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A Resource-based Model for Sustained Competitive Advantage from Information Technology

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The rise of information technology (IT) has driven a great deal of speculation, theorizing, and investigation regarding the potential this technology has for providing companies with competitive advantage (c.f., Clemons & Row, 1988; Porter & Millar, 1985). Both conceptual frameworks and anecdotal case studies have been used to argue that IT can generate competitive advantage by providing easier access to markets, creating product differentiation, increasing customer dependence through prohibitive conversion costs, and providing cost efficiencies. Despite cautions that opportunities to achieve sustainable competitive advantage through IT may be rare (c.f., Clemons and Kimbrough, 1986), IT researchers have maintained that by adopting specific firm strategies and ensuring favorable industrial conditions, sustainable competitive advantage can be achieved (cf. Clemons & Row, 1991; Kettinger, et al., 1994). Their work, shows empirically that, such factors as industry competitiveness, technological and organizational slack resources, and risk management strategies are important determinants of sustained strategic IT outcomes. In contrast, resource-based theorists have challenged the ability of IT to provide a sustainable competitive advantage. In general, resource based theory (RBT) posits that sustained competitive advantage derives from resources that are rare, valuable, non-substitutable, and imperfectly imitable (Barney, 1991).

In this paper, we identify three limitations of the current articulations of the resource-based theory that we believe have made the assessment of the strategic potential of IT problematic. A resource-based model is proposed that addresses these limitations. The potential of the model to identify opportunities for positioning knowledge-based systems (KBS) in service industry for deriving sustained competitive advantage is demonstrated.

Resource-based theory (RBT) rests on the premise that resources controlled by firms are heterogeneous and relatively immobile. Resources that are valuable, rare, inimitable, and non-substitutable provide the basis for sustained competitive advantage measured as economic rent (Barney, 1991). The imperfect mobility (including inimitability and non-substitutability) of resources may be due to a variety of *isolation mechanisms* (Rumelt, 1984). These include co-specialization of assets, unique historical conditions, causal ambiguity, social complexity, and tacit knowledge and skills. Three limitations of the current articulation of the theory are a) a narrow definition of resources that focus

primarily on tangible assets under the firm's control and a lack of attention on resource interactions b) a static perspective that focus on the results rather than on the process of building competitive advantage, and hence non-inclusion of time as a variable c) a lack of a strong working definition of "sustainability" of competitive advantage that account for the dynamics of organizational learning. The model proposed in this paper addresses these limitations by a) defining the concept of resource-bundles that allow different types of resource interactions to be studied b) incorporating time as a variable in the resource interaction equation and c) defining sustainability of competitive advantage based on the time-dependent resource building process.

Porter (1985) defines competitive advantage as "the ability of a firm to earn returns on investment (a resource) persistently above the average for the industry." A firm's resource is broadly defined to include "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm" (Barney, 1991, p101) - in other words a 'resource bundle'. Hence, competitive advantage can be measured in terms of comparative organizational performance along a particular target resource, such as profitability ratios (Clemons & Kimbrough, 1986; Porter, 1985) or market share (Wiseman, 1988), and achieved by manipulating various strategic resources in the resource bundle. The impact on the performance of a target resource can be a function of the firm's resources over time, as infra-structure type resources such as technology and organizational learning exhibit a time-lagged effect on target resources. The resource based model shown below captures the relationship between the target resource at time t and the organization's resource bundle :

$$TR(t) = f\{R1(t), R2(t), R1(t)*R2(t), R1(t)*R3(t), R1(t-1), R2(-1), R1(t-1)*R2(t-1), \dots, Rn(t-n)\}.$$

where,

$TR(t)$ is the target resource at time t ;

$R1, R2..$ are referred to as strategic resources;

$R1*R2, R1*R3$ are quasi-resources that result from the interaction between the strategic resources ($R1, R2$); and $R3$ is an enabling resource, as it impacts the target resource through its interaction with a strategic resource, without it being a strategic resource (i.e. note the presence of $R1*R3$, but not $R3$).

The model defines these different types of resource interactions and describes how target resource at time ' t ' is redeployed to become strategic resources at time ' $t+n$ '. We apply the resource-based model to identify how sustained competitive advantage can be derived from knowledge based systems (KBS) in the service industry.

