How Financial Firms Decide on Technology

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Abstract

The financial services industry is the major investor in information technology (IT) in the U.S. economy; the typical bank spends as much as 15% of non-interest expenses on IT. A persistent finding of research into the performance of financial institutions is that performance and efficiency vary widely across institutions. Nowhere is this variability more visible than in the outcomes of the IT investment decisions in these institutions. This paper presents the results of an empirical investigation of IT investment decision processes in the banking industry. The purpose of this investigation is to uncover what, if anything, can be learned from the IT investment practices of banks that would help in understanding the cause of this variability in performance along with pointing toward management practices that lead to better investment decisions. Using PC banking and the development of corporate Internet sites as the case studies for this investigation, the paper reports on detailed field-based surveys of investment practices in several leading institutions.

1.0 Introduction

Information technology (IT) is increasingly critical to the operations of financial services firms. Today banks spend as much as 15% of non-interest expense on information technology. It is estimated that the industry will spend at least $21.2 billion on IT in 1998 (Ernst and Young 1996), and financial institutions collectively account for the majority of IT investment in the U.S. economy. In addition to being a large component of the cost structure, information technology has a strong influence on financial firms operations and strategy. Few financial products and services exist that do not utilize computers at some point in the delivery process, and a firms' information systems place strong constraints on the type of products offered, the degree of customization possible and the speed at which firms can respond to competitive opportunities or threats.

A persistent finding of research into the performance of financial institutions is that performance and efficiency varies widely across institutions, even after controlling for factors such as size (scale), product breadth (scope), branching behavior and organizational form (e.g. stock versus mutual for insurers; banks versus savings & loans). Given the central role that technology plays in these institutions, at least some of this variation is likely to be due to variations in the use and effectiveness of IT investments. While some authors have argued that the value of IT investment has been insignificant, particularly in services (see e.g. Roach, 1987; Strassmann, 1990; Landauer, 1995), recent empirical work has suggested that IT investment, on average, is a productive investment (Brynjolfsson and Hitt, 1996; Lichtenberg, 1995). Perhaps more importantly, there appears to be substantial variation across firms; some firms have very high investments but are poor performers, while others invest less but appear to be much more successful. Brynjolfsson and Hitt (1995) found that as much as half the returns to IT investment are due to firm specific factors.

One potentially important driver of differences in IT value, and of firm performance more broadly, is likely to be the decision and management processes for IT investments. Horror stories of bad IT investment decisions abound. Consider the example of the new strategic banking system (SBS) at Banc One (*American Banker* 1997). Banc One Corp. and Electronic Data Systems Corp. agreed last year to end their joint development of this retail banking system after spending an estimated $175 million on it. As stated in the *American Banker* article, SBS "was just so overwhelming and so complete that by the time they were getting to market, it was going to take too long to install the whole thing," said Alan Riegler, principal in Ernst & Young's financial services management consulting division. However, not all the stories are negative. New IT systems are playing a vital role in reshaping the delivery of financial services. For example, new computer-telephony integration (CTI) technologies are transforming call center operations in financial institutions. By investing in technology, more and more institutions are

moving operations from high-cost branch operations to the telephone channel, where the cost per transaction is one-tenth the cost of a teller interaction. This IT investment not only reduces the cost of serving existing customers, but also extends the reach of the institution beyond its traditional geographic boundaries.

In this paper, we utilize detailed case studies of six retail banks to investigate several interrelated questions:

1. What processes do banks utilize to evaluate and manage IT investments?
2. How well do actual practices align with theoretical arguments about how IT investments should be managed?
3. What impact does that management of IT investments have on performance?

For the first question, we develop a structured framework for cataloging IT investment practices and then populate this framework using a combination of surveys and semi-structured interviews. We then compare the results of this exercise with a synthesis of the literature on IT decision making to understand how practices vary across firms and the extent to which this is consistent with "best practices" as described in previous literature. Finally, we will compare these processes to internal and external performance metrics to better understand which sets of practices appear to be most effective.

To make these comparisons concrete, we examine both the general decision process as well as the specific processes used for two recent IT investment decisions: the adoption of computer-based home banking (PC banking), and the development of the corporate web site. These decisions were chosen because they were recent and are related but provide some contrast; in particular, PC banking is a fairly well defined product innovation, while the corporate web presence is more of an infrastructure investment which is less well-defined in terms of objectives and business ownership.

Overall, we find that while some aspects of the decision process are fairly similar across institutions and often conform to "best practice" as defined by previous literature, there are several areas where there is large variation in practice among the banks and between actual and theoretical best practice. Most banks have a strong and standardized project management for ongoing systems projects, and formal structures for insuring that line-managers and systems people are in contact at the initiation of technology projects. At the same time, many banks have relatively weak processes (both formal and informal) for identifying new IT investment opportunities, allocating resources across organizational lines, and funding exploratory or infrastructure projects with long term or uncertain payoffs.

The remainder of this paper is organized as follows. Section 2 describes the previous literature on performance of financial institutions and the effects of IT on performance. Section 3 describes the methods and data. Section 4 describes the current academic thinking on various

components of the decision process and compares that to actual practices at the banks we visited. Section 5 describes the results of our in-depth study of PC banking projects and the summary, Section 6 contains a similar analysis for the Corporate Web Site and discussion and conclusion appear in Section 7.

2.0 Previous Literature

2.1 Performance of Financial Institutions

There have been a number of studies that have examined the efficiency of the banking industry and the role of various factors such as corporate control structure (type of board, directors, insider stock holdings, etc.), economies of scale (size), economies of scope (product breadth), and branching strategy; see Berger, Kashyup and Scalise (1995) and Harker and Zenios (forthcoming) for a review of the banking efficiency literature. While there is substantial debate as to the role of these various factors, there is one unambiguous result: that most of the (in) efficiency of banks is not explained by the factors that have been considered in prior work. For example, Berger and Mester (1997) estimate that as much as 65-90% of the x-inefficiency remains unexplained after controlling for known drivers of performance. A similar story also appears in insurance where "x-efficiency" varies substantially across firms when size, scope, product mix, distribution strategy and other strategic variables are considered. It has been argued that one must get "inside the black box" of the bank to consider the role of organizational, strategic and technological factors that may be missed in studies that rely heavily on public financial data (Frei, Harker and Hunter, forthcoming).

2.2 Information Technology and Business Value

Early studies of the relationship between IT and productivity or other measures of performance were generally unable to determine the value of IT conclusively. Loveman (1994) and Strassmann (1990), using different data and analytical methods both found that the performance effects of computers were not statistically significant. Barua, Kriebel and Muhkadopadhyay (1995), using the same data as Loveman, found evidence that IT improved some internal performance metrics such as inventory turnover, but could not tie these benefits to improvements in bottom line productivity. Although these studies had a number of disadvantages (small samples, noisy data) which yielded imprecise measures of IT effects, this lack of evidence combined with equally equivocal macroeconomic analyses by Steven Roach (1987) implicitly formed the basis for the "productivity paradox." As Robert Solow (1987) once remarked, "you can see the computer age everywhere except in the productivity statistics."

More recent work has found that IT investment is a substantial contributor to firm productivity, productivity growth and stock market valuation in a sample that contains a wide range of industries. Brynjolfsson and Hitt (1994, 1996) and Lichtenberg (1995) found that IT investment had a positive and statistically significant contribution to firm output. Brynjolfsson and Yang (1997) found that the market valuation of IT capital was several times that of ordinary capital. Brynjolfsson and Hitt (1998) also found a strong relationship between IT and productivity growth and that this relationship grows stronger as longer time periods are

considered. Collectively, these studies suggest that there is no productivity paradox, at least when the analysis is performed across industries using firm-level data. The differences between these results and earlier studies is probably due to the use of data that was more recent (1988-1994 instead of 1982 or earlier), more comprehensive (>400 firms), and more disaggregated (firm level rather than industry or economy level).

Most previous studies have considered the effects of technology across firms in multiple industries, although a few studies have considered the role of technology in specifically in the banking industry. Steiner and Teixiera (1990) surveyed the banking industry and argued that while large investments in technology clearly had value, little of this value was being captured by the banks themselves; most of the benefits were being passed on to customers as a result of intense competition. Alpar and Kim (1991) examined the cost efficiency of banks overall and found that IT investment was associated with greater cost efficiency although the effects were less evident when financial ratios were used as the outcome measure. Prasad and Harker (1997) examined the relationship between technology investment and performance for 47 retail banks and found positive benefits of investments in IT staff.

