "subject"

APPENDIX D

Research Question Analysis

Section One: Research Question One Concept and Theme Clustering

Why was the firm motivated to invest in E-business?		
Theme	**Concept**	**Quote**
Need to integrate isolated, redundant data sources	Data in isolation, no data exchange, no interaction	"…with their flurry of home grown applications that weren't well connected." **Owner Exec**
		"There was no interaction or interface or data exchange within the system we were using…" **WW FAE Exec**
	Multiple, redundant sources of data	"We had varying sources of data that were conflicting…" **Design Center Exec**
		"…we had a lot of redundancy going on associated with not only identifying opportunities but manually transcribing information about those opportunities over and over" **FAE Exec**
	Business data not coordinated or integrated	"So in my mind whatever data we had was not well coordinated and was not well integrated" **Design Center Exec**
	No real-time data capture	"…we didn't have a very good mechanism to enable them [FAEs] to document in real time the status of things." **FAE Exec**
Organizational data not integrated and coordinated	Information integration needed	"…the confusion factor. There was all kinds of data that was being collected in various different applications…" **Sr. Eng**
		"[The project was aimed at]…information integration, …[and] business process automation…" **IT Architect**
	Bad data	"…the data was so bad we don't know what we are doing…" **Consultant**
	Need for coordinated data	"…it was very apparent that there was a lack of information about what I call ,'where used and when needed'" **STSM**
Achieve better control of business data	There was no single application or tool available to collect, maintain and display the valuable business data associated with the OM process. **Document summary (P1,11,15,17,25,34)**	

Why was the firm motivated to invest in E-business? (Continued)		
Theme	**Concept**	**Quote**
Make processes visible to entire organization (headlights)	Sales activities not visible to the organization	"…more often than not they would have an opportunity that they would document and put in their desk drawer as opposed to putting it in a single repository where everyone could look at it…" **FAE Exec**
	No visibility into data; no headlights or insight	"It may have centered out of the deep engineering frustrations with not having adequate headlight." **Owner Exec**
		"We were sorely lacking any visibility into what our capacity would be in the next time period…" **Design Center Exec**
		"Sr. Management was lacking the ability to see how the pipeline as whole was doing against future revenue targets" **WW FAE Exec**
Organizational processes not integrated and coordinated	Activity status reporting was deficient	"…which was a lack of information about activities going on in the design center…?" **STSM**
	Uncontrolled and unconsolidated business processes	"…the processes are out of control, we want to be able to gain control of the business and run it more efficiently…" **Consultant**
		"There were a lot of business processes but they weren't necessarily end-to-end business processes." **Sr. Eng**
	Process integration needed	"[The project was aimed at]…information integration, …[and] business process automation…" **IT Architect**
	Cross functional difficulty	"…was a good step in terms of recognizing that it was a cross-functional difficulty…" **Project Manager**
Gain tighter control of business processes	"Gain tighter control of business processes" **Documents (P1,4,11,13,14)**	

What was the nature of any extra-organizational influence to adopt e-business?		
Theme	**Concept**	**Quote**
No outside pressure	No external pressure	"…there is nobody from the outside coming in and saying you have to do this." **Owner Exec**
		"We weren't getting external pressure like from above per se." **FAE Exec**
	Function was most important	"I was interested in what capacity do I need to have on hand the next quarter, the next year, two years out." **Design Center Exec**
	Focus on operations	"You know, frankly, I was completely focused on the operational efficiencies of MatrixOne." **FAE Exec**
	No need to be an e-business project	"I don't know that I cared that it was an e-business project. " **CIO**
No e-business pressure	Not an e-business mandate	"I would say, never…[thought this was an e-business project" **STSM**
		"Certainly not [mandated as an e-business project" **Project Manager**
		"I personally back then didn't view this type of stuff as e-business" **Consultant**
	Didn't anticipate that it would be an e-business project	"…at the time we didn't yet understand or foresee a business behavior in that problem space that would drive something we would label e-business." **IT Architect**
Focus on project function delivery	Function was most important	"I need tools and data and stuff to understand what the results are and what strategically is going on." **CRM Process Owner**
No evidence to suggest an external pressure	There are no references to any external pressure to pursue e-business in the Document database. First references to e-business occur between March 2000 and July 2000…nearly six month after the project commenced. **Documents (All)**	
Recommended an e-based PLM solution software package	PLM solution recommended	"I've always thought of the PLM space to be pre-manufacturing release… it can apply anywhere in there where there is custom development type of logic and thought processes going on." **Consultant**
	Chosen solution was Web-based	"…we were Web-enabled right from the get-go which was a difference from what we saw in other spaces." **STSM**
		"…it was very powerful, Web-based, applicable, it had all the attributes that we were looking for …" **Consultant**
	Solution was Web-based PLM software	"… it quickly became obvious that MatrixOne, that particular [e-PLM] tool set, could be cast in a positive light relative to the problem as we grew to understand it." **IT Architect**
		"…and found out that PLM was e-based if you will and that by that time frame we were thinking about things being e-based." **Project Manager**

What was the nature of any extra-organizational influence to adopt e-business? (Continued)		
Theme	**Concept**	**Quote**
Desire for project to improve organizational responsiveness	Dissatisfaction with responsiveness and consistency	"…high level of …dissatisfaction over…lack of ability to do a lot of things…be quick and consistent…" **Owner Exec**
	Details only provide in response to requests	"…opportunities were detailed and filled in only when somebody said we need to satisfy a presentation, or a metric, or a meeting." **FAE Exec**
Improve organization responsiveness	Some mild references to customer satisfaction concerns in documents. Expectations that the project would improve organizational performance but this was not a primary driver of the project **Documents (P19,21)**	

