December 2003

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Recommended Citation

Gibson, Marcus and Arnott, David, "Business Intelligence for Small Business: Assessment, Framework & Agenda" (2003). *PACIS 2003 Proceedings*. 51.
http://aisel.aisnet.org/pacis2003/51

Business Intelligence for Small Business: Assessment, Framework & Agenda

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Abstract
Small businesses, businesses with 20 or less personnel, account for a significant proportion of economic activity and it is the economic sector that employs the most people in OECD countries. Small businesses are fundamentally different than larger organizations in their operations and decision-making processes. Business intelligence (BI) is the current approach to management decision support in large organizations. It includes personal decision support, analytics, enterprise reporting, and data warehousing. BI is also arguably the biggest current growth area in IT investment. This paper explores why BI applications are not widely used in small businesses. It develops a research model that may explain BI adoption, or lack of adoption, in small business. A research agenda to investigate this economically important issue is presented.

Keywords*:*
Small business, business intelligence, decision support systems, data warehousing, technology adoption.

Introduction

Small business enterprise is a significant contributor to the Australian economy, employing more than three million people in more than one million businesses (Annual Review of Small Business 2001). The scale and importance of small business is similar in other OECD countries (Longenecker, Moore & Petty 1994). The small business sector is an unstable environment, heavily influenced by external pressures, and continually expanding and diversifying. This, combined with the fact that smaller enterprises encounter greater levels of economic uncertainty (Storey 1995) results in a situation where the small business has less tolerance for inefficiency than their larger counterparts. Quality decision-making is vital to all organizations but small businesses have less capacity for error.

Decision-making is one of the primary tasks of management. Management involves a process of evaluating, selecting, and initiating courses of action (Simon 1965). Human forecasting and decision-making capabilities have been significantly improved with the use of software systems designed specifically to aid in business administration and choosing courses of action. A call for improved decision-making potential, coupled with increasing IT

capabilities, has led to the emergence of Business Intelligence (BI). The latest BI tools can help managers to drive decisions, and help to make them more effective (Vitt, Luckevich & Misner 2002). Decision-makers are now able to profile customers, measure and investigate critical business operations, rank employees, 'drill-down' through sales, and customise reports. An individual manager may now complete tasks quickly and on an ad-hoc basis, tasks that may have once required entire information systems departments hours to accomplish. BI systems are engineered towards busy people that need information quickly and easily.

Unlike the IT boom that occurred during the 1990's, organizations today can no longer spend money on excessive infrastructure, any technology that doesn't provide a quick impact on the business' bottom line, is not considered viable (Whiting 2003). Strategies to increase business profits are continually being sought and cost cutting is widespread, providing the right conditions for BI to be most beneficial. These systems, although often providing significant business benefits, require the investment of both time and money, and if large multinational corporations are cutting the costs of IT expenditure, where does this leave the small enterprise compared to the large? Small businesses are already limited in their access to capital resources (Blili & Raymond 1993). Therefore, the small enterprise may be at a considerable disadvantage in terms of strategic decision-making support, furthering the gap of capabilities between large and small business.

While there has been a considerable amount of research carried out on the adoption of IT within small business (for example, Cragg & King 1993; Naylor & Williams 1994; Levy & Powell 2000; Mundim, Allessandro & Stocchetti 2000; Poon 2000; Mehrtens, Cragg & Mills 2001), there has been no significant works published on the use of decision supporting technologies within this sector. This paper develops a research agenda for BI in small business. First, business intelligence and its importance in contemporary information technology is described, followed by a brief discussion of the most popular techniques used in BI today. Small businesses are defined, including their size and scope, and are contrasted to larger enterprises. Properties affecting BI adoption are then discussed, and a research agenda is established.

Business Intelligence

In modern organizations information is abundant. The problem for decision makers is not finding information, but selecting *appropriate* information, amongst vast quantities (Davenport & Beck 2001). Managers don't need more information, they need *better* information. Despite the current IT slowdown in industry, BI software vendors continue to make substantial profits, with some vendors reporting profit increases by as much as 40 percent on the previous financial year (Chen 2002; Lei 2002; Whiting 2003). As business profits decline, organizations are recognising quality information as a key component in gaining competitive advantage; as has been reflected in an increase in BI software vendor profits (Whiting 2003).

