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THE PERVASIVENESS OF INFORMATION AND COMMUNICATION TECHNOLOGY: ITS EFFECTS ON BUSINESS MODELS AND IMPLICATIONS FOR THE ACCOUNTING PROFESSION

The main challenge that confronts firms because of the continued development in information and communication technologies (ICT) is the reduction in information asymmetry as product markets become increasingly information-driven. This reduction enables buyers and sellers to be more informed about what is for sale and what is in demand. In some instances this will drive profits down through increased competition as products become more easily commoditised. Alternatively, this can facilitate increased personalisation of products and services, and consequently enable product differentiation and greater profits. This increasing integration by firms of their ICT resources has a number of implications for the accounting and auditing profession.

Firms operating in capital markets within market economies develop business models and use business processes to create wealth. A business model is a strategic plan developed by the firm to identify and capture the market opportunities and the factors of production that lead to that firm's wealth creation. Business processes are those processes that are developed and deployed to acquire, organise and coordinate the factors of production needed to produce goods and services and deliver those goods and services to the market.

Over the past quarter of a century there has been dramatic development and change in the information and communication technologies[1] (ICT) that firms use to organise and manage their business models and implement business processes. This development and change means that firms' business models and processes have been, and will continue to be, challenged. The challenges are likely to lead to a number of possible outcomes for firms depending on how, and the extent to which, they adapt. For example, a firm may refuse to acknowledge the challenges and, as a consequence, fail to sustain its business model and so go out of business. On the other hand, a firm may see the opportunities that these challenges present and may "lever" off them by modifying its business model and processes to further grow its business. As the business model determines the value of the firm's assets in place and its viability as a going concern, the capacity of a firm to adapt to ICT development has a number of implications for the accounting profession.

In this paper we demonstrate how some ICT developments have challenged firms to adapt their business models and business processes, and the implications of these challenges for the accounting profession. Specifically we argue that the main challenge that confronts firms is adapting to markets where there is now a reduction in information asymmetry between producer and consumer as markets become increasingly information-driven. In some instances, this will drive profits down through increased compe-

tition as products become more easily commoditised. Alternatively, this can facilitate increased personalisation of products and services, and consequently enable product differentiation and greater profits. We provide illustrative evidence that a firm's taking action to adapt, or failing to take appropriate action, leads to a substantial change in the capital market value of the firm. We discuss the need for the accounting and auditing profession to consider the implications of ICT development in determining the value of recorded assets in the balance sheet and the viability of the firm as a going concern.

INFORMATION AND COMMUNICATION TECHNOLOGY DEVELOPMENT

Technology development and adoption, and the success that follows such adoption, are hardly new. When thinking about ICT development and its adoption, it is worth reflecting on earlier times and how significant technology changes have affected not only firms but also whole markets and the economies in which they trade.

An example of this technology change and its profound impact on market economies is the Erie Canal in the US. When built in the early 1800s, the canal linked the Great Lakes of North America with the city of New York and the Atlantic Ocean. With the opening of the canal, horse-drawn light packet boats travelled from Buffalo to New York in less than four days, a journey that had taken animal fur-traders many months in the pre-canal period. This technological breakthrough (dramatically improving communication as well as transport) contributed to making New York the financial and commercial centre of the US. The New York population grew from under a quarter of a million people in the early 1800s to more than a half a million a few decades later.

The most dramatic development in ICT has occurred since the early 1970s as the cost per unit of computer power has continually declined at an increasing rate. This trend coincides with the development of the device through which modern computer power and storage occurs — the integrated circuit stored on a "silicon chip". Largely because of this increase in computing power, associated developments occurred that have resulted in greater diffusion of computing power, enabling greater and more convenient access to computer systems and what they can do. This greater access has occurred mainly through the development and expansion of wide-area and local-area networks, initially through wire connections but, nowadays, more and more, through wireless connection.

This growth in power and reach of ICT has been the catalyst for greater adoption and integration of ICT, not just by firms operating in market economies but also by societies and communities generally. Most homes have PCs. More and more of these PCs are connected to the Internet, and more and more of these connections are high-speed broadband connections.. ICT is no longer just the domain of computer specialists; anyone is now able to engage directly with ICT. This engagement and pervasiveness of ICT is having a dramatic effect on the sustainability of traditional business models and processes.

