A STRATEGIC FRAMEWORK FOR THE EVOLUTION OF INFORMATION TECHNOLOGIES

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Over the last decade, information technology (IT) has transformed resource use, business practices, and market competitiveness in numerous industries. To better understand IT's evolution and influence, we have developed a four stage strategic management framework that describes the dynamic processes by which IT applications enable functional or activity integration within firms as well as effects on cooperation between firms (Cloutier, et.al., (1998). These four stages are identified as automation, representation, interaction, and integration. This framework extends several strategic management concepts to explicitly distinguish the roles of IT in the existing marketplace versus the potential marketspace. The marketspace concept recognizes the potential for electronic communications to destroy existing geographically defined marketplace dimensions.

Although a powerful framework, implementation of the framework by itself is less than satisfactory because the full implications of the dynamic elements within and across stages cannot be adequately described with words alone. In this paper we describe how system modeling concepts can be employed to dynamically operationalize the framework. This paper will describe the proposed framework and provide conceptual support for its development. Use of influence diagrams to document the dynamics of information technology adoption in two very different applications: the Canadian financial services industry and the US agribusiness sector, will be illustrated

The remainder of the paper is organized into three major segments. The first focuses on understanding of the strategic issues associated with adoption of information technology. Prior work in this area is reviewed. A strategic framework is proposed and applied in the context of two differing industries. The paper's second major section employs system dynamic concepts to examine the dynamics integrated into the strategic framework. Strategic implications are examined that result from explicit identification of these dynamic relationships. The paper concludes with a discussion of future research potentials inherent in this application of system dynamics to the important issues associated with evaluation of the adoption of information technologies in society.

AN INTEGRATED STRATEGIC FRAMEWORK

This section of the paper focuses on strategic management issues associated with implementation and evaluation of IT in business settings. Relevant strategic management concepts are first briefly reviewed and critiqued. The strategic framework proposed in this paper is then presented. The final component of this section of the paper applies that framework within two industry settings.

IT Adoption and industry transformation: Evidence suggests that firms create value from IT enabled transactions by enhancing interactions with suppliers, customers and final consumers (Glazer, 1993; Parker, 1996). Innovative firms across numerous industries have mobilized knowledge-based strategic assets and competencies in their quest for added value and better returns in the fast growing IT enabled global economy. One such asset is the ability for firms to use IT to convert information into strategic knowledge from which economic quasi-rents can be created and at least temporarily maintained. This ability allows firms to move from bulk, or physical markets, to knowledge-based customization of products and services which satisfy specific, unmet consumer needs. Such economic quasi-rents do not last forever, particularly in global markets where the business environment typically is dynamic. Conceptually, therefore, one of the most significant assets a firm can build is an IT infrastructure tightly connected to knowledge-management practices. This capability can foster the firm's ability to learn and manage change by converting the information it collects, processes, shares, and translates into valuable knowledge. This capability should allow firms to identify strategic responses that both maximize market opportunity and minimize information and knowledge risks associated with changes in the business environment.

Although IT enabled firms are leading the way towards knowledge-based strategic loci that rapidly transform business practices and market competitiveness (Parker, 1996), there is little work on the underlying mechanisms that drive firm competitiveness in such settings. IT adoption and knowledge-based management are activities emerging from a firm's need to reduce information and knowledge risks and from uncertainties associated with the management of shifting strategic boundaries in a fast changing business environment. This paper contributes to research in strategic management by suggesting a conceptual framework and tools for empirical inquiry that are consistent with an emerging dynamic theory of strategy (Porter, 1994, 1996; Rumelt *et al*., 1994).

The research framework employed in this paper formalizes and extends the notions of market*place* and market*space* introduced by Rayport and Sviokla (1995) and applies them to two industries (financial services and agribusiness) that are in many ways dissimilar but are both undergoing IT enabled strategic change. The expression market*space* is used to distinguish the value generated by IT supported, or digitized, knowledge-based customized transactions, in contrast to physical bulk transactions conducted in the market*place* (Henderson and Venkatraman, 1993). The literature indicates that participants in the global marketspace are characterized by their ability to design knowledge-based product and service portfolios (Leonard-Barton, 1995; Nonaka and Takeuchi, 1995) and are able to respond quickly to the complexities of shifting customers/supplier relationship structures (Cash *et al*., 1994; Goldman *et al*., 1995; Keen, 1996; and Moore, 1996). Individual members of a customer/supplier relationship must manage the frontier between the physical and the digital realms through and across value chains. This requires moving the firm's strategic loci to define dynamic paths in a search for a changing strategic fit with the business environment.

