The Business Model Concept and Information Systems Strategy: developing a heuristic tool for exploring knowledge-based SMEs.

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Abstract

In the evolving information economy, a theoretical limitation in the analysis of information systems strategy (ISS) amongst small-to-medium enterprises (SMEs) has been an over-reliance on resource-based strategic management models of competitive advantage. This has hampered the development of information systems strategy theory and is problematic in at least two ways. Firstly, preliminary analysis of knowledge-based SMEs (KSMEs) in the Australian biotechnology industry highlight that resource-based models are inadequate to account for competitive advantage sourced by these firms through inter-firm relationships and industry-structures. Secondly, at the broadest level, recent research on competitive advantage has revealed problems with relying on any single framework to fully explain the range of sources of competitive advantage now being acquired by firms.

This paper aims to make a contribution to ISS theory by presenting an integrated framework for analysing ISS amongst KSMEs in the Australian biotechnology industry. This framework is an adaption of Amit and Zott’s (2001) integrated business model concept for exploring sources of value creation. The adapted framework is presented as heuristic tool to be utilised in future research exploring the role of ISS amongst these KSMEs to source competitive advantage, at organisational, relational-based and industry structure levels.

Keywords
Information systems strategy, competitive advantage, SME, knowledge, business model

Introduction

Information systems strategy (ISS) theory has always been closely linked to the development of strategic management approaches emphasising resource-based sources of competitive
advantage. Initially, a focus on large business examined IS as one resource among many that could be managed to generate competitive advantage, however, as IS became increasingly pervasive within business it was re-positioned as the key strategic resource. With the emergence of e-business the potential for ISS development amongst small to medium sized enterprises (SMEs) was also recognised. Initial approaches to SMEs involved the unsophisticated application of ISS models developed for large businesses to the SME environment. Subsequently, it was recognised that ISS approaches developed for large firms were inappropriate for SMEs (Martin, 2000) and attempts were made to develop frameworks specifically for examining ISS amongst SMEs (Blili and Raymond, 1993). Dominant amongst these approaches has been a resource-based approach to ISS (Levy and Powell, 2000). This model has recently been further developed and applied to knowledge-based SMEs (Duhan et al., 2001). In one sense therefore current models of ISS have remained resource focused strategic management models viewed from an IS/IT perspective (Duhan et al., 2001).

Previous work by the authors investigating knowledge-based SMEs (KSMEs) in the Australian biotechnology industry (Clarke and Turner, 2001a) has revealed limitations to this resource-based approach to ISS. In particular, this approach lacks sensitivity to competitive advantage being sourced by KSMEs in this industry from beyond the organisational boundary including through inter-firm alliances and at the industry level through the creation of barriers to entry via patent blocking. This previous work identified the need for research to adopt multiple perspectives when attempting to explore ISS amongst KSMEs. At the same time, management theorists have identified that electronic commerce and changing global business environments have raised serious theoretical and practical challenges to the application of existing models on how businesses source competitive advantage. Consequently, it has emerged that current models have not been able to adequately explain and/or predict firm activities. In responding to these circumstances, Amit and Zott (2001) developed an ‘integrated business model concept’ as the unit of analysis for unifying the various perspectives of previous models, to overcome their differing levels of analysis and for exploring convergence between the strategic management and entrepreneurship fields.

In this context, this research paper aims to make a contribution to the development of ISS theory for KSMEs by adapting Amit and Zott’s (2001) business model concept to overcome the existing limitations with resource-based approaches and to generate a more integrated approach to ISS grounded in a holistic strategic management model of sources of competitive advantage. This paper illustrates that this integrated approach provides a heuristic tool that is useful for conceptualising the various ways that KSMEs in the biotechnology industry use their information systems strategically to source competitive advantage, at organisational, relational-based and industry structure levels. By moving away from a restricted resource based view of ISS the paper opens up the possibility of a reconceptualising ISS that is more holistic and less techno-centric. In this new conceptualisation ISS encapsulates technology, organisation and information and knowledge flows. In future work, it is the intention of the authors to deploy this heuristic tool in an investigation of the role of ISS in sourcing competitive advantage amongst KSMEs in the Australia biotechnology industry.
The Research Context

