

Information Technology and Its Role in Creating Sustainable Competitive Advantage

Gary Lavon Grant, J.D., Attorney-at-Law

**M. Todd Royle, Ph.D., Department of Management and International Business, Langdale College of Business,
Valdosta State University, Georgia, USA**

INTRODUCTION

Of the many studies that consider the contributions of Information Technology (IT) to the success of organizations, the vast majority conclude that IT cannot be considered a source of sustained competitive advantage. Nevertheless, the literature sets forth numerous examples of IT facilitating innovation, improving efficiency, and exhibiting other characteristics that are established indicators of sustained competitive advantage. How then can these examples be reconciled with the numerous findings that IT is not a source of sustained competitive advantage? As set forth below, within the realm of IT, a clear dichotomy has emerged between “Advantages” and “Sustained Advantages.” The question then becomes to what extent are the advantages of IT sufficiently valuable and apparent so that investment in IT resources will occur even if the advantage cannot be sustained.

Information Technology (IT) is defined as "any form of computer-based information system, including mainframe as well as microcomputer applications." (Orlikowski and Gash, 1992, pp. 2) For the purpose of this paper, IT will be viewed as a resource consisting of the aggregate ability to leverage technology to support the business needs of an organization. IT is used as a general term, referring to Information Technology, Information Systems, and Management Information Systems.

Competitive advantage is a phenomenon that occurs when a firm experiences returns that are superior to those of its competition (rents). Barney (1991) suggests that when these rents persist after competitors have stopped trying to imitate the advantage, sustainable competitive advantage has been achieved. The majority of recent studies on the viability of IT as a source of sustained competitive advantage regard IT as a resource while testing its ability to produce sustained competitive advantage. These studies then conclude that IT is a support function (similar to accounting) rather than a strategically valuable resource capable of producing a sustained competitive advantage. In this paper, however, we argue that such studies are fundamentally flawed in their approaches. Indeed, if IT is to be classified as a mere support function, then it should be viewed as no more than a tool for augmenting the appropriateness, or rent generating potential, of other resources. The current paper proposes that IT should instead be viewed as a moderator, augmenting the effect of information dependent resources on sustained competitive advantage. Furthermore, the paper proposes that firms which concentrate their IT efforts on enhancing the benefits realized from information dependent resources will experience greater rents (the source of sustained competitive advantage) and/or improved sustainability of those rents.

This paper is freighted with implications to managers faced with resource allocation decisions, in that it recommends that IT resources be directed at the information dependent resources that are acting as the source of the organization's sustained competitive advantage. Further this paper enriches the resource-based view by dividing the sustained competitive advantage construct into two components--advantageousness and sustainability. Finally, this paper contributes to the debate regarding the potential of IT to generate sustained competitive advantage by proposing that IT's greatest contribution stems from its moderating effect on information dependent resources.

LITERATURE REVIEW

Information Dependent Resources

Simerly (2002) stated that “[t]he core competence of any organization is the knowledge of its people.” Moreover, Miller and Shamise (1996) identify knowledge-based resources as those whose value is dependent on the talent embedded in the organization’s human capital. These resources produce value because they create causal ambiguity, which limits their competitor’s abilities to mimic the processes that add flexibility to the operations of the organization. Knowledge-based resources thus trade off specificity, or certainty, for flexibility. Such resources might not possess the concrete or immutable nature with which an organization might feel most comfortable; however, those organizations possessing truly talented human capital also possess the potential (albeit sometimes untapped) to utilize that capital in truly innovative fashions that can produce a competitive if not sustainable advantage.

In the spirit of knowledge-based resources, the present paper defines information dependent resources as resources whose value depends on the ability of the organization to move large quantities of codifiable information between individuals and systems. Examples of information dependent resources include: supplier and buyer relationships, in which coordination and an accurate interface are determinants of successes; marketing research, which requires precise definition information needs as well as tools for data mining; and the top management (decision making) team, where accurate and properly formatted information is necessary for effective problem solving. Now that information dependent resources have been properly identified and defined, this paper will review the debate among IT and strategy researchers about the potential of IT to create sustained competitive advantage.

The Productivity Paradox

The field of Management Information Systems (MIS) research has been fueled by its desire to portray IT as a resource capable of producing sustained competitive advantage. An examination of case studies of organizations that have leveraged IT reveals a variety of improved efficiencies, communications and capabilities stemming from the IT initiative. It is no surprise then that early writers in the field, employing only case studies and anecdotes in lieu of empirical research, strongly believed that IT was a source of competitive advantage.