The transition from bulk markets to knowledge-based customization of products or services is no longer strictly confined to traditionally digitized activities such as found in the banking industry. Although firms in the banking and agribusiness sectors offer distinct product and service portfolios, both these industries use IT in the strategy process to capture economic value by customizing products and services (Lejeune and Roehl, 1996; Streeter *et al*.,1991). Indeed, IT enabled activities allow both farm input suppliers and financial service providers to learn from information feedback to their own operations and to formulate and implement strategies to better align with their business environments.   The two industry settings do differ in that adoption of IT is a relatively recent and emerging phenomena in the agribusiness sector. Conversely, extensive implementation of IT has a longer history and already has led to considerable change in the banking industry. One of the reasons that these industries were selected for comparison is the relatively differing experience levels with IT adoption they exhibit.

Well known forces have driven banks into the developing online market, where consumers carry out transactions from ATMs, home, and on the Internet. These activities allow a bank to capture large flows of data from its own transactions and analyze them on a household basis to better tailor services to individuals customers' financial needs. Although perhaps less familiar, a parallel development to online services and intensive use of IT infrastructures is occurring in the agricultural sector. These parallels are depicted in Figure 1. IT adoption in agribusiness often is referred to as 'precision agriculture' (National Research Council, 1997). In that sector, emerging services make use of IT infrastructures such as global positioning satellite-based location identification, "smart" monitors and control devices, remote sensing and visual imaging, in-process yield monitors, and geographic information system-based analytical techniques. These technologies have the potential to meet managers' needs for crop management information at unprecedented levels of detail, moving decision making capabilities from the geographic scope of entire farms or fields to that of a hectare, acre or even square foot basis.

Figure 1. Financial Services and Agribusiness Industries Parallels in IT Implementation

Industry	**IT-based Product and Services Suppliers**	**Consumers for IT-based Products and Services**
Financial Services	Banks, Insurance	Clients of Financial Institutions
Agribusiness	Farm input and service suppliers for precision agriculture	Agricultural producers

An integrated framework: The role of IT in knowledge management is not explicitly part of the Nonaka and Takeuchi (1995) theory of knowledge creation nor the Itami and Roehl (1987) notions of invisible assets. However IT linkages are essential when firms automate to better track consumers and their consumption patterns. The same links are at work when firms deploy IT applications to bring information, models and rules to decision-makers. Further, IT applications are critical to the enabling of decision-makers and professionals to communicate, work in teams, socialize and produce new explicit knowledge. IT applications also can be integrated directly within devices or services (the smartcard in the financial services and the soil analysis performed for a farmer connected to the lab through the Internet) to create additional value.

IT investment, by itself, does not fit well the criteria of the resource-based view (RBV) of the firm (Collis and Montgomery, 1995). IT resources are easily imitable and there is no guarantee that the firm can maintain the value created through IT investments. The consumer, the supplier or the distributor may capture a great deal of the created added value. IT is, however, a powerful transformation enabler if harnessed with other capabilities such as a process-based organization, a people-centered organization, and a client-oriented philosophy. As documented by Powell and Dent-Micallef (1997), IT applications best produce retainable value when deployed with complementary human and business resources.

As a framework to better understand IT's evolution and influence, we propose a four stage framework that describe dynamic processes by which IT applications enable functional and/or activity integration within and among firms. Combined with the Rayport and Skviola (1995) notions of marketspace and marketplace, these IT enabling stages, namely automation, representation[1], interaction and integration, are specified and defined in the transaction matrix in Figure 2.

[1] According to Herbert Simon (1969 :153) : "/…/ solving a problem simply means representing it so as to make the solution transparent."

Figure 2. Strategic Framework for IT-Enabled Processes that Combines Transaction Type and Market Perspective.

Transaction Type	**Market*place***	**Market*space***
Bulk	*Automation:* The use of IT to build transactional systems and to process business data triggered by events.	*Integration:* The direct embodiment of IT capabilities within products/services connected electronically to suppliers.
Knowledge-based	*Representation:* The capture and processing of data to provide information and models to the decision-maker.	*Interaction:* The support, through teleconferencing, electronic and voice mail, and teamwork systems for human cooperation, communication and collaboration.