While these studies show a strong positive contribution of IT investment on average, they do not consider how this contribution (or level of investment) varies across firms. Brynjolfsson and Hitt (1995) found that "firm effects" can account for as much as half the contribution of IT found in these earlier studies. Recent results suggest that at least part of these differences can be explained by differences in organizational and strategic factors. Brynjolfsson and Hitt (1998) found that firms that use greater levels of delegated authority and teams make greater investments in IT and receive greater overall IT benefits. Bresnehan, Brynjolfsson and Hitt (1998) found a similar result for firms that have greater levels of skills and those that make greater investments in training and pre-employment screening for human capital. In addition, strategic factors also appear to affect the value of IT. Firms that invest in IT to create customer value (e.g. improve service, timeliness, convenience, variety) have greater performance than firms that invest in IT to reduce costs (Brynjolfsson and Hitt, 1996).

While these studies are beginning to explore how the performance of IT investment varies across firm, particularly due to organizational and strategic factors, little attention has been paid to the technology decision making process.

2.3 IT Investment Decisions

While there is no concise definition of "best practice" in IT investment decisions, there are a number of consistent arguments advanced in the IT management literature that can be synthesized into an understanding of the conventional wisdom.

For the purposes of discussion it is useful to subdivide the process of IT management into seven discrete, but interrelated processes. The first six processes are oriented around the proposal, development and management of IT projects, while the last process is about maintaining the capabilities of the IT function and its interrelationships with the rest of the business:

1. Identification of IT opportunities
2. Evaluating opportunities
3. Approving IT projects
4. The make-buy decision
5. Managing IT projects
6. Evaluating IT projects
7. Manage and Develop the IT Function

This subdivision loosely corresponds to many of the major issues in IT management such as outsourcing (see e.g. Lacity and Hirscheim; Gurbaxani, 1996), line management-IT alignment (Boynton, Jacobs and Zmud, 1992; Benjamin and Blunt, 1992; von Simson, 1990; Rockart, 1988), software project management (Brooks, 1987; Kemerer, 1996; McConnell, 1997), and evaluating IT investments (Kaplan, 1986; Clemons, 1991; Brynjolfsson and Hitt, 1996).

In addition, this list loosely corresponds to frameworks for the management of IT. The primary difference is that this list views the IT management process as managing a stream of projects rather than focusing on the function of the IT department overall or the role of the CIO, the typical perspective in the previous literature. For example, a common framework used to align IT to business strategy, the critical success factors (CSF) method (Rockart and Crescenzi, 1984), includes three workshops: the first to identify and focus objectives, the second to decide and prioritize on systems investment, and the third to develop, deploy and reevaluate prototype systems. Boynton, Jacobs and Zmud (1992) identify five critical IT management processes: setting strategic direction, establishing infrastructure systems, scanning technology, transferring technology and developing systems. Rockart, Earl and Ross (1996) propose eight imperatives for the IT organization which can be grouped into managing the IT-business relationship, building and managing systems and infrastructure, managing vendors, and creating a high performance IT organization.[1] Thus, while previous work has subdivided the process in different ways, collectively the studies cover all the seven processes we examine.

We will discuss each of the individual points in detail below.

[1] The exact items were: achieve two-way strategic alignment, develop effective relations with line management, deliver and implement new systems, build and manage infrastructure, re-skill the IT organization, manage vendor partnerships, build high performance, redesign and manage the Federal IT organization.

2.3.1 Identification of Opportunities

Historically, the IT function was primarily reactive, responding to requests by business units. A business unit manager would identify a need for a new system or a repair/enhancement to an existing system and communicate this need to the IT function. The IT personnel would then evaluate the idea for technical feasibility and develop a project proposal include an initial determination of resource needs, cost, and delivery time (see , e.g. McConnell, 1997, for a description of this general process; this also corresponds to the initial stages of the "waterfall" systems design method as described in Kemerer, 1996). While this makes effective use of IT personnel in evaluating particular ideas, it provides only a limited role for IT personnel to aid in the identification of technology-based business opportunities.

For that reason, some authors have suggested that the IT function should play a larger role in the identification of technological opportunities. For example, Davenport and Short (1990) emphasize that IT capabilities should inform business needs as well as the business units placing demands on the IT function. Rockart, Earl and Ross (1996) and Boynton, Jacobs and Zmud (1992) identify the role of "technology scanning" and "technology education" as an important component of a centralized IT department; they argue that information systems specialists should be responsible for evaluating new technologies for business applicability since business units will generally lack the resources or the technological capability to perform these evaluations themselves. Moreover, central IT is best positioned to educate the end users to make them good "customers" of the central IT group.

In the banking industry, IT may be able to play an additional role in coordinating technology. Because banks and other financial firms are often managed with largely autonomous business units [for example, banks are often divided into product lines (cash management, investments) or along customer segments (wholesale, commercial, retail)] only the central IT function will have a perspective over the portfolio of systems projects and capabilities. One critical role in this respect is the provision and development of the shared IT infrastructure (e.g. central processors, networks, software standards, etc.). Often these projects naturally span business units such that the only real owner is the IT function; also they generally tend to be highly technical and thus the natural responsibility would also fall on the IT department.

2.3.2 Evaluating Opportunities

Once a project is at least initially defined, there is a process by which the initial idea is converted into a proposal that can be evaluated by management for approval or rejection of funding.

In the last ten years, it has become more or less standard practices to develop a business case or business plan for any substantial IT investment (some small maintenance projects are

simply done on request), although the content, sophistication and formality of this process varied substantially. The most typical of these project proposals (assuming a mid-size to large project) take the form of a business plan which includes a qualitative description of the objectives, competitive environment, a description of the opportunity and, in some cases, an implementation plan. While the form of these plans varies widely, there are some general points of comparison.

For the qualitative portion, the major issue is whether the plan explicitly addresses changes in the business environment, or is primarily inward focused. For minor systems enhancement projects with no strategic objective (or even major investments that are not strategic such as year 2000 repairs), it makes sense for the plan to focus entirely on internal issues. However, to the extent that the investment is made for competitive reasons or is likely to spur a reaction from competitors, it is important to qualitatively evaluate whether the business environment will remain static and, if not, examine possible scenarios that are likely to occur. The assumption of a static business environment is a common decision bias that can particularly plague strategic IT investments; Clemons (1991) terms this the "trap of the vanishing status quo".

For the quantitative financial evaluation, most IT evaluation methods have their roots in traditional capital budgeting procedures such as discounted cash flow analysis (DCF) (Brealey and Myers, 1996). However, while these techniques can work well for projects where costs and benefits are well defined (e.g. purchasing off-the-shelf software in pursuit of operational cost savings), it is increasingly recognized that simple application of DCF approaches is not sufficient for IT investments. This is because much of the value of modern IT investments is likely to be difficult to quantify -- such as revenue enhancements or cost savings through improved customer service, product variety, or timeliness (Brynjolfsson and Hitt, 1996). One commonly used strategy is to value non-quantifiable benefits at zero, although this strategy will systematically bias project evaluations to unnecessarily reject projects.

Recognizing the limitation of the DCF approach, several alternative approaches have been proposed. One method is to base the case entirely on qualitative analysis; unfortunately, this approach often leads to highly subjective judgments and is likely to err on the side of accepting bad projects. Kaplan (1986), recognizing this problem in the context of evaluating computer integrated manufacturing (CIM), proposed using a variant of DCF; a firm calculates the present value of the investment using all the components that can be quantified and then compares this preliminary value to the qualitative list of other benefits and costs. In other cases, where the evaluation is made difficult because of future uncertainties (e.g. market growth and acceptance; response of competitors) decision trees or other types of probability based assessment tools may simplify investment decisions (Clemons, 1990). Finally, for some types of

investments or decisions (for example, the decision whether to invest immediately or defer), advanced techniques such as real options (Trigeorgis, 1997) can be applied.

Although this discussion has focused primarily on evaluating the benefit part of the quantitative evaluation, there are other difficulties in estimating the cost of IT projects, particularly those involving software development. Existing models such as COCOMO (see description in Kemerer, 1996) or function points estimation are known to improve the ability to predict project length, staffing requirements and total costs, although they are known to be systematically off by as much as 400%. However, the accuracy of these estimates can also be improved later in the project when specifications are well defined or by customizing the models to the experience of a particular organization. However, despite the fact that these tools and approaches are readily available (see e.g. McConnell, 1997; Boehm, 1981; or Kemerer, 1996 for a discussion) many firms still utilize "seat of the pants" estimates or lock in schedules and cost estimates before the projects are fully defined.