What internally generated factors influenced the organization to adopt e-business?		
Theme	**Concept**	**Quote**
Need to more efficiently use technical resources	Resource limitations	"When you step back, that human resource, that human capital was really our capacity in the business." **Design Center Manager**
	Resource savings	"…some amazing amount of resource could be salvaged and saved by properly executing this thing…" **FAE Exec**
Requirement to improved efficiency of people's time	Wasted effort	"…they talked about engineering efficiency, which we came to learn later was a major concern in terms of technical people spending time looking for data." **Project Manager**
	Need for efficiency	"…the processes are out of control, we want to be able to gain control of the business and run it more efficiently…" **Consultant**
Reduce administrative workload and increase operating efficiency	Reduce the administrative workload on all operatives but more especially on the various engineering groups and improve operating efficiency. **Documents (P2,19,21)**	
Data reuse efficiencies	Leverage and reuse data	"…cross functional flow of opportunity data, products, and issues…common data, entered once and used many times." **Project Manager**
		"Part of this solution was the need to get all of the data into one place, enter it once and use it many times" **Sr. Eng**.

What internally generated factors influenced the organization to adopt e-business?(Continued)		
Theme	**Concept**	**Quote**
Data consolidation and reuse	Data reuse	"We have all that information and we just transfer it right over to the RTx process and we capture that." **ASIC Methodology Eng**
	Data consolidation	"So it was a quest for having the information at my fingertips and at the time all I could find was …that the knowledge was within individual people." **Tactical Marketing Specialist**
Attractive financial business case	Project proponents prepared a financial business case that exceeded the organization's hurdle rates for justification. **Documents (P19)**	
Need for enterprise-scale security and business control standards	Security and business controls	"…the application needed to meet certain security and separation of duty standards…" **WW FAE Exec**
Enhanced business controls	Business Controls	"We had a business control problem." **FAE Process Owner**

What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results?		
Theme	**Concept**	**Quote**
Project was managed and measured for cost, quality, and deliverable schedules	Managed for cost, quality, and deliverables	"…the level of detail on the milestones and schedules and stuff suggests that it was done under PMP, professional management…" **FAE Exec**
		"The discipline of project management was applied…[and]…the project itself, as a project was managed for cost, quality, and scheduled deliverables." **Owner Exec**
	Well managed project	"The project was well run from a project management standpoint" **CIO**
		"… management and prioritization of the development activities as well as the reporting that was provided to all stakeholders…was very well managed **WW FAE Exec**
Project was well run and highly scrutinized	Well run, highly scrutinized project	"I think it was managed on a par with other things that had occurred in [the company]." **Project Manager**
		"As compared to other projects, I think it was scrutinized more rigorously." **IT Architect**
		"Compared to other projects, I thought it was very well run, very well run…" **Consultant**
Results and metrics	Outstanding measurements and results	"…overall, the measurements, the tracking, the deliverables, and the results were outstanding." **CRM Process Owner**
Formal project measurements reporting	The project business case was used a foundation for subsequent detailed management. Expenses and benefits were tracked on an ongoing basis and reported up through the organizational chain to the Division and Corp. CIOs. **Documents (P2,18,26)**	
Cross functional Executive Steering Committee	Executive forum to oversee project progress	"…steering committee was used as a forum for [the project manager] to share challenges and the churn it was causing…" **FAE Exec**
		"…we had the right people, executives on the steering committee so we had the right functional representation." **Owner Exec**
		"I think we probably had the appropriate governance for the project as an IT project including the budgeting, the funding, the arbitration, etc." **WW FAE Exec**
	Active governance early in the project lifecycle	"The steering committee played a pretty active role over the first year of the project…" **Design Center Exec**
		"I think it was effective early on and that is when you need it the most because you are really trying to get some decisions made." **CIO**
Steering Committee governance	Steering Committee engagement	"They listened; they understood what we were saying and let us take it in the direction that we felt it should go." **Sr. Eng**.
	Steering Committee mandates	"…they made some mandates when necessary about following the process and this [OM system] was going to be the golden source of data and anything that was not in there would not be considered a part of the process." **Consultant**

What types of project and operational measurements have been used to gauge the effectiveness of the e-business project and its results? (Continued)		
Theme	**Concept**	**Quote**
Steering Committee arbitration	Arbitration	"Out of the Steering Committee you got some of the push-pull that you would expect of an organization's fighting for capability." **CRM Process Owner**
Project governance hierarchy	Project oversight hierarchy was an Executive Steering Committee, Project Executive Owner, and a senior experienced Project Manager and supporting project team leadership. Twenty presentations document the ongoing oversight of the OM steering committee.	
Operational measurements	Operational measurement and metrics enabled	"It is by design...a workflow management tool of sorts,…with requirements placed on people, more metrics placed on the performance of people…in their window to measure time to performance and that type of thing…" **Owner Exec**
		"…we did manage to produce the metrics and then evolve the set of targets that we needed to drive the business to the revenue objectives that were expected from us as a whole organization." **WW FAE Exec**
	Operational forecasting and measuring	"From everything that I saw it enabled our ability to forecast demand for physical design resource. I also saw that it allowed us to see our yield." **Design Center Exec**
Operational metrics	Operational metrics	"I'm sure people are measuring things like how many RTMs are on time and simple things like that." **STSM**
Operational milestones, metrics, and analysis	Operational milestones	"…what's going on? Is it going to be on schedule, early, or late? What are the actual dates of meeting checkpoints?" **ASIC Methodology Eng.**
	Operational metrics	"…we draw, basically, all of the turn-around-times, cycle time, schedule serviceability, and overall serviceability." **DCM**
	Operations analysis	"We have nothing to work with if we really couldn't use the data and analyze it and put a set of measurements in place." **CRM Process Owner**
System operation metrics	Document chain of evidence shows instances of OM hardware, software, and system measurements- number of users, user access time. **Documents (D41,43,44,45)**	