Application to financial services and agribusiness industries: This section briefly illustrates application of the framework of Figure 2 to the financial services and the agribusiness industries. The examples introduced below describe how firms in two distinct reference industries are deploying IT applications within the context of the automation, representation, interaction and integration enabling stages.

The financial services industry:

In the 1960s, banks invested in large data centers to automate their transactions and to produce information (delivered as printed reports) for decision-makers throughout the organization. At the time, the notion of a market was primarily physical and determined by location and population density. ATMs were a first attempt to automate the customer's interface (the upper left quadrant of Figure 1). Banks began moving – with a physical world mindset – toward electronic transactions. Under the fear of US competitors attacks on their markets, Canadian banks decided to link their ATMs networks through a consortium called INTERAC

(Lejune, 1994). In the 1980's, retailers installed ATMs and point of sales devices inside their stores; as retailers began to offer basic banking services such as cash withdrawal. A more recent automation activity is product design automation. As in CAD-CAM manufacturing applications, banks are attempting to quickly design specific products that cut across the areas of banking, insurance and brokerage (Merrill Lynch's Cash Management Account). Today large banks are offering a dynamic mix of more than 350 products to their consumers (Lejune, 1994).

Within the lower left quadrant of Figure 3 are IT applications within the representation category. First came all kinds of printed reports, each branch receiving from the data center 30 or 40 different reports a week. Information system applications were built on a product basis and the information was available in that format as well. Increasingly moving towards knowledge-based transactions, banks attempted to create profiles of customers through development of large relational databases. Traditionally, banks were money movers, facilitating and monitoring bulk transactions in their marketplace, and later globally, through international consortiums. Reports are the routine of that configuration. Facing an increasingly buyer-oriented market, banks are becoming information movers as well as money movers; analyzing and monitoring customers at the block, street or household level. The information precision adds value and the individual customer is the targeted unit of analysis. Huge financial investments, however, are required to construct customer information files and data warehouses allowing financial advisors to instantaneously review customer profiles and to take action (provided that the advisor operates in an open organization where trust and open relationships prevail).

Figure 3. Application of the Strategic Framework for IT-Enabled Processes to the Financial Services Industry

Transaction Type	**Market*place***	**Market*space***
Bulk	*Automation*: transactional systems with electronic customer interfaces (ATMs, POS, product design)	*Integration*: E-commerce; Used by the customer with Quicken software to connect with the transactional systems; smartcards.
Knowledge-based	*Representation*: by operation and by product (a report by account); real time reporting; customer profile (CIF, data warehouses).	*Interaction*: The promotion of virtual communities (car buyers) to induce specific financial products sales.

Moving to the marketspace, IT has supported key integrative roles (upper right quadrant, Figure 3). In the historic marketplace, the telephone was the standard means of communication. It was used mainly within the organization (e.g. at the headquarters, branches, etc.) while the consumer regularly physically waited in line to meet tellers and conduct transactions. The integration of telecommunications and computers led to new applications through e-mail, voice-mail, computer conferencing, and videoconferencing; making it more feasible for teams to work (asynchronously and synchronously) across wide geographic areas.

As the marketspace evolves, all above mentioned IT applications are becoming adapted to Internet networks and protocols linking banks directly to customers and consumers. This interaction-based world (lower right quadrant, Figure 3) is emerging where a community of customers can easily interact through the Internet or on the phone between themselves and with financial advisors accessible on a 24-hour basis. The bank's new challenge is to facilitate and monitor transactions in real time. In fact several banks are becoming truly virtual (such as the Mbanx, a subsidiary of the Bank of Montreal). In the physical world, the decision-maker waited two days, two weeks or sometime two months for summary reports that were the basis for informed decisions. In the marketspace, business reporting, computer modeling and decision-making are real-time processes because change can occur very quickly. Real-time interaction controlled by individual customers enables timely decisions based on continuously updated information and models.

The agribusiness industry:

The evolution by which adoption of IT has altered the landscape in the banking industry is relatively well developed because of the more extensive experience that industry has had with the use of IT. Therefore it is instructive to apply the conceptual framework to an industry with a relatively short experience with these technologies.