The research context of this paper is the Australian biotechnology industry, and in particular SMEs within that industry. The biotechnology industry is an example of a knowledge-based industry (Finkel, 1999) with its main function being research and development (R&D) and its primary asset being its intellectual property (IP). Biotechnology is a relatively young industry, that has developed rapidly over the last 20 years, particularly in the areas of agriculture and human health. The Australian biotechnology industry is small by international standards, consisting of a number of large companies, including subsidiaries of multinational corporations and approximately 190 small firms.

The scientific knowledge base of biotechnology firms forms a critical component of their competitive position (DeCarolis and Deeds, 1999). IP has been a major force in the growth and consolidation of the biotechnology industry (Mooney, 2001). More broadly, patents have become a key element of competition in high-technology industries because they are the most tangible of intellectual property rights (IPRs) and provide strong legal protection (Grindley and Teece, 1997; Rivette and Kline, 2000; Teece, 2000). The importance of patents and other IPRs has increased as a result of the transition to the knowledge-based economy and the rising role of intangible assets (Grindley and Teece, 1997; Teece, 2000; Davis, 2001).

The Australian biotechnology industry is a highly competitive business environment where product development costs are high but returns can be very profitable. Intellectual property and the intellectual and human capital held by firms is the major driving force pushing industry development and growth (Oliver and Liebeskind, 1998). Combined these factors make for an environment that exemplifies the changing global business context in the emerging knowledge economy. It is also an environment that raises challenges to current theories on how firms source competitive advantage and the strategic role of information systems in this process.

Information Systems Strategy

In the knowledge economy, information systems (IS) are an integral part of most businesses efforts to sustain competitive advantage or competitive parity (Mata et al. 1995). From a strategic perspective, the value of IS has traditionally been premised on the assumption that linking information systems to business strategy may yield significant competitive advantage or offer transformative potential to the firm and/or industry. In this context, researchers began to explore the links between IS and competitive advantage, this became the domain of information systems strategy (ISS). ISS is then defined as the IS that an organisation needs to establish and to utilise in order to acquire competitive advantage (Levy and Powell, 2000). This can range from systems to improve efficiency and effectiveness, that are internally focused to systems with an external focus (Levy and Powell, 2000) (Earl, 1996). While, initially the focus within ISS theory was on the technology itself being the source of competitive advantage, increasingly there has been a move beyond this to a recognition of the
importance of informational and organisational sources of advantage (Galliers, 1991; Levy and Powell, 2001).

From its inception ISS theory and practice has been intimately linked to developments in strategic management theory and in particular to the resource-based view (RBV) (Dyer & Singh, 1998). The focus of the RBV organisational theorists suggests that technology itself could be considered a strategic organisational resource providing justification for IT investment, management and planning. This resulted in techno-centric view in ISS research. Indeed, it is evident that most methods used in IS strategy planning are still essentially derived from 1980/90s RBV strategic models applied from an IS/IT perspective (Duhan et al, 2001). Consequently, these ISS frameworks have been developed from a resource perspective reflecting the dominant view of the 1990s (Dyer and Singh, 1998: Hoskisson et al, 1999).

More recently, IS literature has recognised the potential of SMEs to benefit from ISS which has led to research by Levy et al (1999), Levy and Powell (2000), Duhan et al (2001). This research has variously explored whether SMEs have the same opportunities for using IS to add value as larger organisations and to develop models designed specifically for ISS amongst SMEs. A subsequent paper by Duhan et al (2001) identified knowledge-based SMEs as being a unique type of SME in which ISS was of potential benefit. For KSMEs Duhan et al (2001) suggested a 'core competencies' approach (aligned to RBV) might be appropriate for developing ISS and articulated a strong case for the application of core competencies in KSMEs, but also acknowledged that further work was required.

