Factors Influencing Technology Acquisition in High-tech Firms

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ABSTRACT

Technology acquisition is a major contributing factor to the future performance of the firm. In the high-technology industry, the decisions surrounding technology acquisition are a significant factor in a firm’s technological strategy. Technology acquisition is a primary factor in the management of technology. Firm’s that understand the complexities of their operating environment and their internal capabilities and weaknesses, are better positioned to respond to the challenges of new technology.

A proposed applied framework identifies four key factors that influence technology acquisition in high-tech firms; firm strategy, market trends, technological capability and technological relevance. An assessment of these factors is important in ensuring a successful outcome.

Keywords

Technology acquisition; Firm strategy; Market trends; Technological capability; Technological relevance
1. Introduction

Responding to challenges of the marketplace induces firms to take up new production methods in the bid to improve product quality and delivery reliability, to reduce costs, and especially to improve flexibility. Failure to recognise and take advantage of the potential of advanced technologies will result in firms not being able to adapt to the changes in the marketplace and the concomitant challenges.

Technology is typically defined as the application of scientific knowledge to achieve a practical result (Yoshikawa, 2003). Durani et al. (1999) thus define technology acquisition as the “adoption of scientific knowledge, techniques and practices that provide a feasible solution to meet a given need”. As such, in order to capitalise from the technology acquisition process, the technology must be available at the right time, to meet the needs of the marketplace (Lanigan, 1994).

This paper aims to highlight the influential factors in the technology acquisition process employed by high-tech firms. There are a number of factors involved, however, this work will focus on four key features, critical to high-tech firms; (i) Firm strategy, (ii) Market trends, (iii) Technological capability and (iv) Technological relevance.

2. Technology Acquisition

In an era of rapidly changing technology and strong global competition, companies acquire new technologies in order to meet the requirements of the market and gain a competitive advantage. Technology acquisitions are acquisitions that provide technological inputs to the acquiring firm
(Ahuja and Katila, 2001). It is an important process, especially for high-tech companies, due to its impact on performance and overall contribution to the goals of the company (Daim and Kocaoglu, 2008). Robertson (1993) highlighted that the key advantage of technology acquisition lies in its ability to reduce the time to formulate and eventually conceptualise a novel technical solution. Durani et al. (1998) categorized technology acquisition as a primary factor in the management of technology in industrial organisations.

The technology acquisition process adopted by a company is dependent on the constraints imposing on the firm; such as cost, time and risk, the firm’s absorptive capacity and the level of independence that the firm requires. As such, technology acquisition was recognised as being perilous, difficult and a strategic process (Daim and Kocaoglu, 2008). Technology acquisition methods must therefore be well-suited to the company’s technology strategy and should be linked to the aspirations of the firm (Lanigan, 1994).

In high-tech firms, technology acquisition is one means of enabling the company to keep in touch with the latest trends of an accelerated technology (Hagedoorn and Schakenraad, 1994).

2.1. **Modes of Technology Acquisition**

As an element of its technology strategy, firms should choose the appropriate mode for acquiring the required technology. The literature provides an elaborate insight to a vast array of technology acquisition channels used by firms. Among these lie; sponsoring university research, external R&D centres, consultants, joint ventures, licensing agreements, in-house technology development, purchase through vendors/suppliers, purchase of existing technology, and technical journals (Lanctot and Swan, 2000; Jones, Lanctot and Teegen, 2000; Yoshikawa,
In high-tech firms, an increase in the number of new products and the pressure to achieve short product development cycles, as well as the requirement for increased productivity and sales, has resulted in in-house technology development being the most utilised mode of technology acquisition (Daim and Kocaoglu, 2008).

2.2. Strategic Planning

Chatterji (1996) warns that technology sourcing should be approached as a strategic business process. The decision to either develop the technology internally or acquire the technology from external sources has been recognised to have considerable ramifications for the future of the firm (Lanctot and Swan, 2000). For instance, the adoption of external technologies may not be sufficient to sustain a firm’s competitive advantage, as external technologies are easily available to other firms. On the other hand, internal technologies are difficult for competitor companies to access (Garud and Nayyar, 1994; Haro-Dominguez, Arias-Aranda, Lloréns-Montes and Moreno, 2007).