The agribusiness industry is a substantial component of the US economy, with production agriculture being a significant earner of foreign exchange earnings. The US agricultural system has a history of relatively rapid adoption of technology. In only the last few years, however, are advanced uses of IT being recognized as potentially relevant for production agriculture. These innovations are described by several terms, with the phrase "precision agriculture" often used to describe the entire package of techniques and applications being explored (National Research Council, 1997). One aspect of precision agriculture is the application and monitoring of production practices within farm fields. The second aspect is the application of advanced electronic communications to facilitate business interactions between agricultural producers and their suppliers and customers.

Figure 4 extends the conceptual framework to describe the evolution of precision agriculture in a fashion similar to that previously employed for the financial services industry. The upper quadrant of Figure 4 refers to automation in the context of bulk transactions in the marketplace. A key technological development enabling precision agriculture has been the availability during the last decade of Global Positioning Satellite (GPS) signals for commercial use. Within production agriculture, GPS signals are being linked to the large and sophisticated machines used to apply inputs and harvest crops. GPS signals, when linked to computer software within these machines, allow input levels to be varied as the machine operates to better match input amounts to the growth capabilities of varying soil types within large commercial fields. Firms that innovated by offering precision agriculture to agricultural producers gained in market share, as they were perceived to be offering more cost-effective services.

The representation phase (lower left quadrant, Figure 4) is beginning to occur as firms strive to provide knowledge-based innovations within the marketplace. Electronic data capture of input and output data is an almost costless side effect of the application of precision agriculture in the field. Firms are striving to enable their sales force to provide improved customer service using production data regarding the individual producer's operation. Current systems employ Geographic Information System (GIS) approaches to provide multi-layer "maps" of output and input levels as the primary analytical techniques. Again the potential to earn greater market share is a primary driver for supply firms. These techniques also are being used directly by some agricultural producers. Doing so will allow those producers to internalize the knowledge gained to optimize production decisions.

Figure 4. Application of the Strategic Framework for IT-Enabled Processes to Agribusiness.

Transaction Type	**Market*place***	**Market*space***
Bulk	*Automation:* GPS signals linked to the large and sophisticated machines used to apply inputs and harvest crops.	*Integration:* New technology components that are enhancing the customer's ability to learn from the data captured not just on one production unit but across literally thousands of such units.
Knowledge-based	*Representation:* GPS approaches to provide multi-layer "maps" of output and input levels as the primary analytical techniques: correlation analysis software.	*Interaction:* The emergence of virtual communities of producers.

Integration in the marketspace (upper right quadrant, Figure 4) is occurring at both the firm and the customer level. Firms are creating and adopting new technology components that are enhancing the customer's ability to learn from the data captured not just on one production unit but across literally thousands of such units. Although precision agriculture is only in the very early stages of integration, it is clear that there are important potential benefits from such capabilities (Sonka and Coaldrake).

Effective execution of the integration phase will require the creation of capabilities that currently do not exist in production agriculture market system. Vast quantities of data will have to be electronically communicated between customers and firms. More importantly, analytical techniques will need to be employed that can effectively analyze large data quantities collected across business units.

Within production agriculture, a second aspect of marketspace integration relates to the agricultural producer employing these same information technologies to provide added value to their customers. Increasingly consumers are interested in attributes of their food supply that are determined by production practices at the farm production level. Examples include produce that can be certified as organic or from specific genetic stock. Producers can employ the same technologies used to more precisely apply inputs as part of certification schemes for their customers (Thompson and Sonka).

Because of the relatively recent adoption of precision agriculture, interaction of knowledge-based transactions in the marketspace can be imagined but commercial instances are rare (lower right quadrant, Figure 4). Armed with data and the ability to electronically interact with customers, firms can be expected to allow each customer to assist in the "design" of product/service offerings that best meet each customer's needs. Similarly customers can be expected to demand such access. An interesting potential within agricultural production is the opportunity for agricultural producers (as IT customers and users in this case) to strive to create the capability to interact among themselves overcoming the small scale of individual farm units.

OPPORTUNITIES FOR SYSTEM DYNAMIC APPLICATION

The integrated framework introduced in Figure 2, and case applications to the financial and agribusiness industries, in Figure 3 and 4, provided an inherently dynamic perspective of the changing and evolving roles of IT in the context of industries where traditional strategic boundaries are shifting. Therefore estimation of the potential net benefits from investing in IT and evaluation of the net benefits from IT innovation, whether by managers or analysts, are difficult. Static indicators and methods, such as net present value or cost/benefit analyses, are limited in their applicability. Therefore, in addition to a dynamic framework for IT evaluation, the need exists for conceptual and empirical methods that can be employed by both managers and analysts (Porter, 1994, 1996).