For example, Ives and Learmonth (1984) posited that if IT is used properly (in conjunction with awareness of the Consumer Resource Life Cycle to establish a niche, differentiate, or move into a position of low cost provider) then a competitive advantage can be attained. Numerous examples of firms realizing considerable relative enhancements subsequent to investments in IT are cited; however, conditions are not controlled, no attempt at measurement is made, and there can be no certainty that the advantages realized are due to IT alone.

McFarlan (1984), utilizing Porter’s 5 competitive forces (Porter, 1980), asserted that IT has changed the composition of entire industries by adding barriers to entry, building switching costs, and redefining critical success factors. Porter and Miller (1985) contended that IT can create competitive advantage by changing the distribution of cost drivers (in effect lowering costs), providing a new dimension on which to differentiate, and expanding markets to include the entire world. While Porter and Miller (1985) suggested steps for managers to follow, they did not support their contentions with empirical evidence. Additionally, Johnston and Vitale (1988) linked the efficiencies, differentiation advantages, and increased switching costs derived from Interorganizational Systems directly to bargaining power and to competitive advantage. They, too, had no empirical support for their conclusions. In sum, while many early studies posit that IT can indeed create competitive advantage and in a variety of ways, none cited empirical support for their conclusions.

Inconsistencies and the Explanation

As researchers began to question the extent to which IT actually affected performance (especially in comparison to other organizations), they made some surprising discoveries. Indeed, many studies from 1986 through 1994 showed that there was little measurable effect of IT on relative firm performance (Clemons (1986), Banker and Kauffman (1988), Floyd and Wooldridge (1990), Mahmood and Soon (1991), Kettinger et al. (1994)). Such findings seem

shocking indeed given the near universal praise heaped upon IT as a creator of competitive advantage in the earlier studies.

Interestingly, Brynjolfsson and Hitt (1996) conducted an empirical study showing that the marginal product for computer capital averaged an incredible 81% for the firms that they sampled. Such a finding would at first glance seem to directly challenge the conclusions of the earlier empirical studies cited above; however, the finding is suspect, owing to the inappropriate use of data pooling and failure to include infrastructure expenses in the computer capital independent variable (such as networking equipment). Such expenses have a high cost and low marginal return, and neglecting to include them will artificially inflate overall marginal return. In any event, regardless of methodological problems, Brynjolfsson and Hitt (1996) failed to show a relationship between IT spending and *relative* competitive advantage.

Nevertheless, convinced that IT represents a resource capable of producing sustained competitive advantage, Sethi and King (1994) attempted to construct a mechanism that draws from the works of Porter (1980), Ives and Learmonth (1984), and others to define a construct referred to as "Competitive Advantage Provided by an Information Technology Application" (CAPITA). CAPITA examines the impact of the application of 9 Efficiency measures, 13 Functionality measures, 8 Threat related factors, 6 Perceptiveness factors, and 6 Synergy factors that can be controlled by MIS, and which have been shown to be sources of sustained competitive advantage.

Also attempting to link IT with sustained competitive advantage, Mata, Fuerst, and Barney (1995) used the resource-based view (RBV) as a method to evaluate four contributions of IT to a firm that may lead to a sustained competitive advantage. The trio found, however, that only one contribution--IT management skills--was a source of sustained competitive advantage. As in the studies cited above, the empirical findings seemed counterintuitive: if IT is a powerful and effective tool for improving efficiency in operations and administration as shown by the case studies, then it should be a source of sustained competitive advantage. Time and time again, however, the empirical evidence has shown otherwise.

Many attempts have been made to explain the apparent inconsistency in the IT/Sustained Competitive Advantage relationship. For example, RBV requires that a resource may not be perfectly mobile in order for it to be a source of sustained competitive advantage (Barney 1991). IT, however, is very close to being perfectly mobile. As a result, when an organization takes an IT initiative, it will only benefit from the advantages of that initiative relative to other organizations in that industry for as long as it is the only organization exploiting that innovation. Inevitably, the skill that went into creating and leveraging that technology will permeate into the environment, then become copied, and eventually become a commodity.