There are many professional definitions of BI, depending largely on the organizational background of those defining it, and what they are merchandising. In essence, business intelligence systems are information systems that extend a decision maker's ability to process

information and knowledge. Large-scale, complex and time-consuming tasks are more manageable, and exploration and the discovery of information are encouraged. BI systems enable near real-time, interactive access to data, allowing manipulation and analysis of critical company information. BI is often referred to as Online Analytical Processing (OLAP), or multidimensional analysis, however many definitions also encompass personal and group decision support systems, executive information systems, data warehousing, intelligent systems, and knowledge management. In their simplest form, these tools permit a decision maker to access an up-to-date, consolidated view of business performance in a simple and easy manner.

Personal DSS (PDSS) are small-scale systems that are normally developed for one manager, or a small number of independent managers, for one decision task. PDSS are the oldest form of decision support system, popularised by Keen & Scott Morton (1978). These include modelling systems and what industry currently terms "analytics". In a PDSS an individual manager has power or responsibility for the decision.

Group support systems are a collection of computer-based technologies that are used to promote multi-participant efforts, especially identifying problems, opportunities and issues (Huber, Valacich & Jessup 1993; Pervan 1998). GSS can encompass a range of services aimed at assisting the decision-making capabilities of groups. These may include messaging systems, conferencing systems, coordination systems, intelligent agent systems, collaborative authoring systems, and decision-support systems. GSS make use of a range of technologies in order to make groups more effective.

EIS are tools used to supply managers with direct access to relevant information in an easy to interpret format. The provision of timely, accurate and actionable information is the aim of EIS. The most useful EIS have been found to be the facilitation of meetings and agenda setting, electronic briefings, and monitoring and browsing of information (Nord & Nord 1995). Common EIS characteristics include an enhanced 'dashboard' style interface and technical capabilities, such as email, ad-hoc querying, and extensive use of third party data (Bergeron, Raymond & LaForge 1991; Mallach 2000, p. 476). EIS packages include financial analysis tools, reporting, critical success factors (CSF's), communication and productivity tools, all of which have the ability to link with large corporate databases, transferring transaction data into useful management information.

Data warehouses provide decision makers with a subject oriented, integrated, non-volatile, time variant collection of data, in order to support management decision making (Inmon 1996; 2002, p.389). Data warehouses usually contain large amounts of data, from both operational business sources, and external sources. They are organised in such a way to facilitate the use of this data to assist in decision-making purposes. Data warehouses provide the large-scale infrastructure for contemporary decision support.

Intelligent DSS (IDSS), or suggestion systems, aim to mimic human intelligence. Using heuristics, IDSS shorten the processing needed to accomplish complex decision tasks. IDSS software use 'rules of thumb' so human decision makers are not required to rethink the same

problem in its entirety each time it arises, the benefit being that tasks may be executed much faster than a human alone could accomplish (Mallach 2000, p.134).

Knowledge management is a process that assists a business in identifying, choosing, organising, disseminating, and transferring important information and skills, contained within an organization's memory, typically in an unstructured form. Knowledge management systems (KMS) aim to identify useful areas of knowledge within a business, and reorganise it in such a way that it may be repeatedly shared. KMS are process oriented, with strategies determined by organizational culture, policies and motivation. KMS have a multidisciplinary background, and incorporate aspects of organizational learning, cognitive psychology, business process analysis, training and science – rather than a single technology. Dyer (2000) identifies some technologies commonly associated with KMS such as email or messaging, document management, search engines, enterprise information portals, data warehousing, groupware, web-based training, and workflow management.

Table 1 outlines the BI approaches described above, and identifies popular uses of the systems, and classifies them in terms of Alter's influential decision support system taxonomy (Alter 1980), a categorization that is still cited today (Mallach 2000, pp. 130-134).

BI Technology	Popular Uses	Alter Taxonomy Classification	Common Technical Approach	Relative Cost
Personal DSS	Scenario analysis, information management, modelling	Analysis information systems, file drawer and, data analysis system (model-oriented)	Small scale, standalone systems	Low
Group Support Systems	Electronic brainstorming, voting,	Data oriented, optimisation models (data-oriented)	Multiple machines, server-based	Med-High
Executive Information Systems	Financial Analysis	Analysis information system, file drawer system (model-oriented)	Client-server	High
Data Warehouses	'Slice and Dice' through data dimension, data mining	Analysis information system, data analysis system (data-oriented)	DBMS servers, high capacity storage	Med-High
Intelligent DSS	Replace human expertise, prediction, prescription, evaluation	Suggestion models, optimisation models (data oriented)	Complex software	High
Knowledge Management Systems	Knowledge distribution, capturing organizational memory	File drawer systems, analysis information systems (model oriented)	DBMS Server	Med-High

Table 1: BI System Classification

The Nature of Small Business

A small business is an enterprise employing less than 20 people (Australian Bureau of Statistics 2000). Small businesses contain the following organizational characteristics:

- They are closely controlled by the managers/owners, who are contributing a large proportion, if not all, of the business' operating capital.