Significantly, while there is merit in Duhan’s approach, previous work by the authors has highlighted that KSMEs in the Australian biotechnology industry source competitive advantage from a variety of levels both within and beyond the firm boundary (Clarke and Turner, 2003). This revealed the core competencies approach to be too limiting for analysing how IS can be used to source competitive advantage amongst KSMEs (Clarke and Turner, 2001a). As a result, this previous work also pointed to the need for ISS to be extended beyond its resource-based roots (Clarke and Turner, 2001a and b, 2002).

The Need for an Integrated Approach to ISS in KSMEs

While RBV of ISS is an important component of any approach to examining ISS amongst KSMEs, previous work by the authors has pointed to the need to examine the utility of other strategic management perspectives including those focused on inter-firm alliances and industry structure (Clarke and Turner, 2001a and b, 2002).

In terms of inter-firm alliances it is evident that strategic networks play a vital role in biotechnology innovation. One of the most salient characteristics of the biotechnology industry is the use of collaborative relationships (Oliver and Liebeskind, 1998). In addition, Powell (1996) contends that the locus of innovation (entrepreneurship) will be found in inter-organisational networks of learning rather than within individual firms. These observations
on the biotechnology industry not only highlight the need for integration but also demonstrate interdependence between various sources of competitive advantage. It also points to the need to investigate the role of IS in these sources of advantage and in supporting linkages between them.

In terms of industry structure, Porter’s industrial organisation approach has also been shown to be relevant to biotechnology SMEs, where strategies such as tying in customers and suppliers and/or creating barriers to entry, through patent blocking, are regular strategies deployed in the industry (Clarke and Turner, 2001a).

The field of entrepreneurship and innovation has also been shown to be explaining competition in the biotechnology industry. The patent system upon which the biotechnology industry is so reliant was developed in order to encourage innovation. Entrepreneurism was identified as a critical success factor of biopharmaceutical companies (Rautianen, 2001). The introduction of new methods has not only created new markets, it has also reorganised industries (Schumpeter, 1934), such as transformation discovery and the pharmaceutical industry induced by the biotechnology revolution.

Clearly all of these different perspectives have relevance for explaining how KSMEs (in this instance in the biotechnology industry) source competitive advantage. But to-date there has not been an integrated approach that considers the inter-relationships between or more pertinently the role of ISS in contributing to this sourcing of advantage. More broadly, it is possible that recognition of the need for a more integrated approach is indicative of the increasingly central role intellectual assets play in the knowledge economy. These observations are also consistent with the recent call by some eminent researchers for entrepreneurship and strategic management to be combined to provide a more appropriate lens through which to examine competitive advantage in the changing global business environment (McGrath and McMillan, 2000; Hitt et al, 2001).

In attempting to move towards a more integrated theory of ISS for KSMEs this section has highlighted the need to leverage strategic management and innovation models on sources of competitive advantage that move beyond the RBV. Discussion of these various models has also revealed that an integrated approach is required to address the characteristics of the knowledge economy and the range of sources of competitive advantage being generated. The next section of this paper examines Amit and Zott’s business model concept as a worthy attempt to meet this challenge for an integrated approach to examining sources of competitive advantage.

**Business Model Concept**

Amit and Zott (2001) in their research on sources of value creation in large e-businesses identified four value creation strategies: efficiency, complementaries, lock-in and novelty. In drawing on strategic management and entrepreneurial literature to explain these sources they
found current approaches inadequate. A number of these sources were derived through multiple perspectives, which led to Amit and Zott (2001) suggesting a meta level model - the ‘business model concept’.