The RBV's imitability caveat thus explains how firms can experience significant improvements from IT and still not realize sustained competitive advantage. A number of authors have pointed out, however, that there are significant first mover advantages associated with IT (Pennings & Harianto 1992, Clemons & Row, 1991, Dos Santos & Peffer, 1995). The focus thus becomes the sustainability portion of the concept. As such, the remainder of this paper will assume that competitive advantages have already been realized and identified, and will consider the capacity of IT to augment the advantageousness and sustainability of those existing advantages. Resources that are providing a sustained competitive advantage will be referred to as "strategically valuable resources."

MODEL AND PROPOSITIONS

From the preceding paragraphs, it seems that IT represents a support function in most organizations--not a critical function. Its role can best be conceptualized by drawing a comparison to Accounting, which also represents a support function in most organizations. Accounting is a critical function in organizations whose product itself is accounting; however, in such organizations, the accounting product would be considered part of the Operations function, while the organization's internal accounting would remain a support function. The same is true for IT. IT can be a part of Operations, a critical function, if the product of the organization itself is IT; otherwise, it would remain as a support function.

To draw on the Accounting analogy further, with the exception of very small and focused proprietorships with no ambitions for growth, organizations cannot neglect to conduct accounting. Similarly, organizations which neglect to invest in IT will fail to realize numerous opportunities for improved efficiency and effectiveness, and if they operate in an environment that is even minimally competitive, they will fall drastically behind competitors which do invest in IT. According to Price (1982), in 1982, firms invested more than 1% of corporate revenue into IT. That number grew to 12% in 2001¹ (US Census Bureau, 2003). Firms that do not invest in IT will develop a Competitive Disadvantage. Thus, although IT has little probability of directly producing a sustained competitive advantage, it is nonetheless a necessary investment.

It is true that IT alone may not be a source of sustained competitive advantage; however, the unique characteristic of IT that separates it from mere support functions in an organization is that IT can be used in conjunction with an existing source of competitive advantage to both amplify the advantage and extend its sustainability. Other support functions, such as the ubiquitous Accounting, do not have such moderating effects on strategically valuable resources. These ideas are illustrated in Figure 1 and propositions 1 and 2. For the purpose of this paper, advantageousness is defined as a strategically valuable resource's potential contribution to competitive advantage.

Figure 1: Proposed Research Model

When a resource has become a source of sustained competitive advantage, the rents that it yields come from two sources: the direct impact of the resource on performance, and the impact of the resource moderated by various capabilities. Wade and Hullard (2004) noted that IT researchers have started to delineate between IT assets and IT capabilities. The resources' impacts are mediated by capabilities. This creates an intricate web of cause and effect relationships that ultimately lead to performance. While the resource itself is the largest driver of performance, its value is augmented by the presence of the capabilities, which can include, inter alia, capacity of distribution channels, a dynamic culture that embraces innovation, and IT capabilities.

Strategically valuable resources will benefit the most from both existing IT capabilities and investments in IT innovations when the resource is information dependent. This is because IT is best suited to collect, summarize, store, move and format large quantities of data and information both quickly and accurately. These qualities of information (quickness, accuracy etc.) have the greatest direct impact on information dependent resources, which will have the greatest impact on rent generating potential if the resources are strategically valuable.

Studies have pointed to a number of organizational resources that lead to sustained competitive advantage. Table 1 lists three information dependent resources that can potentially be augmented by investments in IT. Proposition 1 provides a general outline of the moderating effect of IT on the relationship between strategically valuable resources and firm performance.

¹ However, spending on IT decreased for the first time in 2001.

Table 1: Resources Whose Advantageousness is Augmented by IT

Resource	Why Potential for SCA?	RBV Study	Capability of IT	IT Study
Top Management Team Homogeneity in Stable Environments	Efficiency is a critical success factor in stable environments, and homogeneous top management teams make decisions faster and with more confidence, improving efficiency	Hambrick, Cho, & Chen (1996) Stalk (1988)	Electronic Meeting Systems allow management teams to consider a diverse set of alternatives, while leaving the homogenous structure in place.	Dennis, et al. (1988)
Top Management Team Heterogeneity in Dynamic Environments	The diversity of perspectives inherent in heterogeneous top management teams leads to better decision making and adaptability.	Murray (1989)	Group Decision Support Systems speed up and improve the quality of decision making, facilitating first mover advantage.	Zigurs et al. (1988), Watson et al. (1988)
Supplier/Buyer Relationships	Close relationships with suppliers and buyers reduce transaction costs, and benefit both parties	Powell & Dent-Micallef (1997)	Electronic Data Interchange is a powerful tool for creating efficiencies and encouraging collaboration throughout the supply chain.	Johnston & Vital (1988)

Based on the foregoing, we make the following proposition:

Proposition 1

The more information dependent a firm's strategically valuable resources, the greater the positive effect that IT will have on the advantageousness of the resource.