- They are independently owned and operated, and

- The major decision-making responsibilities lie with the managers/owners. (Australian Bureau of Statistics 2000)

Small business represents around half of the total non-agricultural private sector workforce in Australia, and accounts for 30 percent of total wages and salaries generated by Australian business. This situation is similar in OECD countries (Longenecker et al. 1994; Ballantine et. al. 1998). Small businesses account for 95 percent of the businesses registered in Australia, and the past fifteen years have witnessed a doubling of registered small businesses. The importance of the small business sector has been reflected by an increasing interest amongst academic researchers. The characteristics and intricacies of the small business sector have been studied extensively, in an effort to give small business owner/managers a better understanding of their environment, in order to help gain competitive advantage (Blili & Raymond 1993; Lee 1995; Storey 1995; NOIE 2000).

Small businesses should not be conceptualised as small versions of large organizations. Small businesses do demonstrate some similarities with large firms, and at a macro level they essentially carry out the same management processes, such as decision-making, planning, and coordination. There are however some significant differences between the two sectors, which are mirrored in the way they are managed and organized. Large corporations have significant, sometimes overwhelming, market power. As big businesses grow, and increase their hold on the economy, day-by-day their influence on our lives becomes greater, often more so than universities, government, politicians, and unions (Galbraith 1977). The economic environment is constantly evolving and with these changes comes an increased understanding of big business and their power on the economy. The large corporation has markedly more social and economic power than the small business. Bimodal symmetry, social conditioning, compensatory power, and a pure ability to process larger volumes of work all help to contribute to large firms' immense market force.

The differences between large and small organizations continue, with only 60 percent of all small businesses using computers in their daily business operations. Also as the size of the small business increases, so does the likelihood of computers being used within the organization (Australian Bureau of Statistics 2000). Less than 50 percent of non-employing businesses use computers, compared to 85 percent of those employing between five and 19 people. Only 36 percent of all small businesses have access to the Internet; again the likelihood increases with the size of the enterprise. The most common use of the Internet is for email access (86 percent of businesses with the Internet, or 30 percent of all small business (NOIE 2000)). Very few small businesses engage in direct e-commerce, and as few

as eight percent are making or receiving payments via the Internet. There is some evidence (Chen & Williams 1993) that small businesses are starting to use computers in decision support roles, however there is little to indicate that this use is on a wide scale.