Section Two: Research Question Two Concept and Theme Clustering

How has e-business been utilized to implement organizational process and information integration?		
Theme	**Concept**	**Quote**
Relational database enabled information integration	Consolidated, centralized data	"Now with [the Opportunity Management System]…I can go in and at my fingertips I can see the client design and see the scheduling and the dates and the progress." **Tactical Marketing Specialist**
	Power of relational databases	"So when you bring up the tool, there are preprogrammed views, and that's cool because that is what I use as a manager…I can pull from that database anything and everything that's in there…" **Design Center Manager**
Process definition prescribed the integrated pipeline	Integrated pipeline	"I think putting the whole OM sort of pipeline in a logical format was a good thing. [Previously] we didn't have a lot of written processes; we had a lot of individual department processes that didn't necessarily match each other." **FAE Process Owner**
	Process definition	"The process flow was virtually defined by the tool." **CRM Process Owner**
Business process analysis	Robust process analysis	"…process documentation, analysis, relational data model, process flow related to the value proposition which was related to first time right…" **Project Manager**
Easy consistent system access and enablement	Internet Lightweight Directory Access Protocol (LDAP) eases access confusion	"I think when you guys set it up for us to use the IBM internet password and ID that was a very good enablement for us." **Design Center Manager**
		"…but what is good about the tool is that you guys at one point put in the fact that you made it consistent with your intranet ID and logon…" **CRM Process Owner**
Technology enabled implementation flexibility and low user overhead	Technology burden on the server, not on users	"…from an end user's point of view, the burden you put on him in terms of his continuing resources and the things he has to do to enable him to use the functions is really lightweight." **STSM**
		"…it put the computational capacity back on the server." **STSM**
	Technology flexibility	"That was on influence that we had was that we didn't have to necessarily restrict our process to fit in the tool we were free to define any process that we wanted and then we could implement it in the tool." **Sr. Eng.**
	Less technology burden on the project team	"…the choice we made for the Web [mean that] there were fewer things for us to support as a team. So what you could do was focus on the problem and not on the IT." **STSM**
Business process design enabled by technology	Business processes definition prioritized before technology selection	"They weren't going after technology for technology's sake; they were really trying to understand what the business process should look like and then put the right tools in place to facilitate that business process." **Design Center Exec**

How has e-business been utilized to implement organizational process and information integration? (Continued)		
Theme	**Concept**	**Quote**
Information integration effects	Data dependencies	"…all of a sudden the RTx process had dependencies upon other things within OM…" **ASIC Methodology Eng**
e-business infrastructure supports integration	E-business technology allowed the Project Team to focus on putting all the information needed to perform tasks into one place and allow easy access to that information…IBM intranet web applications (WebSphere), browsers (Netscape and Internet Explorer), e-based PLM software from MatrixOne Corp. **Documents (P7,11,12,13,40)**	
Application features supports integration	Application features such as lifecycle management, reporting, entitlement, triggers, business rules, and notifications support the end-to-end operational environment. **Documents (P8,11,15,16,24,29,32,33,37)**	
Technology induced fundamental transformation	Fundamental change	"Fundamental transformations are implied in the process. **Owner Exec**
	Technology facilitated transformation	"…it has pushed more responsibilities out to the edges in terms of the timely input of data, the completeness of the data and the maintenance of the data…" **Owner Exec**
		"…we spent quite a bit of money just to do enhancements. That may have pointed out, perhaps, that we had the wrong people doing stuff. By deploying OM maybe we got the job to the right people and then they didn't know how to do it." **CIO**
		"I think to a large extent Opportunity Management is a project where technology forced transformation…" **WW FAE Exec**
	System capability greater than the sum of its parts	"It has kind of taken on a bigger life of its own than I really anticipated it taking on in some respects. In that you can really wrap your business around it and pull a lot more information off it…than originally envisioned." **FAE Exec**
Organizational change	New ways of working	"…the organizational structure becomes virtually transparent. It doesn't make any difference who works for whom. The fact of it is that we are working together as a team to manage the process through the pipeline on the front and back end." **CRM Process Owner**
	New roles	"But that transformation occurred…we now have what is called a client engineering project manager...to be the engineering leads faced to certain customers…" **Design Center Manager**
	New responsibilities	"…I think the role of Applications Engineers has changed dramatically over the last several years." **ASIC Methodology Eng.**

How has e-business been utilized to implement organizational process and information integration? (Continued)		
Theme	**Concept**	**Quote**
Organizational collaboration	Working with colleagues that supply information	"So very early on I had to reach out to the field organizations, the sales organization, to understand what their commitment and forecast to bring in new business." **Design Center Exec**
Synergy of integration	New ways to educate employees	"…another impact of this has been that we have really changed the way we educate new employees." **ASIC Methodology Eng.**
	Synergy of consolidated data	"We are able to uncover more and more things that allow the corporation to do process improvement." **Tactical Marketing Specialist**