Barney (1991) cites imitation as the largest threat to the sustainability of a competitive advantage. Barney (1991) identifies three impediments to imitation: causal ambiguity, unique organizational history, and social complexity. The intricate web of cause and effect relationships alluded to previously, along with the dynamic nature of IT, creates causal ambiguity, which limits imitability. IT both adds to this web, and because of its dynamic nature, causes the web itself to change in form frequently, which accentuates the moderating effect of causal ambiguity on imitability. To bridge these ideas, causal ambiguity mediates the relationship between IT and the sustainability of the advantages realized from strategically valuable resources. Note that proposition 2 does not require that the strategically valuable resource be information dependent.

Based on the foregoing, we make the following proposition:

Proposition 2

Information Technology, mediated by Causal Ambiguity, will increase the sustainability of a strategically valuable resource.

In addition to the mediating effect of IT on sustainability through causal ambiguity, IT can be leveraged to moderate the relationship between the strategically valuable resources and the sustainability of the advantage created by those resources. This is particularly true if the strategically valuable resource is information dependent. One of the most powerful ways to use IT to augment the sustainability of a resource, is to create an innovative and efficiency producing system that transcends the boundaries of the organization, use that system to lock in stakeholders external to the organization, and create switching costs for them. This way, even if the system is copied, the probability of losing one's advantage is mitigated by the switching costs for the members of the supply chain.

Studies have pointed to a number of organizational resources that lead to sustained competitive advantage. Table 2 lists three resources whose sustainability can potentially be augmented by investments in IT. Proposition 3 provides a general outline of the moderating effect of IT on the relationship between strategically valuable information dependent resources and the sustainability of above average rents.

Table 2: Resources Whose Sustainability is Augmented by IT

Resource	Why Potential for SCA?	RBV Study	Capability of IT	IT Study
Trust	Difficult to produce and to copy, however not durable, dependant on perception of buyers. Can be CSF when internet transactions take place.	Conner (1995), Hall (1993)	Proactive investments in technological security build trust among customers.	McKnight et al. (2002a), McKnight et al. (2002b)
Employee Know-How	It represents the foundation upon which processes are developed and tools are used. Problem: highly mobile	Simerly (2002)	Knowledge Based Expert Systems allow organizations to capture and access their employees' knowledge.	Finlay (1992)
Supplier/Buyer Relationships	Close relationships with suppliers and buyers reduce transaction costs, and benefit both parties	Powell & Dent-Micallef (1997)	Electronic Data Interchange locks buyers and suppliers into relationships, creating switching costs for both parties.	Clemons & Row (1992),

Based on the foregoing, we make the following proposition:

Proposition 3

The more information-dependent a firm's strategically valuable resources, the greater the effect IT will have on the advantageousness of the resource.

IMPLICATIONS AND FUTURE RESEARCH

This paper carries the implication that practitioners, when faced with decisions about IT resource allocations should consult with top management to determine which resources are currently providing their firm with a sustained competitive advantage. From this list, IT resources should be allocated to support those resources that are considered information dependent. Such a resource allocation strategy can be expected to augment the advantageousness and sustainability of the benefits realized from those resources.

This paper also carries implications for researchers. When studying IT in terms of sustained competitive advantage, it is important not to regard IT as a resource that is independently capable of generating a sustained competitive advantage, but rather as a tool for augmenting the effects of other resources-- particularly those that are information dependent. Future researchers may want to consider other types of resources on which IT has a major impact. In addition, when utilizing the resource-based view to evaluate any of a number of resources, researchers should consider the effect of the resource on both the advantageousness and the sustainability of the benefit realized from the resource. The major limitation of this study is that it only considers one of several possible resource types (information dependent resources) that can potentially be impacted by IT. In addition, the ideas presented will only have a significant impact on organizations when the resource being considered is already acting as a source of sustained competitive advantage. The use of the present framework assumes that firms are able to identify those resources that are providing their competitive advantage.