THE PERVASIVENESS OF ICT IN THE DIGITAL ECONOMY OFFERS BUYERS AND SELLERS THE OPPORTUNITY TO BE MORE INFORMED ABOUT WHAT IS FOR SALE AND WHAT IS IN DEMAND.

INFORMATION AND COMMUNICATION TECHNOLOGY AND BUSINESS MODELS

We argue that the most fundamental change in the economy due to the pervasiveness of ICT is in markets for commodity products and services . Specifically, there has been a reduction in information asymmetry between producer and consumer as markets become increasingly information-driven. This in turn has implications for the business models of those firms which compete in commoditised markets. To provide support for our arguments we provide illustrations of the capital market impact of decisions to adapt or not adapt to these information-driven markets.

ICT and the information-driven market

The pervasiveness of ICT in the digital economy offers buyers and sellers the opportunity to be more informed about what is for sale and what is in demand. This is not just information about the market as a whole but also about market segments (or niches) and potentially down to the level of the individual buyer and transaction. For market participants this may be both good and bad news. Either way, it changes dramatically the strategies required for

approaching the market, the character of sustainable business models, and the nature of the business process through which participants engage the market. The existence of better informed buyers results in greater transparency and potentially greater volatility, liquidity and reach in markets. Informed buyers are more aware of the distribution of prices and product quality in the market, so transparency is improved. As a consequence there is greater price competition in the market, especially for commoditised products or services. In an ICT-enabled market, the technology provides the means for informing buyers. Consequently, firms whose business model is primarily based on an information asymmetry between buyers and sellers are at risk of being forced out of the market. More informed buyers make commodity markets an unprofitable place for sellers.

A market in which buyers are more informed also can yield greater reach, as more customers are aware of a greater range of what is available in the market. This also results in improved liquidity in the market, as ICT can enable more rapid matching of buyers and sellers. On the downside, a more informed market may also be subject to greater volatility as informed buyers rapidly react to each new piece of information that becomes available.

Information-driven markets with more informed customers may cast a dark picture for some sellers, particularly in commoditised markets. However, for the informed and savvy seller, information-driven markets offer new opportunities for gain. They give sellers the opportunity to learn about customer preferences and willingness to pay. While the competition brought about by more informed buyers can lead to commoditisation and even fiercer price competition, sellers have a choice. Informed sellers employ strategies, business models and processes to differentiate, discriminate and ultimately personalise their products or services, rather than be drawn into the trap of commoditisation. In information-driven markets the informed seller can more readily acquire information about precisely what buyers want, not just at an aggregate market level but at the segment and ultimately, individual buyer level. The market can become personalised through effective use of ICT.

Personalisation technologies have been a major focus of research and development in business-to-consumer e-commerce (Kamis and Davern 2004, Murthi and Sakar 2003). Personalisation technologies extract information from markets to model individual consumer preferences and behaviour, so that products and offerings that have a greater likelihood of being purchased can be presented to the individual consumer. Ultimately, it has been suggested, markets will develop in such a way that price itself is personalised. Indeed, Amazon.com has experimented with dynamically adjusting pricing depending on consumer characteristics, although the experiment encountered some consumer resistance because of how it was implemented. In the travel industry this has become commonplace — although to the detriment of the less savvy players. In what might otherwise be thought of as a commodity market — computers — Sun MicroSystems CEO Scott McNeally has also predicted that fixed prices will become a thing of the past (McNeally 2005).

The pervasiveness of ICT and its implications for the market for information now provides both challenges and opportunities for businesses. The challenges of ICT pervasiveness are likely to lead to a number of possible outcomes for firms depending on how they adapt. For firms employing business models and processes well adapted to information-driven markets, the prospects are promising; for those that do not adapt their models and processes, the outlook may be grim.

To support our arguments we provide evidence from firms operating in markets for commoditised goods and services, which ICT pervasiveness has transformed into information-driven markets. We examine how the capital markets react to business models and processes that have adapted well, or those that have not, to empirically illustrate our claims.

A case of failure to adapt: Flight Centre

Travel agency ticket sales are typically the conclusion of a transaction that has involved sifting through information on what are the cheapest flights, what are the flight schedules and visa requirements for international travel, etc.

These agencies have existed because they provide a cheap means for buyers to reduce the *information asymmetry* between themselves and the ultimate seller of a good or service. Information asymmetry exists where the relative bargaining power of two parties in a transaction is determined by one party possessing more information essential to the transaction than the other party. In the case of airline tickets, the ultimate seller is the airline itself, which has no incentive to reduce information asymmetry.