The idea of meta-model or business model concept has generally not been strongly represented in the academic literature although it has been alluded to by a number of eminent scholars. For example, Prahalad and Ramaswamy (2000:81) state the unit of strategic analysis has moved from the single company to… an enhanced network of traditional suppliers, manufacturers, partner, investors and customers. In high tech fields such as those emerging from the Silicon Valley phenomena, competitive advantage has also been attributed to a certain business model rather than to the talents of individual entrepreneurs (Hamel, 1999). As this examples illustrate business models may thus span industry and firm boundaries. As a result, in response to their need to integrate different approaches, Amit and Zott (2001) proposed the ‘business model’ as an unit of analysis for e-business. A business model being defined by Amit and Zott (2001) as the context, structure and governance of transactions so as to create value through the exploitation of business opportunities. In this model, transaction content refers to the exchanged goods and information as well as the resources required to facilitate the exchange (Amit and Zott, 2001). Structure refers to the stakeholders that partake in the transaction and the ways in which these stakeholders are linked. Governance refers to the control of the flow of good, information and resources. It also refers to the legal form of organisations. Under the business model approach, the firm should be seen as a point of reference rather than the unit of analysis (Amit and Zott, 2001).

In their article, Amit and Zott (2001) demonstrate how the business model approach is rooted in well established and accepted strategic management and entrepreneurship theory. They also demonstrate how the business model construct enables the integration of various sources, emphasises interdependencies between the various sources, and overcomes the issues of different levels of analysis (Amit and Zott, 2001). In order to demonstrate the applicability of the business model construct, it has been applied to the various sources of competitive advantage identified in their research (refer Figure 1).

<table>
<thead>
<tr>
<th>Sources of Value Creation</th>
<th>Efficiency</th>
<th>Complementaries</th>
<th>Lock-in</th>
<th>Novelty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure</strong></td>
<td>Exchange Mechanisms</td>
<td>Activities of participants (supply chain)</td>
<td>Transaction reliability</td>
<td>New links between participants</td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td>Information made available as a basis for decision-making</td>
<td>Access to complementaries-services, products information</td>
<td>Promotion of trust through third-party</td>
<td>New combinations of products, services, information</td>
</tr>
<tr>
<td><strong>Governance</strong></td>
<td>Alliance capabilities of partners</td>
<td>Loyalty programs</td>
<td>New incentives</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 1 is a skeletal model of the Amit and Zott (2001)’s table demonstrating the sources of value creation vs business model construct with examples.*
Significantly for the authors of this paper, the limitations of theories on sources of competitive had also been a problem in their preliminary analysis of the role of ISS amongst biotech KSMEs in sourcing advantage. As illustrated in Figure 2, with respect to KM (Clarke and Turner 2001b, figure 2), and to ISS (Clarke and Turner 2001a), research revealed that competitive advantage in biotech firms was being sourced from multiple levels. This was challenging as much of the current strategic management theory considered these various perspectives mutually exclusive. This led to the authors calling for a more comprehensive view of competitive advantage for KSMEs (Clarke and Turner, 2001 a and b).

In this context, this paper argues that the business model construct proposed by Amit and Zott (2001) can when adapted provide a potential solution for overcoming this theoretical dilemma. Therefore Amit and Zott’s business model construct is presented here as an appropriate starting point for exploring the extension and possible reconceptualisation of ISS. It is however recognised that the adaption of Amit and Zott’s (2001) business model as a heuristic tool to examine ISS in KSMEs does raise some issues, for example, it was developed from applied empirical research on e-business in large business contexts. This issue is however, mitigated by the fact that many of the business and IS characteristics of biotechnology SMEs resemble those of the large business context.

**Figure 2** Highlights different views of KM explored within strategic management theory where G represents the intersect of the three approaches (RBV, relational and industry structure) and where KBV in SMEs needs to be placed (Clarke and Turner, 2002).
Adapted Business Model Concept and Biotechnology KSMEs

The utilisation of Amit and Zott’s (2001) business model construct as an approach for describing sources of competitive advantage among KSMEs and as a starting point for examining the role of ISS amongst these firms, is appealing for several reasons. The business model integrates the different perspectives and units of analysis, which had been previous identified as an issues of ISS in the KSME context (Clarke and Turner, 2001a). Secondly, the approach integrates competitive advantage theory with the entrepreneurship and strategic management fields, which is also aligned with the types of businesses dealing in the biotechnology sector, predominantly entrepreneurial type businesses. Thirdly, whilst the business model has been developed from empirical data of large business, this model appears to be somewhat scalable and able to be calibrated to the SME context. This is because the terms ‘structure’ and ‘governance’, two notable characteristics of SMEs which distinguish them from large business, are not specifically defined for large businesses in the ‘business model’ construct. Furthermore, it has been previously noted that these biotechnology firms display some characteristics that resemble those of large businesses (Clarke and Turner, 2001a). Finally Amit and Zott (2001) suggest its application outside of the e-business environment, although it appears to-date this has not been done.