This paper has considered that a number of information dependent resources are sources of sustained competitive advantage, and considered the potential opportunity of using tools of IT to either increase the advantageousness of the resource, or to improve its sustainability. Moreover, the paper has enriched the resource-based view of the firm by dividing the idea of sustained competitive advantage into two components, and considering the effect of moderators on each. It has extended the debate on IT as a source of sustained competitive advantage by arguing that IT moderates the relationship between strategically valuable, information dependent resources and the two dimensions of sustained competitive advantage, as well as arguing the mediating effect of causal ambiguity on the sustainability dimension of sustained competitive advantage. It is hoped that researchers will continue to identify resource types that IT can impact,

and that the information generated as a result of this process assists practitioners in making effective resource allocations.

REFERENCES

- Banker, R., & Kauffman, R. (1988). Strategic contributions of information technology: An empirical study of ATM networks. Proceedings of the Ninth International Conference on Information Systems, pp. 144-150.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99-120.
- Clemons, E. (1986) Information systems for sustained competitive advantage. *Information and Management*, 11, 131-136.
- Clemons, E. & Row, M. (1991). Information Technology and Industrial Cooperation: The changing economics of coordination and ownership. *Journal of Management Information Systems*, 9, 9-28.
- Dos Santos, P., & Peffers, K. (1995). Rewards to investors in innovative information technology applications: First movers and early followers in ATMs. *Organization Science*, 6, 241-259.
- Finlay, P. (1992). IT for competitive advantage: the place of expert systems. *Journal of Strategic Information Systems*, 1, 126-133.
- Floyd, S., & Wooldridge, B. (1990). Path analysis of the relationship between competitive strategy, information technology, and financial performance. *Journal of Management Information Systems*, 7, 47-64.
- Johnston, H., & Vitale, M. (1988). Creating competitive advantage with interorganizational information systems. *MIS Quarterly*, June, 153-167.
- Kettinger, W., Grover, V., Guha, S., & Segars, A. (1994). Strategic information systems revisited: A study in sustainability and performance. *MIS Quarterly*, January, 31-58.
- Mahmood, M., & Soon, S.K (1991). A comprehensive model for measuring the potential impact of information technology on organizational strategic variables. *Decision Sciences*, 22, 869-897
- Mata, F., Fuerst, W., & Barney, J. (1995). Information technology and sustained competitive advantage: A resource-based analysis. *MIS Quarterly*, December, 487-505.
- McKnight, Harrison, D., Choudhury, V., & Kacmar, C. (2002)a. Developing and validating trust measures for e-commerce: An integrative typology. *Information Systems Research*, 13, 334-359.
- McKnight, D., Choudhury, V., & Kacmar, C. (2002)b. The impact of initial consumer trust on intentions to transact with a web site: a trust building model. *Journal of Strategic Information Systems*, 11, 297-323.
- Miller, D., & Shamise, J. (1996). The resource based view of the firm in two environments. The Hollywood firm studios from 1836 to 1964. *Academy of Management Journal*, 39, 519-543
- Orlikowski, W., & Gash, D. (1992). Changing frames: Understanding technological change in organizations. Center for Information Systems Research, Massachusetts Institute of Technology.
- Pennings, J., & Harianto, F. (1992). The diffusion of technological innovation in the commercial banking industry. *Strategic Management Journal*, 13, 29-46.
- Porter, M.E. (1980). *Competitive strategy: Techniques for analyzing industries and competitors*. New York: Free Press
- Porter, M., & Millar, V. (1985). How information gives you competitive advantage. *Harvard Business Review*, 65, 149-160
- Price, M. (1982). Still outside the inner circle. *Industry Week*, November, pp. 51.
- Sethi, V., & King, W. (1994). Development of measures to assess the extent to which an information technology application provides competitive advantage. *Management Science*, 40, 1601-1627.
- Simerly, R. (2002). Strategic Management Case Analysis, Part Two: Firm Analysis. Available: <http://www.westga.edu/~bquest/2002/strategic2.htm>
- US Census Bureau, Department of Commerce (2003). *Annual Capital Expenditures: 2001*. Released January 2003, Accessed December 5, 2003. Available: <http://www.census.gov/prod/2003pubs/ace-01.pdf>
- Wade, M., & Hullard, J. (2004). Review: The resourced-based view and information systems research: Review, extension, and suggestions for future research. *MIS Quarterly*, 28(1), pp 107-142.
- Watson, R. DeSanctis, G., & Poole, M. (1988). Using a GDSS to facilitate group Consensus: Some intended and unintended consequences. *MIS Quarterly*, 12, 463-478.
- Zigurs, I. Poole, M., & DeSanctis, G. (1988). A study of influence in computer-mediated group decision making. *MIS Quarterly*, 12, 625-644