In the past, without an agent or broker, finding the cheapest ticket or the most direct flight was difficult for purchasers. They could find the information but the costs incurred in time and effort were likely to be too great. They would either make a guess about what was the cheapest ticket or, better, use the service of an agent who had invested in systems that enabled a search for the best deal for the customer. That service would reduce the asymmetry; the ticket purchasers would complete transactions confident that they had the same information as the seller and so pay what they consider a "fair" price.

The pervasiveness of ICT and the speedy Web access now available to buyers in markets such as travel have shrunk the information asymmetry between transactors in those markets. This reduction in asymmetry between transactors is now challenging firms whose business models rely on it.

Certainly, the capital markets acknowledge that this challenge (even threat) exists. For example, one of the best-run and most successful travel agents in Australia, Flight Centre, has seen its share price relative to the market slowly subside in recent years. In all likelihood, it is no coincidence that this share price trend started around mid-2002 — about the time that ICT and its power was becoming more and more accessible to buyers (that is, as home Internet connections enabled buyers to secure information for themselves). This power and accessibility now allows buyers in the market to directly reduce information asymmetry — signalling doom for Flight Centre's business model, which relies on the presence of asymmetry.

Cases of adaptation success: wotif.com and Dell

For innovators, there are many opportunities to develop new business models that take advantage of the pervasiveness of ICT. A recent Australian venture that seems to have identified ICT-driven business opportunities is wotif.com. This business appears to understand the problem that information asymmetry creates for buyers in markets for consumer goods and services. wotif.com's business model is simple: it acts as an intermediary to broker excess room capacity for the hotel industry on a just-in-time basis and do it in "virtual" space — the Web. Now potential hotel guests are a few mouse clicks away from an inventory of competitively priced and readily available rooms. The hotels can wait until almost the last minute to offload excess capacity (vacancies) into an otherwise unavailable market. There are signs that the market believes wotif.com has a good business model, notably the appearance of numerous start-up competitors in last-minute accommodation broking.

Dell, a leading computer manufacturer, also exemplifies how sellers in information-driven markets can create strategies, business models and business process to avoid the economic death that comes from commoditisation pressures. Dell demonstrates how to succeed, not just survive, in a market that is typically thought of as commoditised — personal computers. Dell's strategy from the beginning has been one of selling direct to the customer, even before the advent of Web sales and Dell Online. By avoiding using resellers, unlike its competitors, Dell is informed by direct contact with its customers. CEO and founder Michael Dell noted: "Information . . . is central to a company's ability to compete in the global economy" (Michael Dell 1996).

Because of its direct-to-customer strategy, Dell could view the introduction of Web-based sales, and the consequent shift to a more information-driven market, not as a major innovation but rather an extension of its existing strategy. Dell's business model can be characterised by two key components: mass customisation and build-to-order; and "informing" the supply chain and partnering with suppliers.

Mass customisation and build-to-order provide a degree of product personalisation for Dell's customers. For Dell, it entailed providing facilities (largely through its website) to allow customers to choose not among pre-built models but to select what they required from a range of options for each attribute of the computer system (memory capacity, hard disk capacity, CPU speed, CD or DVD drives, etc.). Thus Dell was able to provide customers a product much closer to their individual preferences, yielding more satisfied customers. It also provided Dell with timely information about what was in demand in the market. While some additional costs are involved in providing a customised solution from a broad range of options these are more than outweighed by the benefits of improved customer satisfaction, better information about the market, and reduced inventories due to the build-to-order approach (a non-trivial issue, given the rapid technological obsolescence of any stock held).

Dell's business model also entailed sharing much of this market information with its partnering suppliers. This enabled the suppliers to better match production levels with end-customer demand. Suppliers could thus avoid large inventory holding costs and losses due to obsolescence, resulting in more profits for them and cheaper prices for Dell.

The business processes that enable mass customisation, build-to-order and just-in-time production by suppliers are quite different from the processes employed by Dell's more traditional competitors with their large networks of resellers and arm's-length suppliers. Dell also leveraged ICT even further by interacting with its larger corporate and educational customers through Dell Online's "Premier Pages". These customised webpages could reflect differential pricing for the preferred customers and also integrate the ordering process with the purchasing processes of the customer. For example, an employee at a preferred customer firm could use the premier pages to configure a system and then submit the order. Dell would then automatically forward the order to the customer firm's purchasing officer for confirmation and budget authorisation.