2.3.3 Approving IT Projects

Once a project has been evaluated and a formal project proposal exists, there are a variety of mechanisms that are used to determine which projects should be funded. Most institutions have some form of committee structure, similar to capital budgeting committees, which is responsible for evaluating, modifying and approving projects.

Most of the previous literature on the management of IT has focused on the so-called "IT steering committee" which is an executive level group, often comprised of the heads of business units or their direct reports (see a case example in *Air Products and Chemicals*, Balaguer and Preuninger, 1988). The objective of this committee is to ensure that IT strategy is aligned with business unit strategy, projects are coordinated across business units where there are possible synergies and to educate the business unit managers on the both the actual activities of the IT group and the potential IT opportunities.

2.3.4 Make-Buy Decisions (Outsourcing)

At the inception of any project, a firm has the choice of whether to utilize their internal resources in the IT department (insource) or utilize an outside vendor for any or all of a project (outsourcing). While the market for outsourced services has existed since sale of the first corporate computers, the size of the outsourcing market has grown dramatically in recent years and is expected to grow substantially. In 1997 the market for information technology outsourcing has been estimated at $26.5 billion in the U.S. (Saunders, Gebelt, and Hu, 1997) and at $90 billion worldwide (Verity, 1996). Growth estimates of this market range from 15% to 25% (Gurbaxani, 1996; Saunders et. al, 1997).

In general, an outside firm may be advantaged in providing a service previously produced internally, because of economies of scale, scope or specialization. By aggregating demands for multiple clients, vendors can smooth variations in demand increasing capacity utilization and reducing risk, make investments that trade larger fixed costs for lower variable costs, and have stronger incentives to invest in cost-reducing technology. By narrowly focusing on technology, they may be better able to attract, hire, manage and retain high quality personnel due to better ability to tailor management practices, career paths and incentive structures to a specific activity. The value of these benefits is tempered by explicit and implicit costs of using the market or some intermediate form of governance rather than vertical integration. These problems manifest themselves in three types of risk: shirking (under-performance in hard-to-measure tasks), poaching (misappropriation of shared resources) and opportunistic re-negotiation (exploitation of bargaining disadvantages in ongoing relationships) -- see Clemons and Row, 1992 for further discussion. Some authors have argued that in IT these risks are so severe that outsourcing has, overall, a poor value proposition (see e.g. Lacity and Hirsheim, 1993). However, there are a number of very successful agreements and the growth in the market over the long term suggests that some economic benefits of outsourcing are present.

In practice, outsourcing can take many forms and the complexity of these arrangements is increasing (Gurbaxani, 1996). The simplest arrangement is the use of contract workers; the worker is not employed by the firm, but is managed more or less as if they were an employee. This practice is so common in IT that the presence of contract employees is assumed to be a standard feature of IT departments (see discussion of the "shamrock organization" in Rockart, 1988). At the next level is selective outsourcing in which a firm outsources particular projects or parts of projects to an outside vendor. This is also quite common in software development and technical support activities, although any well-defined task could presumably be outsourced in this way. Finally, the firm may choose to outsource the entire IT function, a practice that began in the late 1980s and has continued today (see description of *CSC/General Dynamics HBS*, McFarlan, 1991 for a general perspective on total outsourcing).

2.3.5 Project Management

Once a project is approved, it is standard practice to assemble a project team of IT staffers to do the actual systems work which also include representatives from the business units. At this point, there has usually been a formal systems evaluation and the development of a project timeline, resource requirements and staffing plan. In addition to managing the work process, two critical management processes are handling modifications to the project plan and managing communication between IT personnel, business unit personnel and the executives overseeing the project.

Few systems projects run entirely as described in their initial plans. In fact, it is a key component of many software development methodologies is a periodic review and reevaluation of the project plan as new information arrives. The primary mechanism for accomplishing this flexibility is to include end users and managers on the project team so that modifications can be evaluated with a concern for business objectives. Almost all modern IT project management methods call for strong involvement in end-users and close coordination between the technical objectives and the business unit objectives (see e.g. McConnell, 1997; Hammer and Champy, 1993; Davenport and Short, 1990; Boehm, 1981, 1988). This modern approach contrasts with traditional "waterfall" based project management techniques which emphasized the development of a comprehensive, formal specification before systems development work would begin and almost no interaction with the end users until the testing phase.

It is well recognized that there are tradeoffs between functionality, cost and time (McConnell, 1997; Brooks, 1987) in software projects. Attempts to ignore these tradeoffs often lead to serious project problems; for example, developers may shirk on testing or cut corners in software coding to meet unreachable deadlines. Pushing projects to deliver before the minimum feasible schedule through staffing increases can cause costs to escalate rapidly since there are strongly diminishing benefits to incremental staffing once a team is beyond a certain size.

A related management task is to ensure that all decision-makers have sufficient information on project status to evaluate changes in the plan, alter resource use or, in extreme cases, terminate or defer the project. The actual project management tools and communication mechanisms are likely to vary widely across organizations but in general they include some form of periodic reporting, a project timeline with preliminary deliverables and regular project meetings between developers, end-users and other decision makers. Communication has been argued to be essential in preventing project escalation, in which poorly performing projects are allowed to continue until ultimate failure (Keil, 1995).

2.3.6 Evaluation

Another standard component of modern systems development practice is project post audits. The goal is to identify ineffective or effective work practices, examine the assumptions which were employed in scheduling to improve overall estimation accuracy, and to ensure that the required functional was delivered (McConnell, 1997). A similar logic would suggest it may be useful to also evaluate whether or not the business benefits were actually realized to improve project evaluation methods and to understand whether a component of the project management, development or delivery process results in a reduction of potential benefits.

2.3.7 Managing and Developing the IT Function

The last and, arguably, the most crucial aspect of effective IT deployment is the management and development of IT professionals. As described in Prasad and Harker (1997), the IT labor force is a major contributor to the overall productivity of banking organizations. Today's high demand for IT personnel is unprecedented in U.S. labor history. Figures from the Bureau of Labor Statistics show that while the overall job growth in the U.S. economy was 1.6% between 1987 and 1994, software employment grew in these years at 9.6% every year, and "cranked up to 11.5% in 1995"; the prediction is that over the next decade, we will see further growth in software jobs at 6.4% every year (Rebello 1996). During their fieldwork, Prasad and Harker (1997) encountered a Senior Vice President at a major New York bank who lamented the fact that "The skills mix of the IT staff doesn't match the current strategy of the bank," and he "didn't know what to do about it." At the same bank, the Vice President in charge of IT claimed, "Our current IT training isn't working. We never spend anywhere near our training budget." IT labor is in very short supply, and issues as basic as re-skilling the workforce cannot be addressed given the lack of sufficient IT labor in banking.

Other researchers have observed this dependence and under investment in human capital in technologically intensive environments. To quote Gunn's (1987) work in manufacturing, "Time and again, the major impediment to [technological] implementation ... is people: their lack of knowledge, their resistance to change, or simply their lack of ability to quickly absorb the vast multitude of new technologies, philosophies, ideas, and practices, that have come about in manufacturing over the last five to ten years."

Effective management of IT professionals is discussed extensively in most modern treatments of systems analysis (see e.g. Kemerer, 1996), and many firms have begun to adopt unusual work arrangements in an effort to retain IT personnel over the long term.

2.3.8 Summary of IT Investment Management

The arguments above can be summarized in the Table 1.

Table 1. Conventional Wisdom on IT Investment Management

Step	Conventional Wisdom
Identify Opportunities	• Close partnership between IT and line managers • Critical role for IT in "technology scanning" to apply current technology to business problems • Emphasis on two-way communication of ideas
Evaluate Opportunities	• Increasing levels of sophistication of the evaluation (qualitative, quantitative, accommodating intangible cost and benefits, advanced financial techniques • Need to address uncertainty in the environment • Need to address competitive reaction/changes in competitive environment for "strategic" investments • Utilization of software engineering techniques for initial project planning
Approve Projects	• Initial evaluation by IT-business unit teams • IT Steering committees for larger, cross functional projects to both make decisions and align projects to business strategy
Make-buy Decision	• Contractors extensively used • Selective outsourcing taking into account resource/skill needs and outsourcing risks • In house development of systems where risks are too high
Managing Projects	• High-level of communication between developers and end users • Formal methods for determining initial schedule and resource requirements • Flexibility in adapting to unforeseen projects delays; tradeoff between functionality, cost and time recognized explicitly
Evaluation	• Post-hoc technical evaluations to improve project management and estimation techniques • Business audit to improve business planning process and provide incentives for accurate initial evaluation
Managing IT function	• Emphasis on retaining skilled employees through flexible work design and incentive systems • Investment in maintaining and improving IT capabilities through recruiting and training

3.0 Methods and Data

The data for this study is drawn from a mixture of questionnaires and semi-structured interviews administered to multiple recipients at six banking institutions (when the study is completed we expect to examine seven or more institutions). Questions cover general issues of IT management in the firm such as the methodology for identifying and evaluating projects, developing business plans, the approval process, and their project management guidelines.