3. High Technology Industry

Over time, managerial motivations for acquisitions have included the need to increase productivity, improve product quality, shorten product development cycles, reduce production costs and increase sales; to name but a few (Jones, Lanctot and Teegen, 2000; Daim and
Kocaoglu, 2008). The high technology industry is one in which the technology employed, is rapidly evolving, to meet the needs of the market.

In many cases, high-tech firms strive to stay ahead of market demands. These firms differ from other types of organisations, whereby the primary focus is on increasing the number of new products and reducing product development cycles. As such, technology acquisition in high-tech firms in particular, will be influenced by strategic planning, market trends, the ability of the firm to respond to technological challenges, and the firm’s own knowledge base and familiarity with related innovations (Daim and Kocaoglu, 2008; Hung and Tang, 2008).

4. Conceptual Model

Extensive work has been done on technology acquisition, however, only a limited number have focussed on the high-tech industry and the factors affecting technology acquisition in these firms.

This paper puts forward those key factors that influence technology acquisition in high-tech firms. A clear link is established between technology sourcing and strategic management; thus characterising the starting point for the acquisition process, which consequently defines future technology activity.

It is proposed that by understanding the strategic notions of high-tech firms, those factors affecting technology acquisition can be better managed and thus used to delineate the future performance of the firm.
5. **Methodology**

The objective of this work was to identify the key factors influencing technology acquisition in high-tech firms. While the primary focus is on these influential factors, the paper also touches on the numerous modes of technology acquisition, their concomitant impact on the firm and the consequent implications for the future of the firm.

At the very outset, a review of the existing literature on technology acquisition; with respect to the high technology industry, strategic planning, technology management, and case studies, was performed. Particular attention was paid to four key factors affecting technology acquisition; firm strategy, market trends, technological capability, and technological relevance.

The literature provided a good base of the factors that affected the mode of technology acquisition. These factors, together with current research, on the factors associated with high-tech firms, and case studies were integrated to develop a framework that exhibited the criticalities pertinent to companies operating in the high technology industry and their impact on the firm’s sourcing of technology (Fig. 1). The findings from the literature review will be presented and discussed in the following section.

6. **Results and Discussion**

As stated previously and also illustrated in Figure 1, the key factors influencing technology acquisition in high-tech firms are; firm strategy, market trends, technological capability and technological relevance. These are the primary factors, which in turn are affected by factors
internal to the firm, such as the firm’s finances and human resources, and the intangible factors relating to the uncertainty associated with the acquired technology, and the experience level and perceptions of the firm’s employees. In addition, external factors such as the firm’s customers and competitors, the technology suppliers and overall market activity, also indirectly affect the four, primary factors influencing technology acquisition.

6.1. Firm strategy

One of the most important strategic decisions management faces in today’s globally competitive environment surrounds the issues of technology acquisition or development. In the past, firms typically relied on internal development and the technological capabilities of the firm. In recent years however, external sources of technology have been gaining attention worldwide (Chatterji, 1996; Hagedoorn, 1994). For many firms, a feasible technology strategy defining the need for external vs. internal technology development, and identifying when to alternate between the two, can be of vital strategic importance (Jones, Lanctot and Teegen, 2000).

Developing technology internally ensures greater control over its distribution and provides a viable technical capability for the firm. However, internal development typically requires greater resource commitment than the firm is willing or can afford. Conversely, acquiring technology from external sources could assist with rapid development and implementation of commercial technology and products, while simultaneously accessing state of the art technology (Jones, Lanctot and Teegen, 2000). Nonetheless, it must be noted that external technology acquisition can suppress the need to develop and consequently advance the internal technological capabilities of the firm.
As has been highlighted above, there are two fundamental alternatives that are available to a firm; internal technology development or external sourcing of technology. A decision between these two extremes must be based on the strategic decisions of the firm; regarding technology management. Technology management requires a thorough understanding of the environment the firm operates in and the internal conditions of the firm, which in turn will enable it to rapidly adapt itself to changes in the business/market landscape (Dae-Hyun and Pyung-II, 2000).