While the business model construct appears to overcome the inadequacies of individual perspectives by providing a more integrated approach when looking at sources of competitive advantage in KSMEs, there are still issues in applying directly to the biotech SME context. While the business model still has much to offer over other approaches currently available in IS or management theory, the issue of definition remains problematic in the case of the KSMEs. The main concern here is that the business model concept definition is based around the ‘transaction’. While this is entirely appropriate in the context of e-business, in the case of Australian biotechnology KSMEs, these businesses are generally in the R&D stage of the innovation development. The transaction stage within the biotechnology process generally not occurring until the commercialization occurs, often 12-15 years after the firm’s formation. Despite the majority of biotechnology firms not participating in transactions, these firms still seek to achieve competitive advantage over other biotechnology firms and to secure alliances with big pharma corporations. Normally, this is achieved is through their knowledge, particularly the possession of IP which gives them exclusive rights to the knowledge development and commercialisation. Furthermore, most Australian biotechnology firms are in the pre-clinical or development stages. As was previously highlighted these KSMEs leverage knowledge as a potential source of competitive advantage at firm-level, relational-level (alliances) and industry level (patent blocking) (Clarke and Turner, 2003).

As a result, this paper argues that in adapting the business model for KSMEs the ‘transaction’ can legitimately with ‘knowledge’, as it seems to be the basis of competition within the biotechnology industry, especially at the stages applicable to biotechnology firms in Australia. It is also suggested the transaction-based business model may be more appropriate in latter stages of the biotechnology firm’s lifecycle. In this case we suggest:
**Knowledge Content** - refers to the type of knowledge created, acquired, disseminated, and to the resources and capabilities required in order to enable the creation of knowledge.

**Knowledge Structure** - refers to parties involved in creating, acquiring and disseminating the knowledge and the ways in which they are linked, taking note of the ordering and mechanisms that allow this to occur.

**Knowledge Governance** - refers to the flows of information, resources and knowledge and how they are controlled by relevant parties.

The adapted business model construct (Table 1.) applied to the biotechnology KSME context illustrates how different sources of competitive advantage identified from the literature, can be located in the construct (Table 1). The ability to locate these sources of advantage into the adapted model suggests that in knowledge-intensive industries an adapted business model approach based on knowledge is useful. This is particularly the case in business environments where intellectual assets are central in competition, as exemplified by biotech KSMEs.
<table>
<thead>
<tr>
<th>Knowledge Content</th>
<th>Innovation (Entrepreneurship)</th>
<th>Value Chain (Industrial Organisation)</th>
<th>KBV (Resource-Based View)</th>
<th>Strategic Networks (Relational)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● Technology (bone and Saxon, 200)</td>
<td></td>
<td>Types of knowledge</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>● Explicit vs Tacit (Polyani, 1965)</td>
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<td></td>
<td></td>
<td></td>
<td>● IP (Schneider, 2002)</td>
<td></td>
</tr>
<tr>
<td>Knowledge Structure</td>
<td>● SMEs (Schumpeter, 1939) tend to be good innovator, non bureaucratic and flexible-behavioural characteristics Nooteboom, 1994, Rothwell, 1994).</td>
<td>● Structure of the value chain</td>
<td>● Knowledge dissemination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Locus of innovation in networks (Powell, 1996)</td>
<td>● Look at vertical upstream and downstream collaboration (Calabrese et al, 2000)</td>
<td>● Internal and external knowledge (Spencer, 2003)</td>
<td>● Types of collaborations</td>
</tr>
<tr>
<td></td>
<td>● External and internal</td>
<td>● Tying in customers and suppliers is achieved through alliances, in particular vertical alliances with upstream/downstream</td>
<td>● Absorptive capacity (Cohen and Levinthal, 1990)</td>
<td>● Vertical and horizontal alliances (Calabrese et al, 2001)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● Formal networks.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>● Informal networks/relationships (Oliver and Liebeskind, 1998)</td>
</tr>
</tbody>
</table>
Table 1. A Potential Framework for sources of competitive, emerging from the literature on biotechnology firms and SME and applied to the business model construct.
Application of Business Model to Information Systems Strategy