How have pre-existing business and technology infrastructures influenced the evolution of the e-business project?		
Theme	**Concept**	**Quote**
ASIC Design Methodology	Design control methodology	"[Our release methodology] really is what controls a design as it goes through the ASIC process." **ASIC Methodology Eng**
	ASIC tracking system	"In order to complete these designs, we have a tracking system which is near and dear within our first time right value proposition…" **Design Center Manager**
Factory metaphor	Factory mentality	"…management viewed the Design Center as a factory." **Design Center Manager**
Sell cycle phases and activities	Sell cycle activities mapped into OM	"I tried to foster an alignment of the … sell cycle steps and required deliverables and the opportunity management process as mapped into the [Opportunity Management System]" **WW FAE Exec**
Control requirements	Adequate controls	"I think the controls are very adequate…" **FAE Process Owner**
	Process mediated controls	"I have learned over time about what we have to do to demonstrate that we have a process under control. But the fact of it is that without a tool infrastructure…you could not do a satisfactory job." **CRM Process Owner**
Existing operational methodologies	Pre-existing organizational processes and ways of thinking were embedded in the Opportunity Management system: Sales and Design methodologies, corporate business controls rigor, and the material flow concepts embodied in factories. **Documents (P16,33,37,40)**	
Plethora of standalone data applications	Standalone databases	"… our [standalone] database wasn't being effectively updated because it wasn't recognized and tied into everything that it needed to be nor architecturally could have been." **FAE Exec**
	Distributed applications	"Well I think there were the [standalone] applications themselves and the distributed way we let people develop them…" **CIO**

How have pre-existing business and technology infrastructures influenced the evolution of the e-business project? (Continued)		
Theme	**Concept**	**Quote**
Without dedicated automation they relied on numerous, isolated, underperforming applications	No other alternatives	"…they had fundamentally grown up grass roots with [standalone distributed applications] as a vehicle to automate their environment and so on with all the warts and ugly things associated with that." **IT Architect**
	Disjointed data applications equals disjointed processes	"The main problem with [standalone applications] became when you had a database that was not connected to anything else…so you ended up with disjointed processes…silos…none of them were interrelated…they would throw data over the wall." **Consultant**
	Poor response signature	"…with [standalone applications] your response time stunk" **STSM**
Desire to integrate	Value in integrated data	"… we didn't want the Release Methodology process to be in its own little area…its not like having one large database where you can to and query everything." **ASIC Methodology Eng**
Too many data places	Required multiple applications to build a complete data picture	"I'd ask for a piece of information and they would say go this application and I would have to go get it on my desktop and that would be about 25% and then I'd say well what about this…then they would say go to that application and that would be another 10% and so before I knew it I had quite a collection of databases and I accessed them each individually." **Tactical Marketing Specialist**
	Redundant data tracking	"So what we found was that there were pieces of an opportunity listed in those forty different databases and none of those databases talked to each other. In a lot of cases we didn't know all of the information that was in those nor did they know what was in ours." **FAE Process Owner**
Standalone application dysfunction	Although easy to deploy, standalone data applications, primarily Lotus Notes applications, exacerbated silo and functional isolation mentality, left data disparate, uncoordinated, and redundant, and promoted unstructured data and processes. **Documents (P2,7,11,28,29)**	

How do the economics of e-business technology enable the management of internal operations?		
Theme	**Concept**	**Quote**
Networking	Networking power of the Internet	"…it became apparent to a lot of us, and I would put myself in that camp, that the ability to use the power of the Internet was compelling." **Owner Exec**
Leverage inexpensive browser	Leverage the browser	"…you didn't have to do a major upgrade on clients and all of that. The fact that you only had to worry about the server side technically made it go faster. There were less people affected at their desk." **CIO**
	Browser as inexpensive client	"The notion of not having to license and install a client application at each client was compelling…the ability to use the Internet browser was a clear factor…" **Owner Exec**
Easier world wide deployment	Extended geographic reach	"But it is magnified now because your audience for this business space is so geographically diverse. That's the only way you could have hoped to break even on rolling this out and getting some business value." **IT Architect**
Web presentation layer provides control and efficiencies	Web presentation layer plays a big role for success and efficiencies	"…so when the Web browsers came about you could more efficiently target function that you wanted users to actually touch and do…so we can have better control over what people see and therefore what they do and we can force them to do things in a certain way…" **Consultant**
Low cost thin client advantage	Thin client advantages	"We felt that being on the Web, having the users have just their skinny client…and then interacting with the database out in the ether somewhere was a better solution then having people have a very thick client on their workstation." **Sr. Eng**
	Thin client equals low deployment costs	"Clearly the decisions we made about not embracing and rolling out, in widespread form, a thick client version of the package [enabled us to] more quickly and easily [deploy] to the masses especially given their distributed nature." **IT Architect**
Data improvement via organizational synergy	Network effect of multi-organizational data use	"…organizations came on board from a synergistic point of view over time…and what's happening is that each one of these groups has incrementally improved the data quality and the breadth of the data." **STSM**
Contemporary compelling technology	Contemporary compelling technology	"…I asked, was this OM thing, Web-based or application based? The answer coming back was that it was Web-based. I said great because then I'll invest some time in it." **Tactical Marketing Specialist**
Ease of use equates to less training	User friendly	"That is to say its user friendly enough that if you want to spend a few minutes instead of spending a couple of hours of training…all you do is fire up a Web browser and log on…really simple." **CRM Process Owner**

How do the economics of e-business technology enable the management of internal operations? (Continued)		
Theme	**Concept**	**Quote**
Lower development expense due to reliance on Internet Standards	Standardized Internet middleware	"…it certainly was less expensive to do it in an e-business context where all that stuff was supplied…we didn't have to develop all of the function associated with the browser and the middleware…[and] we reduced overhead to support it" **Project Manager**
	Standardized function	"The standardization around html and later on around Java as an interpreter sitting on a machine so you could do more fancy stuff were the basics that you could always assume would be there." **STSM**
No client software Use IBM network	No special client software is required; which will simplify the global OM install. Also, takes advantage of IBM's computing and network infrastructure. **Documents (P11,12,17,21,22)**	