In addition, we conducted in-depth interviews focusing specifically on two recent (or pending) IT investment decisions: the adoption of computer-based home banking (PC banking), and the development of the corporate World Wide Web site. By focusing on specific projects we were able to see how their general procedures were (or were not) followed, compare business plans and approaches across institutions for a similar project, and generally obtain specific answers on how the bank actually makes decisions and implements technology projects. These projects are both relatively recent and represent two different types of technology decisions that banks commonly face. PC banking is a relatively well-defined product with a large potential vendor base, ample examples of how other banks implement the technology and design similar products, and a well defined project owner (either the alternative delivery group in the retail bank or the head retail executive). Thus, it is representative of the typical, moderate size technology project that a bank might undertake.

The corporate web page is more of an infrastructure project, which has a multitude of potential owners and beneficiaries and at the moment is relatively ill defined in terms of business objective. Because the benefits are difficult to quantify and sponsorship of the project is likely to be vague, we would expect that this project would be at least partially handled outside the normal technology evaluation process. In addition, infrastructure investments were identified as a key concern of Chief Information Officers in our preliminary investigations.[2]

For each sub-component of the questionnaire, we attempted to identify the most informed respondent (Huber and Power, 1985). For example, to get the details on the PC banking implementation, we spoke with the project leaders on the implementation team, the marketing director responsible for promoting the product, the senior retail executive in the bank on how PC banking fits into corporate strategy, the CIO on how PC banking was or was not a typical project and how it was approved, and the manager of the call center that provided support to PC banking users.

Overall, our interviews involved approximately 10 people at each institution for roughly 1.5 hours each. Appendix A contains details for how to obtain copies of the structured interviewing instrument used in this investigation.

[2] Following our first pilot site for the questionnaire, we convened a group of representatives from the other sites to review preliminary results and to discuss specific issues that should be pursued in the study.

4.0 Preliminary Results on the General Technology Decision Process

Following our earlier discussion of the seven basic components of IT investment management, we discuss our empirical observations to date on each.

4.1 Identification of Opportunities

In our initial analysis, we find that most banks still adhere to the project-based philosophy of IT areas reactively responding to requests rather than proactively seeking out new technology applications. All six of our sites indicated that the primary identification of new IT opportunities was from the business unit, with only one site stating that the IT area occasionally provides input. In addition, the IT area has historically played a limited role in providing technology education to line managers and executives in the business units; and when they do, it is again by reacting to the business units requests.

One area where the banks tend to not have reactive IT areas is for infrastructure projects. In this case, the projects are typically initiated by IT as well as funded centrally through the IT budget.

Table 2. Identification of IT Opportunities

	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
How are new IT opportunities identified?	•Driven by specific business unit objectives	•Driven by business unit managers	•Driven by business unit managers	•Primarily line of business •Sometimes input from IT to business unit	•Driven by business unit managers	•Driven by business unit managers
Role of IT in infrastructure projects?	•Funded through central IT budget •No formal justification •IT drives projects	•Funded all infrastructure through central IT budget •Sets standards	•Funded through central IT budget •IT drives projects •Sets standards	•Usually funded through central IT unless lead users identified •May be "taxed" to business units •IT project leader but try to enlist business unit leader	•Recommendations come from CIO and are approved by Chairman •Sets standards •Funding through technology (CIO) budget	•Funded by LOB using technology •Is an issue b/c infrastructure cited as a enterprise-wide weakness
Role of IT in technology education?	•Mostly reactive •Effective after idea identified	•Mostly reactive •Effective after idea identified	•Mostly reactive •Effective after idea identified	•Strong feeling business does not know enough about technology •IT beginning to have "technology days" to educate senior business unit managers	•Mostly reactive •Effective after idea identified	•Mostly reactive •Effective after idea identified

4.2 Evaluating Opportunities

Our results suggest that almost all banks have a formal process for evaluating projects including a qualitative and quantitative justification that is either a payback period or discounted cash-flow analysis. There is little use of more sophisticated evaluation tools such as reverse discounted cash flow (DCF), scenario planning or decision tree analysis. There is also a consistent lack of examination of potential environmental responses or changes both in the quantitative and qualitative portions of the business cases we reviewed. In terms of cost estimation, few organizations use formal cost estimation models, although many claim that their methods, which are based on comparison to historical experience, have proven to be fairly accurate. Also, some organizations may compensate for inaccurate initial estimates by proactively adjusting the schedule as the project.

The responsibility for project plans varies substantially. Organization's ranged from the project planning primarily conducted by the IT function to a multifunctional team to planning primarily conducted by the business units.

Table 3. Evaluation of Opportunities

	Bank A	**Bank B**	**Bank C**	**Bank D**	**Bank E**	**Bank F**
Tools used for financial justification	•Basic NPV analysis •Informal benefit estimates	•Cost savings estimates •ROE •Size of project	•Basic NPV analysis •Informal benefits estimates	•Basic NPV analysis •Informal benefits analysis	•Formal benefits analysis	•NPV analysis measuring flows to earnings and cost savings
Tools (if any) used for qualitative evaluation		•Measure fit with bank's strategic plan			•Measure fit with bank's strategic plan	
Extent of external focus of the evaluation	•Both internal and external	•Primarily internal	•Primarily internal	•Primarily internal	•Primarily internal	•Primarily internal
Tools used for cost/resource analysis	•No formal tools; rely on analyst judgment	•No formal tools; rely on analyst judgment	•No formal tools; rely on analyst judgment	•No formal tools; rely on analyst judgment	•No formal tools; rely on analyst judgment	•No formal tools; rely on analyst judgment
Who is involved in the initial project plan?	•Business unit primarily with input from IT	•Business unit primarily with input from IT	•Business unit primarily with input from IT in second phase	•Formal multi-functional project team •IT tend to lead evaluation effort	•Business unit primarily	•Business unit primarily with input from IT

4.3 Approving IT Projects

In practice there are generally multiple committees with a wide variety of responsibilities for approving IT projects. While these committee structures are often fairly complex, they share some common traits. First, they are generally organized by size of investment; smaller projects can be approved at the department or business unit level while larger projects (greater than a set level, which was between $500k and $1mm for our the institutions we have been examining) generally go to higher levels, as high as the board of the bank. The objective of this tiering appears to be to tie financial accountability with the appropriate level of managerial authority.

Second, the committees are almost always multifunctional in nature; lower level committees generally involve IT project managers and department/business unit managers, while committees at higher levels usually involve executives from other business units, which oversee and approve a portfolio of projects across the entire bank.

Finally, despite complex formal processes for the approval of projects, there is little evidence that the higher level committees actually take a substantial role in the decision process. Few if any projects are rejected by groups outside the business unit; almost all the screening occurs at a lower level. This may be particularly true for organizations that make most of the decisions based on the quantitative analysis -- only when a project exceeds the required financial hurdle is a project brought to a higher level committee, and it is rare that these project proposals are radically altered during the committee evaluation. Thus, it may be better to interpret these committees as informational groups rather than decision-making bodies.

Even though the formal processes are well developed, informal processes play a large role, particularly in the allocation of resources across projects. While in some cases there was an attempt to use a structured priority process across business units, most prioritization decisions are made based on historical norms (future budgets track previous budgets), fairness (a group that has not had a recent major investment may get one approved even if it may not be highest priority for the institution), and cultural norms. These practices raise the question as to whether this form of committee structure is an effective mechanism for managing cross-project budget allocations.