Firm strategy therefore, is a primary factor influencing the decisions around technology acquisition. It is clear that firms that recognise this link and align their technology sourcing activity with the strategic direction of the organisation, will be better able to source technology that is not only capable of meeting the current needs of the firm, but also has the potential to provide for future requirements.

6.2. Market Trends

Product or process technologies currently adopted by the firm often dictate future choice (Durani, Forbes, Broadfoot and Carrie, 1998). Durani et al. (1998) point out that the failure of the firm to retain market leadership can be attributed to failure to identify and conquer market trends. As stated above, technology acquisition should be viewed as a strategic process. Success is dependent on firms understanding the markets they operate in, and positioning themselves; through appropriate technology acquisition.

Market trends can have a significant impact on the mode of technology acquisition. For example, a firm operating in a rapidly developing market is likely to face tight time pressure, to meet the demands of the market. In such instances, the firm is likely to turn to external sources
for the required technology, because unless the firm has superior development capability compared to its competitors, internal development could cost the firm time and effort, which would be better spent implementing the technology. The technology could be sourced even faster if it were acquired from another firm that already possesses the technology (Yoshikawa, 2003). Here, the firm has two acquisition modes to choose from, to acquire the technology; form a licensing agreement with a firm that has the technology or acquire the firm itself that has the technology (Dae-Hyun and Pyung-Il, 2000; Hung and Tang, 2008).

In the high technology industry, one of the key factors to gain competitive advantage is the firm’s ability to establish market-place requirements and consequently identify technology solutions to meet those needs (Durani, Forbes, Broadfoot and Carrie, 1998). As highlighted in Figure 1, an awareness of the key trends in the market place; the requirements of target customers, the actions of competitors, and the product portfolio of technology suppliers, can make a significant difference in the outcome of the technology acquisition process adopted by the firm.

6.3. **Technological Capability**

Technological capability is a further factor found to affect technology acquisition. Wang et al. (2006) describe technological capability as “a set of pieces of knowledge that includes both practical and theoretical know-how, methods, procedures, experience and physical devices and equipment”. As such, technological capability represents an important source of competitive advantage and thus superior performance, in technologically competitive markets.

Many studies throughout the literature have attempted to highlight the importance of the firm’s technological capability and its influence on decisions surrounding technology sourcing, in
obtaining competitive advantage. Developing technological ability is thus crucial to a firm’s sustainability and success in the environment it operates in (Moon, 1998). Technological capability not only has a direct, but also an indirect impact on business performance and new product development performance (Wang, Lo, Zhang and Xue, 2006). Linked in with technological capability, lies absorptive capacity, which has a positive effect on the productivity of technologies acquisitions and improves the efficiency of the process of developing new products (Haro-Domínguez, Arias-Aranda, Lloréns-Montes and Moreno, 2007).

Firms with high technology capabilities, have more choices available to them for technology acquisitions (Hung and Tang, 2008). Haro-Domínguez et al. (2007) point out that the greater the existing skill capabilities and technological knowledge resource the firm harbours, the greater it’s interest in internal development. Further, internal development also assists in achieving greater control of the firm’s distribution, ensuring a viable technological capacity (Kotobe and Murray, 1996). Haro-Domínguez et al. (2007) reference a study conducted in the biotechnology sector, which showed that when a certain level of technological capacity is reached in a particular area, firms typically trust their own technology more than external technology.

Firms with strong technological capacity can take advantage of their knowledge base when formulating decisions around technology acquisition. These firms are better equipped to deal with the uncertainty of new technology and have the necessary resources and experience to carry it through to successful completion. An assessment of the firms’ own knowledge base and technology capability is thus necessary to aid with the decisions around technology acquisition. Further, in order to better support the technology sourcing activity, firms should invest in developing their technological capabilities and absorptive capacity.
6.4. **Technological Relevance**

In the high technology industry, the rate at which new products can be released is dependent on the speed of technology acquisition. This is critical to creating and sustaining a competitive advantage for the firm. The technological relevance of the newly sourced technology to the acquiring firm significantly influences the success or failure of its implementation (Hung and Tang, 2008).