How has e-business influenced the automation, creation, and redesign of business processes?		
Theme	**Concept**	**Quote**
Fundamental restructuring	Transformation and restructuring	"It was a fundamental transformation in that we…were certainly not satisfied in automating the status quo…the opportunity was to fundamentally restructure the work and work flow to get cross-enterprise linkages built." **Exec Owner**
Process reengineering	Reengineering	"Half way between high- and lowfalutin reengineering…" **CIO**
Significantly reengineered processes	Fundamental changes	"…we went in and made more fundamental changes albeit not as rapidly or extensively as we would have liked to as opposed to just automating existing practices." **Project Manager**
	Innovative	"…clearly it is innovative and probably in many ways midway between innovative and revolutionary." **IT Architect**
	Profound change	"…the whole lifecycle management thing, to me, is a profound change in the way you guys did business here and it has a great benefit in terms of efficiency and throughput…" **Consultant**

How has e-business influenced the automation, creation, and redesign of business processes? (Continued)		
Theme	**Concept**	**Quote**
Novel integration of existing processes and enablement	Novel integration of existing processes	"I think the concepts of OM are not novel but bringing it all into one system under one umbrella is probably a logical extension of that." **Sr. Eng**
	No change to basic processes	"In general, I would say that we have not changed processes. We didn't change our process fundamentally; we understood why the customer was failing and pushed back with some new capability, education, training, and tools…" **STSM**
Some reengineering and fine tuning of processes	Some reengineering	"…we certainly did some re-engineering to the Design Methodology process. It wasn't a simple mapping of questions into OM." **ASIC Methodology Eng**
	Fine tuning	"…we did take the best knowledge we had of the way that we felt the process would flow and work properly and use that as a starting point. Once that base was put in place then it became a process of fine tuning and tweaking it so that it becomes more and more effective." **CRM Process Owner**
Integrated business process reengineering and e-business concepts	The team integrated business process reengineering efforts, e-business enablement concepts, and data consolidation and control work. **Documents (P6,13)**	

Section Three: Research Question Three Concept and Theme Clustering

What were the overarching difficulties and roadblocks that were encountered while attempting to apply e-business to internal operations?		
Theme	**Concept**	**Quote**
Parochial organizational interests	Narrow parochial organizational interests	"…everyone had something in place to address their own specific issues without comprehending the bigger picture." **FAE Exec**
Fear and resistance to change	Fear and resistance	"Initially, there was actually more fear and resistance with regard to the technology and issues than there was excitement about the new tool and options." **WW FAE Exec**
	Natural resistance to change	"But part of it is just a natural resistance to change and part of it is a loss of functionality that they expected to be there." **Design Center Exec**
Unwilling to change or cooperate	Resistance to change	"The number one issue, and its everywhere, is resistance to change…that's just the way people are…people just don't like to change…they get comfortable with their jobs." **Consultant**
	Unwilling to cooperation	"…trying to get people to play so to speak. [They] have their own processes and ways of doing things and it may be very efficient for them…but it may not be very efficient for the overall end-to-end process…" **Sr. Eng**
Skepticism of vision	Skepticism of projects ambitious vision	"I think people were very reluctant to buy into the whole notion of OM because they didn't believe that it could be successful, that it would die of its own weight." **Sr. Eng**.
User skepticism	User's wait and see attitude	"…wait and see if it is really going to take off. I saw a lot of that attitude. Yes, that's great but I'm just going to wait and see if this is an up and coming thing that gets embraced by management or it goes by the wayside as the latest fad." **Tactical Marketing Specialist**
Lack of cooperation	Lack of cooperation and knowledge sharing	"The reality is, given the human psyche; knowledge is power and let's face it a lot of times not everybody gives all the knowledge out for all sorts of reasons." **FAE Process Owner**
	Comfort zone	"People are in a comfort zone…so I get what I need, I do my job this way. I don't need to embrace this. I'm doing just fine, thank you." **Tactical Marketing Specialist**
	Rebelliousness	"By nature, people do not want to change. A lot of times people tend to be rebellious instead of cooperative. So in certain cases people refuse to play the game the way that the process is defined and the tool requires? **CRM Process Owner**
	Complaining	"I think it is the nature of people to complain…" **ASIC Methodology Eng**

What were the overarching difficulties and roadblocks that were encountered while attempting to apply e-business to internal operations? (Continued)		
Theme	**Concept**	**Quote**
Lack of understanding of bigger picture	Day-to-day concerns obfuscate bigger picture	"The roadblock in a lot of cases is just getting people to understand the bigger picture because they get mired down in what they have to do day-to-day and they forget about this overall bigger goal." **CRM Process Owner**
Pockets of organizational resistance	Not all organizations embraced the OM project with enthusiasm, pockets of departments resisted attempts by the Project team to include them in the end-to-end process view. **Documents (P35)**	
Business case development	Developing a compelling, convincing business case	"…I think that, initially, getting a compelling story together that was sufficient to get the project funded was very important. Had that not been done we wouldn't have been able to do the tough work." **Owner Exec**
Lack of high level process ownership	Lack of high level end-to-end ownership responsibility	"…guidance from a single end-to-end process owner that would have been empowered with clarifying and arbitrating what these processes should be. That is what was lacking." **WW FAE Exec**
Need for unambiguous process and data ownership	Need for documented and owned cross-functional processes	"…lack of owned documented and enforced cross-functional processes and associated with that is the lack of recognition of a need for them and for the benefit of them…the entire organization has to recognize the business processes and they have to have people responsible for them." **Project Manager**
	Trying to find the true owner of a process	"[It is difficult] trying to find the true owner of a process, somebody to really make the decisions when you have a disjoint process then trying to find somebody at a high enough level…that can make decisions…" **Sr. Eng**
	Uncertain data ownership	"The most difficult problem was data ownership. It still is. Trying to get [any end user] to understand that they are not the only users of the information and that there is a difference between who owns the process and who owns the data…" **STSM**
Process ownership misunderstandings	At various times misunderstandings about process ownership, data requirements, and tool usability created frustration and confusion. Many had difficulty recognizing and accepting end-to-end process perspectives and many couldn't grasp the logic of providing data that was not of immediate interest to them but was critical to other parts of the business. **Documents (P2, 15, 39,40)**	
Functional silo thinking	Functional silo thinking versus big picture understanding	"…most of the folks that were involved with this problem were not thinking end-to-end, they were thinking in terms of their own silos…" **Project Manager**
Very complex project	Highly complex project vision and undertaking	"I would say pulling off the vision with as many variables, data suppliers, and data elements have just turned out to be, I think, much bigger and more complicated than we expected**." FAE Process Owner**
Funding shortfalls	Funding shortfalls	"Funding has been the biggest issue with the project overall." **CRM Process Owner**