This section describes results of an ongoing research effort to apply system dynamic concepts to the four stage framework presented in the preceding section. First a brief review of the challenges inherent in evaluation IT implementations will be presented. Then, influence diagrams will be presented examining the dynamic aspects of IT implementation employing the paper's four stage framework.

Evaluation of IT effectiveness: The strategic management literature emphasizes that competitive pressures are pushing managers to continuously learn as a vital component of the strategy formulation and implementation process (Mintzberg, 1994 The capture of economic value from the management of details (Porter, 1994) in the execution of functions, given the systemic pressure that regulates the rate of learning (Senge, 1990) and the accumulation and depletion of knowledge stocks, has been stressed in the emerging literature regarding the dynamic theory of strategy. Therefore these aspects should be incorporateable within dynamic investigations of IT implementation.

Despite numerous attempts, success in evaluating net benefits of IT investment has been limited. Strassmann (1997) indicates that measurements of the return on investment for IT investments in the US over the last 15 years indicate returns of about 1%. However investments in IT in the US each year amount to half the world's IT investments in dollar terms (recently around $500 billions). Continual investment at these levels seems inconsistent with obtaining such a low rate of return, assuming anything close to economically rational manager behavior.

These types of results are sometimes labeled the IT paradox effect; the more you invest in IT, the more per capita productivity lags behind, especially in service intensive industries (Roach, 1992?). In a recent article, Hitt and Brynjolfsson provide an analysis purported to end the IT paradox. However, Strassmann questions data, methods and results of that work, raising concerns that Hitt and Brynjolfsson considers only IT dollars invested in hardware. In so doing, hidden costs in telecommunication infrastructure, networks, software, maintenance, learning and employee training, and inefficient time use during transition periods are not considered even though they typically are significant in microcomputers deployment.

Controversy and mixed signals from analyses of IT deployment, such as those just identified, are typical. Generally done with secondary data at the macro or industry level, the results of such work are likely to be inconclusive. As demonstrated in the integrative framework presented in this paper, all IT deployments are not equal either in terms of their purposes or of the measures useful for evaluation. More micro-level analyses are needed that focus on the specific purposes of IT deployment and employ the most appropriate measurement tools consistent with those purposes. In other words, a dollar spent with the goal of automation in the marketplace (as discussed in Figures 2 to 4) is likely to have a very different pattern of returns and require a differing mix of complementary resources than a dollar spent to achieve a goal of interaction in the marketspace. In addition, it is important to be able to consider the compound effects of investing in and across the four quadrants.

Dynamic synthesis: In this section we develop the approach we are using to build an integrated model linking IT investments enabling (automation, representation, interaction and integration) organisational transformation. A dynamic model of strategic IT application should explicitly detail the underlying mechanisms of time, space, and change (Bunge, 1979). Conceptually and empirically, the system dynamics approach offers promise because of its capability to explicitly capture complex causal interactions, delays and feedback loops within a system (Forrester, 1994; Morecroft and Sterman, 1994).

System dynamics is not a new tool (Forrester, 1961) having been employed for decades in the study of complex systems. System dynamics, based on mathematical synthesis of dynamic systems methods (Porter, 1969), as a core of well-defined principles for problem-solving in management was first proposed with its current emphasis by Forrester (1961) in *Industrial Dynamics*. The early system dynamics methodology developed by Forrester combined operations research and electrical engineering analogs, some of which were previously used in a series of economic studies published in *Econometrica* during the 1952-53 period (see Herbert Simon (1955)). Although inherently flexible in its application, the dominant empirical application of system dynamics gained wider acceptance for natural and biological systems applications.

In recent years, however, the managerial applications of system dynamics have gained momentum (Morecroft and Sterman, 1994; Senge, 1990). This renewed interest in the method is likely the result of computational advances that provided manager's access to quantitative usable results of complex computations and the growing realization of the systemic nature of managerial decision making. The approach has evolved by striving to incorporate researcher and decision maker mental maps (based on firm and industry experience and knowledge) to address strategic problems in their entire complexity (Hall *et al*., 1994). Tacit knowledge can be made explicit by articulating and elucidating aspects of individuals' experiences, prospects, and mental models (Nonaka and Takeuchi, 1995). Economic theory, data, empirical results, experience and decision makers' mental maps based on experience of firm-level strategy problems can be integrated in a dynamic system of interconnected information functions and behavioral loops.