Dell used ICT to integrate its business processes directly with its customers and suppliers, informing both of them for Dell's ultimate benefit. The success of Dell in what would typically be seen as a commodity market is evidenced by comparing the returns on Dell's stock with those of one of its leading competitors, Compaq. Over the period from January 1997 to January 2002, the share return of Dell was 400% greater than that of Compaq. The difference in returns over the five-year period after the introduction of Dell's Online sales presence evidences the substantive competitive advantage that Dell had created through appropriate strategy, business model and business process. Further, the advantage appears to be sustainable, as it clearly persisted over the five-year period, even through the crash of technology stocks in 2000. This success in an information-driven

market is in stark contrast to the ongoing challenges faced by players such as Flight Centre which are operating with business models that no longer fit the market. The key appears to be developing strategies, business models and processes that take advantage of the information-driven market to differentiate and personalise the market rather than be driven to commoditisation by it.

IMPLICATIONS OF ICT DEVELOPMENT FOR THE ACCOUNTING AND AUDITING PROFESSION

The challenge to the traditional business model of the firm from ICT development has significant implications for the accounting profession. In the twentieth century the primary business model of a typical firm was underpinned by physical assets such as property, plant and equipment. These physical assets could be reliably valued and the value did not change significantly between accounting periods. In the twenty-first century, the advent of ICT developments has resulted in a significant increase in intangible assets (*eg*, an Internet-based supply chain) underpinning the business model and processes. This has two main implications. First, the value of individual assets as recorded in the balance sheet in an information-driven market can change rapidly. The evidence from the capital market of the change in value for firms such as Dell, which is well adapted to an information-driven market, in contrast to firms such as Flight Centre, which is not well adapted, implies that the underlying assets, as recorded on the balance sheet, will also change. The accounting and auditing profession has a legal obligation under AASB 136 *Impairment of Assets* to ensure non-current assets do not exceed their recoverable amount (*ie*, an amount that is the higher of an asset's net selling price and its value in use).

Second, the viability of some firms as going concerns is critically dependent on their capacity to adjust to ICT developments. A key objective of the audit is to determine that the firm is a going concern. The audit profession therefore needs to be able to recognise that the inability of some firms to adapt to ICT development will result in an unsustainable business model and business processes, ultimately leading to the end of a going concern. The speed of information-driven markets also implies that the switch from a going concern to a non-going concern can occur quickly.

The implications of the growth and greater integration of ICT for the value of individual assets and the viability of the firm demand that the accounting and auditing profession must keep abreast of ICT developments to fulfil their professional responsibilities.

CONCLUSION

Over the past quarter of a century there has been dramatic development and change in the information and communication technologies that firms use to organise and manage their business models and business processes. We argue that the most significant implication of this change is a reduction in the information asymmetry between producer and consumer and a shift to information-driven markets, with resulting impacts on firm value. This development challenges firms' business models and business processes, perhaps leading to a number of possible outcomes depending on how, and to what extent, firms adapt to the change in the market for information. We have shown with firm-specific evidence that a firm which does not adapt to these challenges can fail to sustain its business model and ultimately lose value. Alternatively, we have shown that a firm that sees the opportunities presented by these challenges "levers" off them by implementing appropriate business models and processes and will be positively valued by the capital market. This has significant implications for the accounting and auditing profession with respect to asset valuation and going-concern judgments.

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NOTE

1 Information and communication technologies are (a) the computer hardware and software used to input and process data and output information (the information part of the technology) and (b) the physical devices and software used to link hardware together and to transfer data and information between hardware (the communication part of the technology).

REFERENCES

Dell, M., 1996, address to the Commonwealth Club, 27 January, previously available at http://www.commonwealthclub.org/96-01dell-speech.html.

Kamis, A., and M. Davern, 2004, "Personalizing to Product Category Knowledge: The Mediating Effect of Shopping Tools on Decision Confidence", proceedings of the 37th Annual Hawaii International Conference on Systems Sciences.

McNealy, S., 2005, "Welcome to the Bazaar", available from http://www.sun.com/executives/perspectives/bazaar.html, originally published in *Harvard Business Review*, March 2001.

Murthi, B.P.S., and S. Sarkar, 2003, "The Role of the Management Sciences in Research on Personalization", *Management Science* 49, 10: 1344–62.