What practices, under what conditions, proved to be the most and least useful and successful?		
Themes	**Concepts**	**Quotes**
Manage project from neutral, operations area	Place project ownership within a neutral, operational area	"…because we had so many constituents and stakeholders, I think the logic of putting it [Project Management] in neutral territory was that it was a cross enterprise application and business process if owned by a singular stovepipe the human tendency would be for the optimization to be around that particular area as opposed to across the enterprise." **Owner Exec**
Business decision making from a single data source improves quality of data	Data quality of a database will improve if you make business decisions based on that data	"…you can't have competing sources of information so that means if you have decided to use repository one for information then that's the only one you are going to use…the only way to improve the integrity and quality of data in a database is to use it to make business decisions. If the data quality is poor or suspect but you use it to make business decisions the affected parties will quickly improve the quality of the data." **Design Center Exec**
Frequent cross-organizational status and progress reviews	Frequent cross-organizational reviews for accuracy and completeness	"…we tried to engage the users whether it was helping define the processes, 'as is' and 'to be' and then we went out and we had maybe 15 or 20 reviews with various folks to show what we were thinking and to find out what we had captured and where we missed it…" **Project Manager**
Phased process deployment and data improvement	Incremental roll out of new function	"If we had tried to build an end-to-end process all at once and deploy it, it would have failed of its own weight. The business, I don't think, would have been patient enough to wait for it and the people who use it wouldn't be willing to make such big changes at once." **Sr. Eng**.
	Gradual improvement of data quality and accuracy	"…gradual improvement in data sources. In other words, the problem is so big that we ended up using a gradualist approach, sometimes we would focus on just getting one attribute in control then we would go on to the next.." **STSM**
Use a standardized, repeatable development process and churn out releases as quick as possible	Release often	"…how fast can the team do the releases in a credible fashion doing quality work and how fast can the using organization absorb them…the message in business is speed, speed, speed…if you are going to churn out six week releases and you've done it fifteen times…everyone knows how to do it… so you back off on the planning, metrics and details " **Project Manager**
	Use a standardized development process and stick to it	"…we decided to implement a standard [development] process. I think that led us into a higher probability of success of moving of moving forward. I also think that every release that you actually finish adds to the success of the next release…its one of those exponential things where the first one is hard because no one has done it, no one knows what they are doing or where it will all end." **Consultant**

What practices, under what conditions, proved to be the most and least useful and successful? (Continued)		
Themes	**Concepts**	**Quotes**
Assign experienced, seasoned team members	Team should be composed of experienced cross-functional talent	"…we had among all of us cross functional experiences…so we were able to integrate things…we had in-depth backgrounds in the various areas we were working in…and we all had executive access and good reputations…" **Project Manager**
Move quickly Segment project Use modified project management	Move quickly with experienced, knowledgeable people, segment the project in smaller discrete units in order to provide value and utility to the business as soon as possible, a good technology infrastructure speeds project implementation, business process redesign in conjunction with behavior change is difficult, use modified project management techniques. **Documents (P17,31, 36)**	

How are the information requirements of operations addressed?		
Theme	**Concept**	**Quote**
Mobility and access	Mobility and access across geographies	"Mobility and access…Those were clearly needs because there were 1500 people around the world working with this process regardless of what their role was." **Project Manager**
Ubiquitous, real-time access to pipeline information	Real time access to a pipeline view	"Giving people access to the data, the ability for real time updates [via] Web-based access…and I guess we can actually see the whole pipeline of what is going on with the data." **FAE Process Owner**
	Easy, prevalent access	"…it was easier to access, it was more prevalent, meaning that I could actually access it from different computers as long as I had the right security…" **Tactical Marketing Specialist**
		"Uhm, yes…the access was nice." **ASIC Methodology Eng**
Rapid, impromptu searches for data	Search for data during phone calls	"Now with OM…I go in and…see the client design and see scheduling and the dates and the progress…While I'm talking to them I'm dialing into OM trying to, on the fly, get educated so can speak intelligently to them." **Tactical Marketing Specialist**
	Rapid search while on a phone call	"…so I'm sitting here and a customer calls up and says 'my design is late, why?' and within about 25 seconds or so, less than a minute, I can have that design up in front of me with who is working on it, what the commit dates were and are, and what technology it is in…everything that deals with the business issues." **Design Center Manager**
	Search for status during phone conversation	"I can be on a phone call and somebody can ask about an opportunity and get the latest data or see whether it is out of synch or not, immediately." **FAE Process Owner**
Search and view vital business and technical information	The search functions of the OM system provided users with the capability to track and view vital business, technical, schedule, and status information associated with each opportunity via an easy to access web-based delivery system. **Documents (P13,15)**	
Internet and Web delivered high performance	Performance on the Web-based system was better	"And what I found…is that the Web-based [system] was quicker. I would put in a search and I'd get an answer very quickly where sometimes in Notes the search feature couldn't search the right way or I found it a little clumsy to use." **Tactical Marketing Specialist**
	Internet infrastructure provided higher performance than phone lines	"…the advent of DSL and cable modems, I think is the thing that saved it…because phone connections were just horrible for everybody. High speed transmission capability as a standard really helped everybody." **FAE Process Owner**
High performance search function	OM system records indicate that users performing large searches experienced less than ten second response time. **Document (P32)**	