The process of building a system dynamics model is to explicitly interrelate the conversion, accumulation, and transition of stock or levels of resources (knowledge, capital, inputs, upstream outputs, etc.) from one state to another. Resources fluctuate between levels following rates of conversions that are control variables which have a direct influence on the depletion of inputs (e.g. raw materials) or accumulation of outputs (e.g. knowledge). The rates of conversion are interconnected through balancing and reinforcing feedback loops that regulate the accumulation or depletion of stocks. For example, producing a given product might deplete raw material but would increase the level of knowledge that was acquired in the process. Time delays are accounted for by specifying stages necessary to transform resources and feedback within the structure. As stressed by Forrester:

> Symptoms, action, and solutions are not isolated in a linear cause-to-effect relationship, but exist in a nest of circular and interlocking structures. In such structures an action can induce not only correction but also fluctuation, counterpressures, and even accentuation of the very forces that produced the original symptoms of distress. All changes takes place within the control of feedback loops. Growth, decline, goal-seeking, and oscillation re a consequence of feedback loop dynamics (Forrester, 1994, p.54).

As defined conceptually and then illustrated for the financial services and agribusiness settings, firms investing in IT can be pursuing markedly differing goals and striving to achieve very different outcomes depending upon where the initiative fit within the conceptual frameworks four stages. The settings are dynamically differentiated, particularly in terms of feedback interrelationships within the firm and with customers and of time lags between initiation and effects. Therefore each of the four stages should be carefully assessed relative to its underlying circular and interlocking structures (as noted by Forrestor above). In the next two sections, influence diagrams for the automation and the representation stages will be presented and described. {Space limitations preclude examination of the integration and interaction stages in the current version of this paper.}

Automation:

An influence diagram depicting the key causal forces and feedback loops for the automation stage is presented in Figure 5. A natural starting point for this depiction is with the profit margin box in the center of Figure 5. Over time, managers are presumed to perceive that there is value to be gained in use of IT tools in automation. This perception could be as a leader in technology adoption in the industry or in response to competitor innovations. As shown in loop B1 of Figure 5, this perception results in an increase in the desired level of IT capability and then to investment in IT automation. The immediate response is a negative effect of that investment on profit. As indicated in loop R1, however, greater automation capacity leads to a reduction in the number of employees, and therefore on payroll. This effect is positive for profit margins.

As customers respond to automated access the volume of those services should increase (loop R2), especially if customers experience a convenience benefit from the automation. Transactions margins from automated services increase profits with an increasing volume of transactions. The accumulation of transactions data generally leads to the realization, over time, that there is value to be gained in the management of the transactions data. As standardized platforms for database management become available, the use of the accumulated transactions data adds to profit margins.

The dynamics of automation emphasize initial investment outlays being offset by initial reductions in labor force and from the margins earned from an increasing number of automated transactions. Over time, additional value from management of the transaction data based created is recognized and earned.

Representation:

Figure 6 contains an influence diagram for the representation stage of the framework. In a fashion similar to that of Figure 5, manager's perception of a positive linkage between profit margins and the value of customer information is a starting point for the dynamics of adoption. Again the result of this perception (B1) is an increase in investment leading to a decline in profit margins. The effective use of tools to enhance customer value requites a number of responses within the firm, that don't necessarily involve a reduction in workforce numbers. Instead changes within the organization's culture and value creation are required. These lead to an enhanced and altered set of knowledge and skills relative to products, services and customer needs. The direct effect of this expanded knowledge base is to provide customer access to customized services. Redefinition of customer/employee relationships, which take advantage of IT capabilities, lead to information based customization of products and services. The combined effect of these elements is an increase in profit margins through transaction margins, enabled by the employment of IT resources. A feedback effect of these influences is an increase in automated transaction volume which further accelerates the desire for expanded investment in IT.

In contrast to the dynamics of the automation stage, there are very differing motivations and influences in the representation stage. The increase in automated volume is driven by additional customer service and redefinition of the customer/employee interface whereas in the automation stage reduced payroll expenses are a major source of the benefits to be gained.