The informal processes are highly evident for projects that do not fall within a specific business unit. Typically, at an early stage an executive business owner is identified for a project. Usually for projects originating in a department or business unit, business unit managers (or their reports) are responsible for championing the project. However, for projects that potentially benefit multiple users or provide indirect benefits, the decision process is much less clear. For example, many banks have begun making investments in corporate-wide networking and software standards; these investments potentially benefit all users, but not until future software projects are undertaken to utilize this capability. For example, highly technical infrastructure

projects tend to be owned by the IT function and charged out to the business units as a "tax". Less technical projects that also have an infrastructure characteristic, such as the corporate web page, have less clear lines of authority. In the six institutions we studied, the web page had a different corporate sponsor at each. Our preliminary observation is that there is little formal apparatus for handling these "exception" type of projects, which may make their management and implementation more difficult.

Finally, the mechanism for funding and budget accountability interacts strongly with the approval process. In most cases, almost all IT charges are borne directly by business units and thus a unit manager willing to pay for the project out of their own budget will be unlikely to have a project rejected. Where there is no business unit owner to fund the project, even relatively small projects can be difficult to approve. This potentially creates investment biases toward narrow, business unit specific projects, rather than enterprise-wide efforts that require multiple executives to agree to collectively fund a project.

Table 4. Approving IT Projects

	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
Sketch of committee structure	•Business unit filters ideas and presents to technology committee •Larger projects go to bank-level committee	•No formal structure- goes from SBU head to Chairman	•Business unit technology committee first signoff; then to regional executives •Larger projects go to IT board or bank board	•Initial ideas go to business unit representatives of IT •Larger projects go to IT board or bank or holding company board	•Same as bank management committee except no chairman or CEO	•Planning Committee of 4 Vice Chairman and 1 President •Larger projects go to Chairman and the Board
Level of spending before project goes to IT steering committee	•150K	•900K	•200K	•750K	•500K formally, $100K informally	•Not an active committee- comprised of 4 Vice Chairman and CTO
Level of spending before project goes to bank board	•$500K	•$2mm	•$500K	•$5mm	•$5mm	•$10mm ($2mm informally)
How are resources allocated between business units?	•Technology committee decides on prioritization	•Priority system (1-5) rating, but heavily subjective based on ROI and past success	•Priorities committee charged with allocation	•Primarily based on previous budget and "fairness"	•Technology Steering Committee decide on prioritization	•Planning Committee decides on prioritization
What role does IT play in coordinating projects across the organization?	•Through involvement in priorities committee	•CIO can informally influence SBU sponsors	•Through involvement in priorities committee	•Some effort of coord. by CIO but not systematic •No prioritization by board - they respond yes or no	•Through involvement in Tech. Steering Committee	•Little- done by Planning Committee
To what budget are IT projects charged?	•Business units pay 100% of all non-infrastructure costs	•Business units pay 80% of IT expenditure	•95% funded by business units	•Service corporation budget contains IT projects	•Business units pay 100%	•Business units pay 100%
Where are projects killed /approved	•Business unit	•Business unit	•Business unit	•Business unit	•Business unit	•Business unit

Table 4. Approving IT Projects (continued)

	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
How many projects are approved at committee level?	•100%	•N/A	•100%	•Essentially all	•90%	•80+%
Of projects that are undertaken what percentage are planned for in the budget?	•65% planned	•N/A	•45% planned	•50% planned	•50% planned	•50% planned

4.4 Make-Buy Decision

Almost all of the banks in our sample utilize some form of outsourcing although no bank has adopted a total outsourcing arrangement. Similarly, each bank utilizes contract workers however they vary somewhat in their mix between employees and contract staff on projects (in every case, the use of contract workers has risen substantially due to the year 2000 [Y2K] problem efforts). However, the banks varied on their extent of customizing third-party software. At one extreme, a bank looked to primarily build its own software, while at the other extreme, a bank looked to buy third-party software and perform as little customization as possible. The majority of the banks fell in between these extremes, buying third-party software and extensively customizing it.

In both the PC and the web projects (to be discussed more extensively later) the banks selectively outsourced many of the individual activities, often to different firms, but remained responsible for the overall management and guidance of the project. While there was little evidence that banks had experienced unusual problems due to outsourcing risks, our analysis may be subject to the bias of focusing on recent projects, where problems have yet to materialize. Our interviews suggest that the ability to obtain specific technical skills was a primary driver of the decision, and secondarily a simple need to have sufficient staff to conduct new systems development and maintenance work while remedying the Y2K problem.

Table 5. Use of Third Parties in IT Areas

	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
What percent of IT area was contract workers prior to Y2K?	•5%	•10-20%	•5-15%	•10-15%	•0-1%	•5%
What percent of IT area is contract workers during Y2K?	•25%	•33%	•20%	•25-33%	•10%	•20%
In terms of software used at the bank, to what extent does your bank customize third party packages?	•Extensive customization	•Looks to build rather than buy, but trying to change that	•Extensive customization	•Extensive customization	•Does very little customization	•Extensive customization
How has outsourcing been used for PC banking?	•All PC Banking except support	•Initial Web development •Some PC technical development	•All PC Banking except support	•Web development •PC banking network •Tech Support for PC Banking	•PC banking network •All PC Banking except support	•Web development •All PC Banking except support
How has outsourcing been used for corporate web page?	•Initial development outsourced •Hosting outsourced	•Initial development outsourced •Hosting outsourced	•Initial development outsourced •Hosting outsourced	•Initial development outsourced •Hosting outsourced	•Initial development outsourced •Hosting outsourced	•Initial development outsourced •Hosting outsourced

4.5 Managing IT Projects

In the six banks we studied, we found a fairly high level of sophistication in the IT project management process. Most banks began projects with formal time and cost estimates although these were generally not prepared using estimation models. Nonetheless, most systems personnel we interviewed were satisfied with the accuracy of their project plans. Roughly half the banks had end-user involvement, at least at the beginning of the project, although some organizations tended to decrease user involvement after the initial project plan. Almost all projects at the institutions had regular project meetings and reports, although in some cases there was also executive review of all active projects on a periodic basis. One major source of variation is the extent to which projects were encouraged to achieve pre-designated milestones. In some institutions, delivery time was critical; in others, the emphasis was on meeting cost targets.

Surprisingly, there were relatively few problem projects reported; when asked, most IT managers could think of at most one project that the bank had terminated prematurely. Part of this may be due to highly conservative project evaluation methods; alternatively, many projects underwent a pilot phase before full implementation and thus the potentially problematic projects were terminated during pilot testing.

Interestingly, in the PC banking project, the banks had a considerable amount of variation as to their motivation and their ultimate success measures. The motivation ranged from competitive necessity to customer acquisition or retention to convenience and lower cost. These also served as the performance measures that the banks used, but no bank had their original motivation turn out the be the actual or expected source of value.

Table 6. Managing IT Projects

	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
How is progress of IT projects tracked?	•Track cost and time formally	•Track cost and time formally	•Track cost, time, and functionality formally	•Have weekly status updates	•Track cost and time formally	•Track cost and time formally
How is progress of IT projects communicated?	•Distribution of minutes of meetings	•Project manager informs LOB sponsor	•Through committee structure	•Through weekly meetings	•Through monthly status reports	•Weekly status reports to LOB sponsor
What are the critical dimensions that projects are managed to?	•Schedule driven organization-functionality and cost can be sacrificed to meet schedule	•Each transaction is cheaper than the last	•Emphasis on meeting cost targets	•Emphasis on delivery date	•Emphasis on schedule and cost	•Emphasis on cost targets
Are end-users formally involved in projects?	•No	•Yes, through project team	•No	•Yes, through project team	•No	•Yes, through Technology Relationship Managers
Have there been any technology blunders?	•Yes	•No	•Yes	•Yes	•Yes	•Yes
Have any projects been scrapped once they were started?	•No	•Yes	•No	•Yes	•No	•No
What was the primary motivation for PC banking?	•Competitive necessity	•Customer retention	•Convenience and lower cost	•Customer acquisition	•Convenience	•Cost reduction
What is the primary way that PC banking adds value? (self-reported)	•Customer retention •Bank experience	•Lower cost •Customer convenience	•Customer retention	•Customer retention	•Customer retention	•Lower cost to serve

4.6 Ex-post Evaluation

In the institutions we examined, we found that there was very little project reevaluation. Some institutions performed a technical evaluation after a project was completed, but few reexamined whether or not the costs and benefits were actually as expected. However, there does appear to be a clear trend in this direction; one institution had just adopted a formal project audit process and another was beginning to include measures derived from IT plans in managerial compensation.