How are the information requirements of operations addressed? (Continued)		
Theme	**Concept**	**Quote**
Real-time design schedule information	Real-time views to design schedules	"A lot of the data in OM we actually want to be able to review real time, how is this IP coming for this particular design, is the design on schedule, who else do we need, what other dependencies do we have?" **Design Center Exec**
Schedule performance to key project milestones	Status of opportunity vis a vis key milestones	"So we have vision there of the state of the design, what's going on, is it going to be on schedule, early, or late. What are the actual dates of meeting the checkpoints? And that gives us a preview of whether or not we are actually going to hit the date." **ASIC Methodology Eng**
	Information about scheduled milestones	"I could find design schedule information. So for our clients who had decided to do their designs and do business…internally, it was a project management flavor of when they would hit certain milestones and what was involved at that milestone." **Tactical Marketing Specialist**
Plan, commit, outlook, and actual schedule information	The OM system enabled operations users to better predict and schedule the opportunity lifecycle across multiple, dependent organizations; providing plan, commit, outlook, and actual schedule information. **Documents (P10,27,33)**	
Strategic pipeline analysis and modeling	Strategic pipeline analysis and modeling	"I mean the data analysis piece was something that you had to be able to do to effectively…and I tried to do as much modeling, using the data, as I could at the time to understand what we would see as our strategic pipeline." **CRM Process Owner**
Data aggregation and reporting functions	The system provided advanced data aggregation and reporting capability. **Documents (P11,12,33)**	

How has e-business affected the level of integration between processes?		
Theme	**Concept**	**Quote**
Centrally sourced data abets managing integrated processes	Manage all data from one source	"There is just evidence, a realization that it makes sense to manage all that information together. Once people realize it…it's like the gophers who all stick their heads up at one time and realize that they have neighbors, in terms of being able to integrate data" **IT Architect**
	Integrated data is needed to manage processes	"I think data is making sure that everybody is on the same page. That you understand what's needed for the process and making sure that the data that is needed is there and that people can see it and understand it and deal with it." **Sr. Eng**.
Coordinated, integrated data enables analysis and decision making	Decision making is stymied when data is uncoordinated	"If in fact, we only have a piece of the data and somebody else has a piece of the data and those two pieces never come together how can anybody really make the tradeoff calls if you don't have the right picture?" **FAE Process Owner**
	Well managed and maintained data supports analysis and decision making	"…we were pushing the entire Marketing team, at the time, to refresh, update, correct the data, and get the data quality [as good] as we possibly could so we could really massage the data, analyze the data and use it for our purposes of projections and stuff." **CRM Process Owner**
A "golden repository aides process integration	Without a "golden repository" of quality data, process and systems become confused and inefficient. The OM system became the source for opportunity lifecycle data by consolidating several score of data sources. **Documents (P2,34,39)**	
Required data	Implement less hardwired processes through use of flexible data structure	"…you want a data structure and an enabling tool that allows you to move…you don't want a straight jacket of rules in your solution that says you can't do different things…so you want less process hardwiring in your tool than you'd think." **Project Manager**
	Required data carrot and stick	"The thing that proved the most useful…was the concept of required data. It was a carrot and stick approach. The carrot is, if you supply all the required data you can move forward [in the process]. The stick was if you don't supply the right data you can't move forward." **STSM**
Business processes and data are intertwined	Business processes are based on data	Business processes and data are so intertwined it's hard to sort out. What are business processes based on? They are based on data. It is the lifeblood of the business processes…the data." **Sr. Eng**.
Required data for pipeline movement	The required data concept was used to manage the opportunity lifecycle pipeline. Each product has different required data requirements but the system does not allow movement through the pipeline without its required data. **Documents (P15,32, 37)**	

How has e-business affected the level of integration between processes? (Continued)		
Theme	**Concept**	**Quote**
Better access and control over integrated process pipeline	Better access to process data	"It was very clear to me that there was value from a user's standpoint in having on-line real-time access to pull the pipeline and use it for a number of different applications." **Owner Exec**
	Much better control over headlights and planning	"It gave us much better control over our headlights and planning capacity requirements for physical [chip] design…" **Design Center Exec**
	Achieved end-to-end business process linkage	"…we did get to the end goal which was to achieve this end-to-end linkage between long term revenue growth objectives and specific opportunity and design in goals at the individual level." **WW FAE Exec**
It freed up people within the processes	It freed up people within the processes	"I think OM absolutely freed up people. I think it was a labor saving thing. It did that. If you look at the people who were entering data multiple times, it was the facilitator; it provided the capability to move the organization forward. It took people out." **CIO**
Increased the efficiency of many organizations	Increased efficiency, reduced redundancy, better view of the processes	"I think we have really increased the efficiency of quite a few organizations and I think [there the organization has seen value in] the integration, the elimination of a bunch of databases, people entering the same data multiple times, and seeing the end-to-end process, understanding what they do, and it influences other people." **Sr. Eng.**
Data availability supports all operational processes and activities.	One stop shopping	"By far the biggest benefit has been the one stop shopping. You don't have to maintain all of those different places and go to all of these different locations. I think the whole integration of most of the relevant data into one location [is great]." **ASIC Methodology Eng**
	First place interrogated	'I clearly saw the value in that [database integration] and even to this day…the first place we go is OM to find "where used." **Design Center Manager**
	Primary source of backup information	"But I also found that it has allowed me to step in and cover for somebody that is out sick…and perhaps they've given me [only] a little information." **Tactical Marketing Specialist**
	Data available at your fingertips	"We've come miles from those days. OM is an unbelievable tool in terms of the data that is available at your fingertips." **FAE Process Owner**
Multifunctional, processes can be integrated into an enterprise-wide network	This project demonstrates that multifunctional, cross-organizational processes can be integrated into an enterprise wide network of supporting and interacting processes. Evidence is developing that some processes are seeing 6 X improvement in turn around time and the Division, for the first time, can use the data for both operational and planning purposes. There has been significant effect on employee attitudes and behaviors relative to data input, currency and analysis and an ever increasing tendency for various staff analysts and management to engage the database in search of information rather than request "data roundups." **Document (P17)**	