CONCLUSION

IT enabled firms have led the way towards knowledge-based strategic loci that rapidly transform business practices and market competitiveness (Parker, 1996). However, there has been surprisingly little work on the underlying mechanisms that drive firm competitiveness in such settings. This paper contributes to research in strategic management by advancing a framework to broaden our understanding of the mechanisms associated with shifting strategic boundaries across industries and by suggesting an approach to empirical analysis in these circumstances that is consistent with an emerging dynamic theory of strategy.

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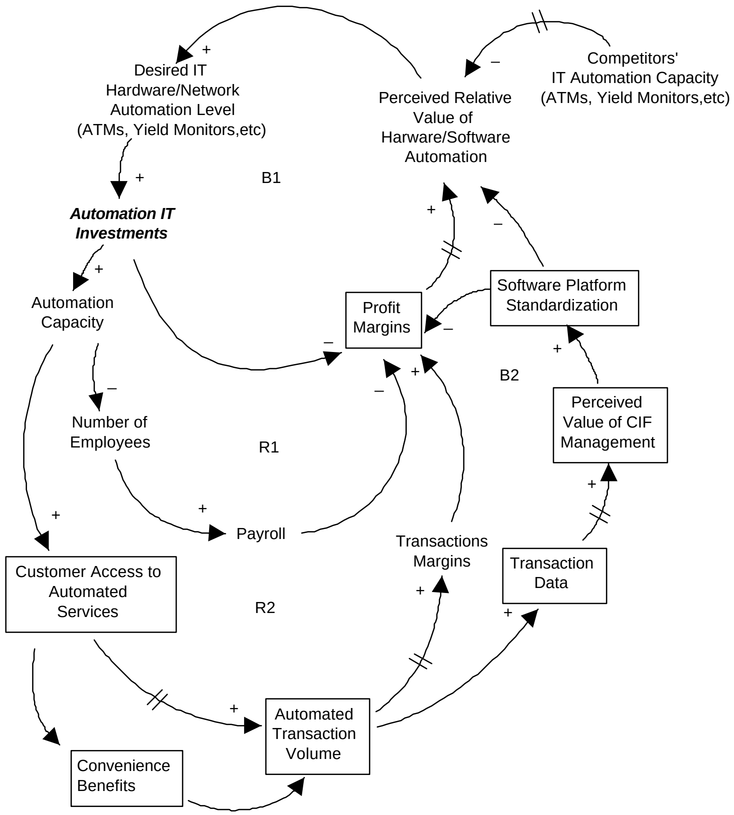

Figure 5. Influence diagram for the dynamics of the automation stage.

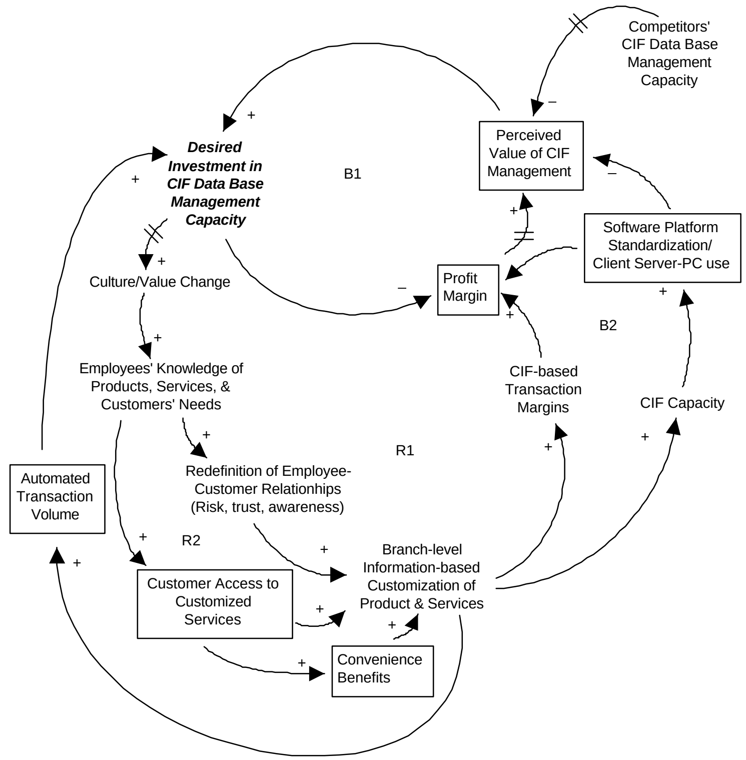

Figure 6. Influence diagram for the dynamics of the representation stage.