Certain technologies, regardless of their complexity, build on established technology, systems and assumptions currently held within the firm. In such cases, the complete transfer of the acquired technology could be minimal, and consequently easier for the firm to adopt and implement the technology. Conversely, a given technology may be particularly different to the acquiring firm’s technology base and know-how. In these instances, the firm is forced to develop roles and models to suit the new technology (Barley, 1986). Thus, when technologies are relevant to the firm’s existing skill base, the risk of acquisition is diminished and integration is expected to be easier.

Steensma (1996) points out that technical complexity is inherent to the technology itself, and that it lies outside the realm of control of the organisation. He (Steensma, 1996) argues that the degree of systemic shift is a factor of the firm’s existing technical expertise. By understanding the entire spectrum of the technology; from cultivating an awareness of its existence, to developing an understanding of the underlying theory behind the technology; its interdependencies with other technologies and its links to future strategy, firms will be better positioned to understand and transfer the newly acquired technology (Steensma, 1996).
Hung and Tang (2008) touch on another important factor relating to technological relevance and its influence on the firm’s decision to acquire technology – the level of resource commitment required. The authors (Hung and Tang, 2008) hypothesise that the higher the relevance between the technology acquired and the firm’s core technology, the less resource the firm needs to commit. This is an important factor for many firms and especially for their high-tech counterparts, where in-house technology development is a key component of business strategy and core competency (Neelankavil and Alaganar, 2003; Daim and Kocaoglu, 2008).

7. Conclusions

Technology acquisition plays a key role in the management of technology in high-tech firms. Firms operating in the high technology industry; which is typically characterised by above-average levels of research and development activity, new product development and short product development cycles, are growing at rapid rates, in order to keep up with today’s technologically savvy society.

It is proposed that there are four key factors influencing technology acquisition in high-tech firms; firm strategy, market trends, technological capability and technological relevance. Together, these factors aid in the technology acquisition decision-making process, by providing valuable considerations for firms sourcing technology.

Central to the model is the strategic direction of the firm, which governs the decisions made and consequently the technology acquired. These decisions regarding the mode of technology acquisition, internal vs. external development, future market performance and resource commitment, affect the success or failure of the acquired technology and in turn the future performance of the firm. Firms that ignore the strategic and organisational implications of the
acquired technology will eventually find themselves behind in their efforts to remain competitive.

The decision to develop technology internally instead of sourcing technology externally is strongly dictated by firm strategy. Should firms seek reduced product development cycles and market leadership, external technology acquisition becomes an obvious choice, due to the shorter time scales involved compared to internal development. These decisions however, should be firmly rooted in the firm’s knowledge and understanding of the environment it operates in.

Market trends are another key influential factor in the technology acquisition, decision-making process. Firms need to be able to quickly respond and adapt to changes in the market and this can be achieved by making the right choices; when acquiring new technology.

Technological capability and technological relevance are important factors for high-tech firms sourcing new technology. The technical capacity of the firm influences its ability to develop and implement technology. Firms with high technological capability have more options available to them when sourcing technology – strong technological capability not only permits internal development but also ensures successful implementation of externally sourced technology.

Technological relevance on the other hand, is the significance of the acquired technology, in terms of the firm’s own knowledge base. When technologies are relevant to the firm’s existing skill base, the risk of acquisition is diminished and integration is anticipated to be easier. An assessment of the firm’s knowledge potential with respect to the new technology is thus critical to ensuring a successful outcome.
In conclusion therefore, an evaluation of these key factors must come into play when considering technology acquisition. Firm strategy provides the guiding light in the decision-making process, while market trends, technological capability and technological relevance can strongly influence the decisions made.

References


Fig. 1: *The Technology Acquisition framework for High-tech firms*