APPENDIX E

E-Operations Primary Documents

P 1: OM Letter-Joint letter from OM Steering Committee and Project Team to MD organization, describes problem and solution approach (2/10/2000)

P 2: OM Bus Case Prose-Description of business case, project expenses forecast, and benefit assumptions (3/28/2000)

P 3: Options-Software selection options and approaches (3/29/2000)

P 4: OM Communication Letter-General communication letter from Project Team to MD organization (7/21/2000)

P 5: Purchase/Supplier Announcement Planning-OM Project position vis a vis software vendor relationship (10/09/2000)

P 6: VendorExecutive-OM status and update to IBM Sr. Executives (1/25/2001)

P 7: First Exec Communication letter-Project Executive Owner communication to MD organization (2/14/2201)

P 8: Executive Meeting-Vendor status and progress meeting (3/13/2001)

P 9: ARCH 092001 Working Meeting-Project Team meeting minutes on topic of architecture (9/20/2001)

P10: Stage_C_Essence-OM implementation phase planning documentation (1/3/2002)

P11: First letter for Sales Executive-Advisory that OM will be deployed for Sales and FAE team use; from Sales Executive (3/4/2002)

P12: Second One-Additional communication from Sales Executive (4/1/2002)

P13: Sr. Executive Picture words-Internal announcement of OM deployment and project review by IBM Sr. VP (6/6/2002)

P14: Why OM-OM project rationale reminder (6/20/2002)

P15: FAE Letter-From OM development manager to Sales team addressing concerns (10/8/2002)

P16: Application News-Preparations for business controls audit (11/8/2002)

P17: The OM Story_V0.3-Corporate communications summary of OM project (5/8/2002)

P18: Benefits Measurement Methodology-Components of expected and realized project benefits (5/21/2003)

P19: Pres_IRB for OM-Presentation to Division Investment Review Board; project approval request (4/7/2000)

P20: Pres_Comm Steering Committee Mtg 20April 2000v1-Steering Committee status report (4/19/2000)

P21: Pres_ Comm Corp approval charts vd-Corporate presentation; OM Concept (5/9/2000)

P22: Pres_Ref SP Template CIO-Corporate measurements; investment drivers (5/11/2000)

P23: Pres_PracRev_Aug2P24: Pres_Comm HCT Charts 0602000 IT Architect v1.0-Practitioner review; OM Concept (8/2/2000)

P24: Pres_Comm Design enter Exec Updt Charts jtt v7.0 092000-Project status review with Steering Committee Executive (10/11/2000)

P25: Pres_Comm Steering Committee vs jtt 080801-Steering Committee meeting status report (8/10/2001)

P26: Pres_Comm Steering Committee 091901 jtt v2.1-Steering Committee meeting status report (9/19/2001)

P27: Pres_OM Concerns-Technical disagreement summary (9/26/2001)

P28: Pres_Comm Executive change jtt 102501 v1.2-OM deployment plan change (10/30/2001)

P29: Pres_Sales Representative-Project time line and history (12/19/2001)

P30: Pres_Comm Project Update vs jtt 021802 v1-OM history, status, and outlook (4/2/2002)

P31: Pres_TD FG Weekly Status jtt 052202 v1-Executive Owner briefing (4/2/2002)

P32: Pres_Comm Sr. Exec Briefing vs jtt 043002 v1-IBM Sr. Exec. Project status briefing (5/22/2002)

P33: Pres_Fall Plan 02 Proposal Plan vs jtt 080802 v3-OM Planning proposal (8/21/2002)

P34: Pres_September 2002 Steering Committee vjs v1-Steering Committee meeting (9/17/2002)

P35: Pres_Director-Steering committee member briefing (10/25/2002)

P36: Pres_Comm_Jan03_Briefing_vs_jtt_012003_v1.1-Project time line, value proposition, and plans (1/21/2003)

P37: Pres_Fred File-Executive Owner briefing (2/26/2003)

P38: Pres_Comm_IGS_Vendor_Briefing_042903_vs_jtt_v1.1-OM Progress report (4/29/2003)

P39:Pres_Comm_The_Essence_of_a_Life_Cycle_Management_Project_jpb_110503_v0.24-Comprehensive OM Project briefing (11/5/2003)

D40: Comm Leader's General Charts jtt 102600 v.31 (10/26/2000)

D41: OM System usage metrics- System users and resources consumed (6/17/2002)

D42: CRM kickoff package-Marketing strategy (2/9/2004)

D43: OM System Performance-Operations metrics (3/8/2004)

D44: OM Project Overview-Project status and summary (6/17/2004)

D45: 4Q04 User Statistics-OM System users and resource consumption (1/3/2005)

D46: OM-General project overview (2/22/2005)