From the discussion above, the application of an adapted ‘business model’ as a heuristic tool to conceptualise the various ways that KSMEs in the biotechnology industry use their IS strategically to source competitive advantage appears to have several strengths. Not only does the adapted model move ISS theory beyond its resource based roots but also overcomes the simplistic equating of business value with productivity gains from IT at the firm-level (Tallon et al., 1999). In the new global business environment, competitive advantage is moving IS beyond merely providing productivity gains and extending sources of competitive advantage beyond firm boundaries. The adapted business model provides an integrated view of sources of value creation and competitive advantage, undoing the constraints of the organisational boundary present in much management and IS research (Trauth, 2001; Walsham, 2000).

The adapted model sensitises researchers to three potential ways in which may IS may be utilised strategically within these firms to source competitive advantage (Figure 3). The examples cited leverage insights generated from preliminary investigation of KSMEs in the biotechnology industry.

1) IS itself may be a source of competitive advantage. The opportunities provided by IS have to be exploited to gain competitive advantage from it (Baets, 1992). For example, exclusive access or ownership to a particular technology.

2) IS may be used to support the strategic decision-making process (such as supporting the strategic plan (Huff and Beatie, 1985). For example, subscription to a ‘competitor analysis’ database may provide management with information required to formulate their business plans.

3) IS may support the strategies of sourcing competitive advantage. For example IS utilised to support the flow of knowledge between companies in an alliance.

It is evident that biotech KSMEs source competitive advantage through multiple avenues and that strategic use of IS may be integral to these processes. What is not clear is the extent of the role IS plays in enabling these businesses to achieve competitive advantage. Therefore future work will utilise the heuristic model to support the development of a methodological approach to the exploration of ISS in KSME in the Australian biotechnology industry. Furthermore, it is anticipated that by moving from a RBV of ISS the paper opens up the possibility of a reconceptualising ISS in a more holistic and less techno-centric manner. In this new conceptualisation ISS encapsulates technology, organisation and information and knowledge flows.
Figure 3 Illustrates possible ways in which biotech KSMEs may utilise their ISS to source competitive advantage.

Conclusion

One of the features of the new millennium is volatility, turbulence and unpredictability (Amit et al., 2001). As new businesses and industries emerge, researchers in many disciplines such as management and IS are struggling to apply existing models and theories to this new competitive landscape. The area of competitive advantage is one such theoretical field facing these challenges. In the modern business environment and with the emergence of new business models the ability to integrate multiple perspectives will be important. Indeed, some management researchers have already begun to integrate their models (Gulati et al., 2000; Spanos and Lioukas, 2001).

The development of ISS theory has traditionally reflected developments in strategic management theory, partly because of the increasing evidence of the competitive advantages to be acquired through the alignment of IS and business strategies. As management scholars grapple with current approaches to explain sources of competitive advantage sources in the evolving business landscape, it is inevitable that similar research challenges should be addressed by IS researchers in ISS theory.

This research paper has aimed to make a contribution to the development of ISS theory for KSMEs. By adapting Amit and Zott’s business model concept it has been possible to overcome existing limitations of RBV approaches relied on in existing ISS theory. This adapted model also provides a more integrated approach to ISS that is grounded in a holistic strategic management model on sources of competitive advantage. The heuristic tool developed will be useful for conceptualising the variety of ways in which KSMEs in the biotechnology industry may utilize there is strategically to source advantage at firm, inter-firm and industry levels. The next stage of the research will involve data collection and exploring ISS in biotechnology firms through semi-structured interviews.
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