A service firm is known to maintain its competitive advantage by creating new products (i.e. service options) and providing them with competitive quality. In other words, a service firm remains competitive by influencing one of its target resources: 'service

quality'. Literature in service quality (Parasuraman et. al. 1991) has identified ten determinants for service quality : responsiveness, access, courtesy, security, tangibles, reliability, competence, communication, understanding/knowledge, and credibility. Note that the first five are typically related to the physical environment and service provider's attitude, while the last five deal with the content and delivery of its primary product, the service. An insurance company that wanted to provide competent service to all its customers has reengineered its basic service functions and stored all the needed knowledge associated with these 'generic' service functions in a knowledge based system (Gale, 1993). A hotel chain has captured various customer preferences in a knowledge base and used it provide customized service in the future, thus enhancing its image as an understanding and knowing organization (Turban, 1993). Thus, if each of these strategic service determinants is a part of the resource bundle, a service firm can use KBS technology to manipulate its soft resource (knowledge, capabilities, etc.) to influence these resources for competitive advantage. The target resource can still remain to be the profitability of the firm, determined by the price charged for the service, the number of customers serviced, etc.

$TR(t) = \{ (\text{Reliability, Competence, Communication, Knowledge, Credibility}) * \text{KBS} \}$

A service firm can influence one or many of these resources in its 'resource bundle' to gain competitive advantage and direct its focus of KBS technology accordingly. For example, a large software firm may prefer to compete on providing reliable and credible service to its clients, as it has enormous advantage over its competitors because of its size and experience. Hence, while comparable to others on other parameters, it may use KBS technology to capture all related experience of theirs in the past and use it to provide credible and reliable strategy. On the other hand, a small financial investment firm, operating in a small but exclusive market, may want to store a significant portion of their customer profile and use KBS technology to select appropriate portfolio mix based on what customers have chosen in the past, thus competing as an 'understanding and knowledgeable service provider'. We further show how the five different types of service gaps identified by Berry et. al. [1988] can be used to configure the appropriate resource bundle operative at a particular point in time. In short, the paper shows how existing gaps in service delivery or the identification of 'strategic service determinants' over which a firm has certain advantage over its competitors, can be used to potentially identify opportunities for the effective use knowledge based systems that can result in sustained competitive advantage.

We use three cases (briefly illustrated below) to show how such competitive advantage was recognized and operationalized in three instances.

Case 1: An Underwriting System at an Insurance Company

Insurance underwriting knowledge was captured as rules in a knowledge base and made available to field underwriters so underwriters can make consistent decisions on policy underwriting in a timely fashion. In this case KBS technology improved customer service (a strategic resource) by allowing underwriters to write high quality policies (another

strategic resource) and allowed the firm to maintain its competitiveness in terms of profitability (target resource).

$$\text{Profitability} = f(\text{customer service} * \text{KBS}, \text{policy quality} * \text{KBS})$$

Case 2: An Equipment Configuration System for a Manufacturing Firm

Design knowledge about a product was captured as rules in a knowledge base so a sales person can, quickly and correctly, configure a product based on customer requirements. This allowed sales people to provide quicker service to the customer, which may be a competitive necessity (than a competitive advantage). However, because the technology allowed the capture of complex product knowledge without unduly complicating the sales person's job, product engineers were able to design complex products that can be customized as efficiently as simple products, and seek higher price premiums (in turn, increase profitability). Hence, the technology allowed the firm create a competitive product (quasi-resource) and bring it to market, thereby increasing profitability.

$$\text{Profitability} = f(\text{service} * \text{KBS}, \text{competitive product});$$

$$\text{Competitive product} = f(\text{design knowledge} * \text{KBS})$$

Case 3: A Loan Evaluation System at a Credit Union

The loan approval knowledge of multiple experts was captured by a federal credit union to enhance consistency in loan decisions as well as to reduce the time needed to process these loans. These time savings were used by the firm to critically evaluate other loans that are currently contributing to loan losses as well as add other types of loans. In other words, the loan decision time (a strategic resource), in conjunction with KBS technology, allowed the firm to alter its loan mix and improve loan approval success (and profitability).

$$\text{Profitability} = f(\text{service} * \text{KBS}, \text{transaction volume});$$

$$\text{Transaction volume} = f(\text{decision time} * \text{KBS})$$

In short, using the resource modeling constructs described earlier, an organization can proactively use the KBS technology to gain competitive advantage under the following conditions:

- if one of its strategic resources is its knowledge base (as in the case of consulting operations);
- if it can act as an enabling resource to improve the level of another strategic resource such as improving decision consistency and quality (as in the case of knowledge worker activities);

- if it can assist in the creation of a quasi-resource such as a new product or service that can be considered strategic (as in the case of service/manufacturing operations), or
- if it can influence organizational adaptability to environmental changes over time (as in the case when learning is involved).

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