Table 7. Evaluating IT Projects

	Bank A	**Bank B**	**Bank C**	**Bank D**	**Bank E**	**Bank F**
Is there a post-audit review?	No	Yes	No	Yes	Yes	No
What is the objective of post-audits?	n/a	•To assess financial returns and see if objectives were met	n/a	•Validate business value assumptions	•Validate business value assumptions	n/a

4.7 Managing and Developing the IT Function

Table 8 summarizes the key characteristics of the six banks in this study with respect to their management of the IT function. All of the banks had special incentive programs in place for IT professionals, most in the form of bonuses. Also, while turnover was sited as an important issue on each of our site visits, there was significant variation in the extent. There was much less variation in terms of the extent of training an IT professional receives. However, there was variation as to whether the training was performed in-house, outsourced, or more commonly a combination of the two.

Finally, there is a great deal of frustration by the IT professionals due to the lack of understanding by senior management as to role of the IT group in the organization. In terms of major areas for improvement in the IT process, the management of IT professionals remains one of the biggest, if not the biggest, challenges facing the banking industry.

Table 8. Managing and Developing the IT Function

	Bank A	**Bank B**	**Bank C**	**Bank D**	**Bank E**	**Bank F**
What incentives are in place for IT personnel?	•For high-level people there are stock options, for the rest bonuses are used.	•Quarterly bonus program	•Up to 40% of salary as bonus	•Bonus; huge for employees who remain after Y2K	•Bonus program	•Bonus program and ability to work on "fun" projects
What is the annual turnover of the IT function?	•15%	•14%	•15%	•0%	•40%	•"same as rest of industry"
How much training does the average IT person receive per year?	•2 weeks	•2-3 weeks	•1 month	•2-3 weeks	•2-3 weeks	• 2 weeks
Is IT training performed primarily in-house or is it primarily outsourced?	•In house	•Outsourced	•Combination	•Combination	•Combination	•Combination
Is there formal job rotation in the IT function?	•No	•Yes	•No	•No	•No	•Yes

Table 8. Managing and Developing the IT Function (continued)

	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
What are the primary performance metrics for the IT function?	•Budget •Availability	•Cost per transaction for the various businesses •Make every transaction faster, better, cheaper, etc. •Security •Infrastructure integrity	•Financial plan, headcount, and turnover. Timing, functionality, cost.	•Manage to budget •Turnover	•Operational-on-line availability •Service quality measured through surveys sent to LOB and customers	•Financial plan; return of projects; employee retention; service quality to LOB customers
What is the major concern in the IT area?	•Y2K	•Qualified people •Resources to do all projects	•Y2K then mergers	•Staff retention	•Operational availability •Employee retention	•Infrastructure •Cost containment
How well does senior management understand technology? CIO perspective (1-10, with 1 being the least understanding)	•4	•5.5	•5	•6.5	•8.5	•5
How well does senior management understand technology? PC banking team perspective (1-10, with 1 being the least understanding)	•4.5	•5.5	•5	•2	•6.67	•4.5

4.7 Summary of Overall Process Observations

Our initial investigation suggest the following overall observations:

- IT departments are not effective enough in educating end users about technology. Most departments continue to operate as a cost center or job shop rather than as an organization that provides technology-based business ideas.
- IT project evaluations tend to do an insufficient job of evaluating potential project benefits and do not employ state-of-the-art evaluation methods. Some of this is likely due to the nature of the projects, but the uncertainty surrounding benefit estimates make it more difficult to hold managers accountable for business benefits rather than technical success and may lead banks to be overly conservative in their project undertakings. This conservatism is further suggested by the almost non-existence of terminated projects or projects rejected at higher committee levels.
- There is a complex and formal process for managing IT investments, yet most investments are made at a relatively low level; higher level committees have little input into actual decisions. Moreover, informal processes play a large role, particularly for ill-defined projects and those without a primary customer or owner. The most potentially important decision role of the high level steering committees do not appear to be fully utilized; there is limited evidence that tradeoffs between projects are objectively evaluated or prioritized.
- Most organizations have effective methods for obtaining user input at the beginning of projects and managing the technical aspects of IT projects. There is substantially more variation in the involvement of end-users during the project.
- Post-project auditing is not common and where present, is primarily addressing technical considerations.

5.0 Preliminary Results: The Case of PC Banking

Pushed by growing consumer demand and the fear of losing market share, banks are investing heavily in PC banking technology (Frei and Kalakota, 1997). Collaborating with hardware, software, telecommunications and other companies, banks are introducing new ways for consumers to access their account balances, transfer funds, pay bills, and buy goods and services without using cash, mailing a check, or leaving home. To meet this demand from consumers, banks are pursuing PC banking projects to bring such services to the marketplace.

In all the institutions studied, the PC banking project more or less followed the organizations standard IT evaluation and approval project. The only substantial variation in process was whether the PC banking product was managed separately from the rest of retail operations, managed as part of alternative delivery (e.g. supermarket branches, call centers) or integrated like any other typical product. All of the PC banking projects had formal business plans and went through the committee structure in the normal way. In most cases these projects were moderate size for the institution, on the order of $500K - $5mm dollars.

The major variation in these projects came about in two ways. The first was the extent to which the project was justified. There is a wide variety of possible sources of business value, although the various banks emphasized different sources. In the following section, we will probe both the source of this variation as well as discuss some preliminary results in terms of the outcome on these various measures. The second source of variation was the extent of third party involvement in the development and implementation process. For PC banking there are numerous activities that could potentially be outsourced (fulfillment, provision of dial-in networking, the client software, data processing of transactions, and the help desk) and we observed different combinations of in-house and outsourced service for each of these.

5.1 Value Proposition for PC Banking

From our interviews and a search of existing banking and related economic literature, we identified a number of possible motivations for investing in PC banking. These break down into several general categories: operational cost savings, revenue enhancement (new accounts/account deepening/account consolidation), customer retention, customer segmentation, product differentiation, and enabling price discrimination.

Cost Reduction. Studies have shown that the cost of a transaction in alternative channels (telephone, Internet) is substantially lower than the cost of a transaction conducted through a normal branch. Thus, there is the potential to reduce costs by conducting more transactions electronically. However, this cost reduction is tempered by two factors. First, the cost of performing the transaction is also lower for the customer and thus we would expect more transactions to occur (offsetting at least some of the benefits of lower costs). Second, the savings

from reducing transaction processing can only be realized if some other change is made to actually capture these costs (such as closing branches).

Revenue Enhancement. Some banks expect to expand revenue through obtaining new customers or extending the relationship with existing customers. One thought is that customers will be attracted to the convenience and incremental services provided by PC banking enough to switch. This could occur either within the bank's traditional geographic region or outside that region, since electronic interaction can substantially reduce the need for branch presence.

Alternatively, the revenue enhancement can occur through extending existing relationships. The two critical drivers of profitability in banking are the numbers of products per customer and the asset or liability balances for these products. It is possible that the PC banking platform provides the facility to sell additional products either because it provides a sales medium or because it is more convenient for the customer to consolidate banking activity in a single bank to obtain a complete electronic picture of their financial status. Alternately, the product could simply encourage customers to increase their utilization of existing products. For example, they may consolidate multiple checking accounts for added convenience, or may choose to extend a relationship due to the perceived higher service obtained by having multiple points of interaction with the bank.

Cost Avoidance. Two of the major costs in retail banks are acquisition cost of accounts, and the costs of utilizing branch offices for account servicing. It may be possible for banks to deliver equivalent levels of sales and service with fewer branches per customer if some of the activity is offloaded to electronic channels.[3] Alternatively, the advertising and customer acquisition costs may be lower on the Internet or through electronic channels due to reduced advertising costs or better customer targeting as compared to traditional mass media, and the reduced need for branch personnel to open new accounts.

Customer Retention. Given that acquisition cost is a large driver of profitability, the ability to retain (good) accounts longer can have a substantial profit impact. Of course, the challenge is in identifying the good accounts for long-term relationships and re-pricing or encouraging termination of unprofitable accounts.

In addition to the typical arguments made in the banking press, the literature on electronic commerce economics suggests some other drivers of value. Although electronic markets are often associated with perfect competition, the PC banking market is far from perfect. The cost of setup is substantial, both in terms of obtaining an account as well as the cost of setting up the

[3] However, while this seems intuitively plausible, early evidence on multi-point distribution of banking products (e.g. branches, supermarket branches, ATMs, call centers, etc.) suggests that the overall number of transactions also expands and thus, eliminates some of the gains of moving customers to lower cost channels.

software and learning to use it. This creates switching costs borne by the customer which are likely to enable banks to charge higher prices than they would otherwise (see a general model in Pratt, Wise and Zeckhauser, 1979). However, this may be truer for proprietary products than general-purpose packages that presumably can interface with multiple banks.

Second, banking in many regions is more or less an oligopoly due to the need for substantial infrastructure in the form of branch networks and technology. Because these investments have a substantial component of fixed cost, this creates the possibility of economies of scale, limiting the number of small banks that can be competitive.[4]

Third, the product is not entirely homogenous, creating the possibility of product differentiation. For example, products can differ in overall quality (vertical differentiation) as well as non-quality attributes (horizontal differentiation). To the extent that different feature sets or price-quality tradeoffs exist for different consumers, firms can capture greater value by targeting their offerings to particular segments or quality levels (Salop and Stiglitz, 1976; Salop, 1979; for a discussion of these factors in competition among electronic travel agents see Clemons, Hann, and Hitt, 1998).

Fourth, there are clear differences in customer profitability in retail banking and the electronic channel may provide an increased ability to identify profitable customers and engage in price discrimination in which different customers are charged different prices (Varian, 1992; Clemons and Weber, 1990).

Overall, this discussion suggests that there are a wide variety of potential sources of value for electronic commerce products in general as well as our specific case of PC and web banking. However, it is difficult to tell which of these are first order effects and which are relatively minor. Distinguishing between these possible explanations is largely an empirical question.

Our initial results suggest that collectively the banks in our study are expecting almost all of the benefits we have described although each bank has a distinct set of expectations. Two examples drawn from the banks in our study are tabulated below (Y means that the bank expects this sort of benefit):

Table 9. Value Proposition for PC Banking

	Bank A	**Bank B**
Revenue Enhancement		
New customers (in footprint)	Y	Y
New customers (outside)	Y	
Cross-sell	Y	Y
Consolidate relationship	Y	Y

[4] Whether or not scale economies are actually realized is a separate matter in much debate. See for example Berger et. al. (1995).

Deepen relationship		Y
Select high value customers		
Cost Avoidance		
Operational cost reduction	Y	
Reduction of branch expense		Y
Reduce acquisition cost		
Customer Retention		Y
Other Strategies		
Price discrimination	Y	Y
Horizontal (taste) differentiation		
Vertical (quality) differentiation		

Altogether, we see a wide variety of potential sources of value being described by the respondents. While the lack of consistency is striking, it suggests that there are a wide variety of approaches to investing in PC banking. In the next section, we explore the profit impact of PC banking of the various components (to the extent they can be measured)

5.2 Actual Benefits of PC Banking

Cost Savings. Our initial analysis suggests that cost savings is not a major component of the value of PC banking. This is primarily due to the relatively low customer penetration rate (1-5% for the banks in our study) combined with high fixed costs if the product is developed in house or high variable costs if a third party service is employed (e.g. Intuit Service Corporation).

Revenue Enhancement. To understand the effects of PC banking on various outcome measures such as number of products (Nprod), account profitability (π) and account balances (Balance), we estimate various regression models of the form:

$$(Nprod, p, Balance) = a_0 + a_{PC}(PCBanking) + g_{LOR}LOR + g_{LOR2}LOR^2 + \sum_{\text{i=age groups}} g_{i,age}A_i + \sum_{\text{j=inc. groups}} g_{j,income}I_j + g_{oh}OwnHome + g_{Mar}Married + e$$

We thus relate the outcome metrics to the use of PC Banking (PCBanking), the use of extended functionality PC banking that includes bill payment (BillPay), and dummy variables capturing demographic characteristics: age (A), income (I), home ownership (OwnHome), and marital status of primary account holder (Married). In some analyses, we also control for other relevant factors unique to specific analyses. Appendix B contains the results of this analysis.

Our initial results indicate that PC banking customers on average use more products and maintain larger balances than the average customer (Table B.1 in Appendix B). For one bank in our study, the average household has 2.6 products while the average PC banking household has 3.2 (a statistically larger amount). A small portion of these differences is due to demographics; PC banking customers tend to represent attractive customer segments (both in terms of age and income). However, demographics per se have little explanatory power and the coefficients on PC banking are only slightly lower when demographic controls are removed (see Table B.2). Overall this suggests that while PC banking does indeed appeal to a better demographic segment, demographic difference appear to contribute little to bottom line differences in the value of PC banking.

The baseline regression model suggests that PC banking customers, on average, yield $50 more revenue contribution based on the banks' profitability model. There is almost no apparent incremental value for customers that use only the baseline PC banking product. That is, almost all the value is from the customers who utilize the additional feature of bill payment (the majority of the user base). The increase in product usage directly affects relationship profitability. When an additional control for number of products is included (or alternatively controls for asset and liability balances), the explanatory power of the regressions rises substantially, but the coefficient on PC banking is halved.

While it appears that PC banking customers are more profitable, it is difficult to know whether they were more profitable before they adopted the product or the incremental account value came after the product was adopted. That is, does PC banking make customers more profitable or is it a segmenting product to which profitable customers are attracted? To capture the distinction between whether PC banking increases account value or if PC banking appeals to high profit accounts, we examined differences between customers who adopted the PC banking product within six months of opening the account (new customers who use PC banking) versus those that already had a banking relationship prior to adopting PC banking.[5]

Overall, we find that customers who are new to the bank and who have adopted PC banking are, in general, less attractive than the customer population (see Table B.3). Most of this effect is probably due to the fact that new (to the bank) customers tend to have fewer products and lower balances. When time of relationship is included as a control, the differences lessen somewhat. At present, we are obtaining additional data so that new customers and new PC banking customers can be compared directly rather than comparing new PC banking customers to the overall population.

Another analysis to separate the causal relationship between PC banking and profitability is to examine differences in products and accounts before and after PC banking was adopted. Overall, our results suggest that the amount of account upgrading after PC banking is relatively small, although it appears to make a positive contribution to profitability. We are currently awaiting additional data that will allow us to separate the effects between baseline account growth versus differential account growth for PC banking customers.

Overall, initial customer analysis suggests that cross-selling activities play a moderate role in making PC banking customers more profitable. However, to the extent that high profitability customers are adopting PC banking it may suggest a role in retention: the bank's best customers disproportionately adopt the product.

We are currently investigating further the possibilities for cost savings and cost avoidance and have found that aside from the product being a source of differentiation, there is little evidence of a deliberate attempt to differentiate the product or engage in price discrimination.

[5] The six-month window was included for data concerns. The customer information file does not record the PC banking account as being active until the software is actually installed on the customers' PC and a dialup session has been initiated to setup the account. Thus, we allow 1 month following account opening to capture customers who do not immediately install the software. However, this 1-month gap was too small to have a reasonable sample size in this analysis. We therefore expanded it (temporarily) to six months.

5.3 Involvement of Third Parties

The delivery of the PC banking product includes many activities, several of which can be subcontracted to outside parties. Interestingly, different institutions choose to outsource different pieces of the process.

Table 10. PC Banking Outsourcing

Process	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
Product Design and Conception	Insource	Insource	Insource	Insource (but contracted by package)	Insource	Insource
Client Software Development	Outsource	Insource with vendor partner	Insource	Outsource (packaged software)	Outsource	Outsource
Internal Software Development	Insource	Insource/ Outsource combination	Insource (adapted from ATM network)	Insource (new)	Insource	Insource/ Outsource combination
Dial-in Network	Outsource	Insource	Outsource	Outsource	Outsource	Outsource
Payment System	Outsource	Insource	Outsource	Outsource	Insource	Outsource
Fulfillment (software, docs)	Outsource	Insource	Insource	Outsource	Insource	Outsource
Technical Support	Outsource	Outsource	Outsource	Insource	Outsource	Outsource
Product Support (non-software questions)	Insource	Insource	Insource	Insource	Insource	Insource

Even with the extensive degree of outsourcing, there have been few reported problems with these arrangements. However, for banks that have essentially outsourced the product itself (e.g. Bank D), the costs can be high, exceeding the monthly charges for the product. In addition, banks with a greater level of operational outsourcing (software, network, and payment system) tend to have higher numbers of transaction errors and greater difficulty in their resolution.

Most banks appear to have a long-run strategy of bringing these functions back in house when PC banking customers are transitioned over to web based banking, although the transition strategies differ. Two banks plan to discontinue upgrades on their proprietary products for PC banking users and invest all upgrade resources in the web-based product. One bank continues to utilize an outside vendor while they continue to define a web strategy.

6.0 Preliminary Results: The Case of the Corporate Web Site

At the time of the study, all of the banks we visited had established a basic corporate presence on the World-Wide-Web (WWW) and were in the process of deciding on whether to provide transactional capability on their site. Like PC banking, most banks recognized that a WWW site was at least a competitive necessity, a requirement to be in business. However, in contrast to PC banking and most other investments, the web presence tended to be developed and implemented outside the normal approval and development processes normally employed by the bank.

Identification of IT opportunities. In the case of the web site, the idea originated from a wide variety of internal participants. In one case, a separate business unit was established, in another the project was entirely driven by the IT organization.

Evaluating Opportunities. Only one bank in our study underwent a formal business proposal and evaluation process for their web site. All of the others went through a two-stage process. First, an initial site was developed without a formal business plan or evaluation; these sites tended to be relatively weak and primarily informational rather than transactional. After a period of several months, a more formal development process was proposed, a business owner identified, and a formal project plan written. Interestingly, these plans were largely implementation plans; in general, there was little cost justification or formal business planning involved for how the web presence was going to support the business. If anything, the process resembled how an image advertising campaign might be conducted: there was an implementation plan, a formal budget and a set of outcome metrics, but they focused on generic benefits (e.g. build a presence on the web) rather than specific business objectives (e.g. make the web an alternative to the call center for initial contact outside the branch; expand outside existing geographic reach, etc.). No bank constructed a financial justification for the web project at this stage, although in one case, the web development group was run as a self-liquidating cost center, so that business units who desired web services could bid and pay for these activities out of their own budgets.

Approving IT investments. Even though these investments tended to be relatively small, many of them were approved or endorsed at high levels in the bank as a strategic priority. This was generally outside the usual process.

Make-Buy Decision. Almost all of the initial developments of the banks' web sites were done by outside contractors. Most banks reported that they lacked the skills to construct these sites and believed that the development process would be faster externally. One bank utilized an external contractor to build a highly user-customizable site; others simply utilized the external vendors to build a generic site quickly. Web hosting was often done externally due to the lack of appropriate facilities. All banks are expecting to bring development as well as hosting back in

house relatively soon and many have already made the investment in people as well as the infrastructure.

Project Management. Most of the actual project work was done out of house so most banks reported that they simply evaluated delivery milestones. As such, the process was typical of other projects which were largely outsourced.

Ex-post Evaluation. While almost all of the institutions we surveyed collect extensive statistics (often a by-product of the server software that delivers the content) and some even attempt to track the usage behavior of individual customers using "cookies", very little of these data have been used to date. Some rudimentary activity statistics are tracked and reported but it is primarily directed at activity rather than outcome; no bank currently has a reporting system for determining how many customers were attracted by the web site (with the exception of the number of on-line applications).

6.0 Summary and Conclusion

The preliminary analysis of the PC and Internet projects in the banking industry points to one common theme (apologies to the Rolling Stones): you can't always get what you want, but if you try, sometimes, you get what you need (to add value to the firm). In the case of PC banking, the end result of this additional capacity is not to add new, profitable customers to the firm, as many banks believed. Rather, it seems to fulfill more of a role of retaining high-value consumers. In the context of the Internet, this value proposition is even more difficult to understand and justify.

Thus, gone are the days when technology was justified and managed on a cost basis; today's investments require complex organizational changes to achieve the revenue savings demanded by the business case for new technological investments. Moreover, an increasingly complex set of inter-organizational arrangements must be created to acquire the technology. In our preliminary analyses, it appears that many firms have failed to develop the organizational systems necessary to successfully acquire and effectively utilize the capability of new technologies.

What does it take to make this work? Frei, Harker and Hunter (1998) discuss the changes that firms must undergo to be successful in innovating with technology. The standard view is that R&D, operations, and marketing combine in a complex web of interactions, to generate innovation (Figure 1).

Figure 1. Basic Relationship in Innovation Processes

However, as we have seen from our previous discussion, vendors that supply outsourced services and technology play a vital role in this innovation process. More important is the role of the "systems integrator" in the development of innovations; the person or organization that pulls together not only the operations, IT, and marketing functions for a single innovation, but also manages the portfolio of innovations in the organization (Figure 2). Ultimately, it is this systems integration function that will make or break innovation efforts. Jonash (1996) argues that the systems integration function belongs in the hands of the Chief Technology Officer who will coordinate the efforts of internal and external innovation efforts for the benefit of the organization. The results described herein tend to support this view.

Figure 2. Expanded Relationships for Innovation

The role of the systems integrator is crucial for the future of retail banking. Frei, Harker and Hunter (forthcoming), in summarizing their various analyses of retail banking efficiency

paints a picture of what makes an effective bank. The good news (or bad news, depending on your perspective), is that there is simply no "silver bullet", no one set of management practices, capital investments and strategies that lead to success. Rather, it appears that the "Devil" is truly in the details. The alignment of technology, human resource management, and capital investments with an appropriate production "technology" appears to be the key to efficiency in this industry. To achieve this alignment, banks need to invest in a cadre of "organizational architects" that are capable of integrating these varied pieces together to form a coherent structure. In fact, several leading financial services firms have realized the need for such talents and are investing heavily in senior managers from outside the industry (most notably, from manufacturing enterprises) to drive this alignment of technology, human resource management, and strategy. The challenge, therefore, is not to undertake any one set of practices but rather, to develop senior management talent that is capable of this alignment of practices.

The "bottom line" of this analysis is service industries, like banks, must develop a new generation of management talent to play this role of architect, one who can blend technical knowledge with complex organizational design issues to drive innovation through their firms.

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Appendix A: Interview Materials

The complete survey used as part of this study can be found at the following address:

http://opim.wharton.upenn.edu/~harker/survey.pdf

Appendix B: Preliminary Econometric Results on PC Banking

Table B.1 Sample Characteristics

(simple differences without controls)

	Profitability	Balances	Number of Products
Average Non-PC Customer	94.6	4447	2.63
PC Banking- Billpay Customers	+51%*	+101%*	+22%*
PC Banking - Non-Billpay Customers	+12%	+41%*	+19%*

* denotes significantly different from average population at p<.1 or better

Analysis: Customers who use PC banking are more attractive.

Table B.2. Predictors of Profitability

	No Controls	Demographics	Products & Demographics
Use Billpay	48.2*** (13.8)	53.1*** (15.4)	24.2* (13.9)
Use PC but not Billpay	11.5 (24.2)	16.2 (24.3)	-13.3 (22.0)
Duration of customer relationship (month)		.211*** (.0733)	.0534 (.0673)
Ownhome		9.87 (29.37)	-3.24 (26.4)
Married		3.32 (13.8)	-11.9 (12.4)
Age Controls		Jointly Significant	Jointly Significant
Income Controls		Jointly Significant	Jointly Significant
Checking Acct.			87.7*** (9.72)
Other Deposit			37.7*** (7.26)
Investment			4.39 (4.70)
Home Loan			178.5*** (14.8)
Other Loan			17.1* (10.2)
N (households)	1662	1662	1662
R^2	0.74%	5.97%	24.2%

**** - p<.01; **- p<.05; *- p<.1*

Analysis: PC banking (billpay) customers more profitable; half of this effect is due to greater product usage and not necessarily more favorable demographics.

Table B.3. Profit Effects of Customers Who Started as PC Banking Customers

(Note: only 4% of customers started w/ PC banking)

	No controls	Demographics	Products & Demographics
Started w/ PC Banking	-45.9 (33.8)	-1.53 (34.14)	32.4 (30.7)
Duration of customer relationship (month)		.208*** (.0743)	.0534 (.0673)
Ownhome		10.02 (29.5)	-3.24 (26.4)
Married		3.27 (13.8)	-11.9 (12.4)
Age Controls		Jointly Significant	Jointly Significant
Income Controls		Jointly Significant	Jointly Significant
Checking Acct.			88.5*** (9.72)
Other Deposit			37.7*** (7.27)
Investment			4.45 (4.70)
Home Loan			181.1*** (14.8)
Other Loan			16.9* (10.2)
N (households)	1662	1662	1662
R^2	0.11%	5.27%	24.0%

**** - p<.01; **- p<.05; *- p<.1*

Analysis. Although small sample makes it difficult to draw conclusions, no evidence that PC banking attracts unusually profitable customers because they are newer customers and newer customers are less profitable. However, results suggest that compared to customers with same product utilization, they may be slightly better.