BI in Small Business

Business intelligence is an information technology that can help a manager to cut-costs, create stronger customer linkages, innovate, and plan. Despite the advantages, there is little evidence that such advanced technologies are to be found in small business. There are a number of factors that may be affecting the adoption rate of BI technologies. Figure 1 presents a model of characteristics considered to affect business intelligence adoption within a small business environment. The model has been developed based on a review of research identifying small business characteristics considered to affect IS/IT adoption.
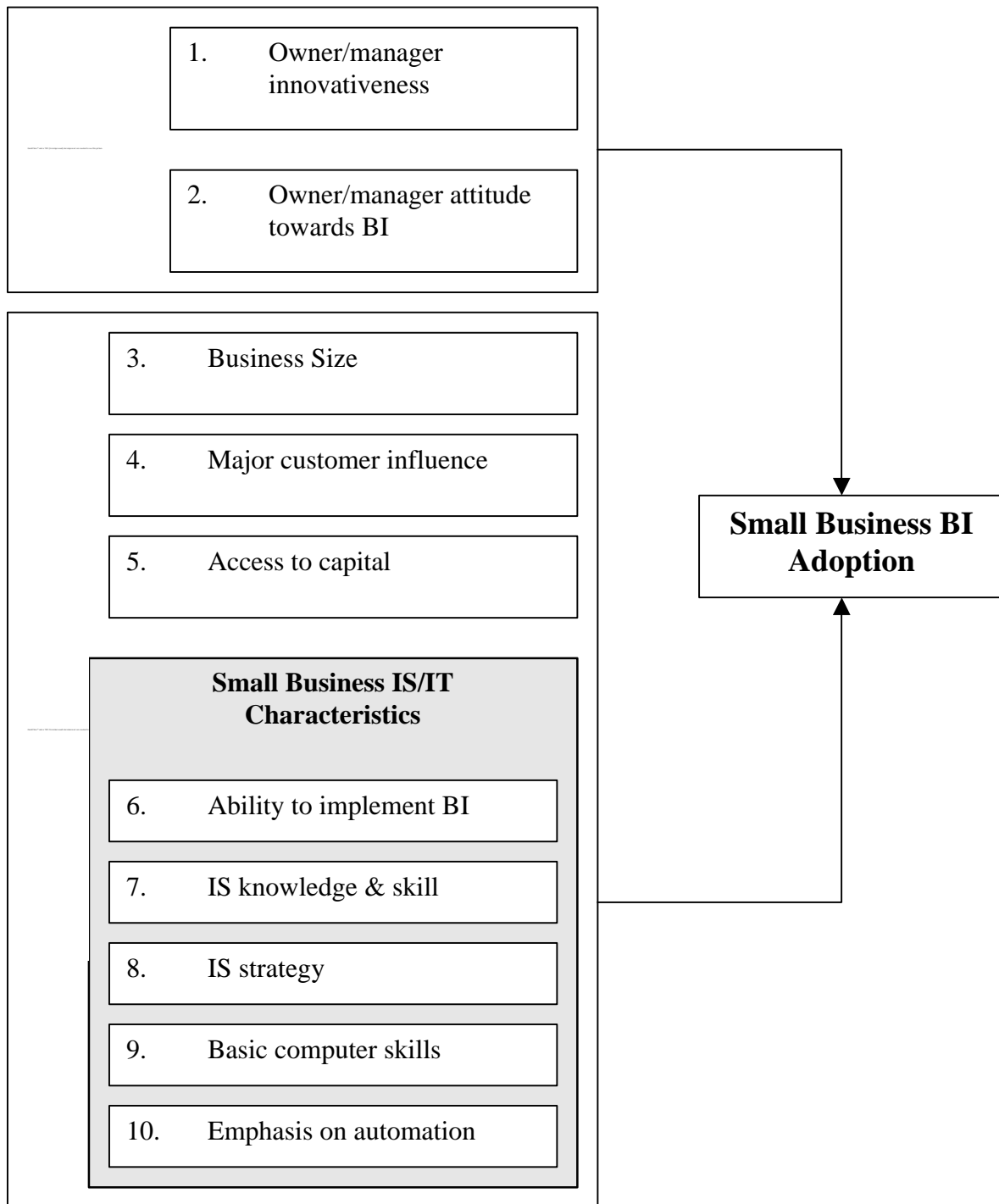
1.	Owner/manager innovativeness

2.	Owner/manager attitude towards BI

3.	Business Size

4.	Major customer influence

5.	Access to capital

Small Business IS/IT Characteristics

6.	Ability to implement BI

7.	IS knowledge & skill

8.	IS strategy

9.	Basic computer skills

10.	Emphasis on automation

Small Business BI Adoption

Figure 1: Small Business BI Adoption Model

Table 2 identifies the supporting academic and Government research that was used to develop the Small Business BI Adoption model shown in Figure 1. Each characteristic is discussed below.

Characteristic Number	Characteristic	Supporting Research	Research Proposition
1	Owner/manager innovativeness	(Kirten 1984; Thong 1999; Mintzberg 1979; Rizzoni 1991)	A
2	Owner/manager BI attitude and knowledge	(Thong 1999; Gable & Raman 1992; Baker 1987; Ettlie 1990)	B
3	Business Size	(Australian Bureau of Statistics 2000; NOIE 2000)	C
4	Influence of major customers	(Ballantine et al. 1998)	D
5	Access to capital resources	(Welsh & White 1981; Blili & Raymond 1993; Ballantine et al. 1998)	E
6	Ability to implement Bi	(Blili & Raymond 1993; Thong, Yap & Raman 1996)	F
7	IS knowledge and skill	(Neidleman 1979; Lederer & Mendelow 1986; Lees 1987; DeLone 1988; Montazemi 1988; Ballantine et al. 1998)	G
8	IS strategy	(Moses 1985; Lederer & Mendelow 1986; Hagman & McCahon 1993; Ballantine et. al. 1998)	H
9	Basic computer skills	(Neidleman 1979; NOIE 2000)	I
10	Emphasis on automation	(Malone 1985; Lincoln & Warberg 1987; Hashmi & Cuddy 1990; Kench & Evans 1991; Khan & Khan 1992; Chen & Williams 1993; Fuller 1996; Zuboff 1998; Bridge & Peel 1999)	J

Table 2: Small business BI adoption factors

Characteristics 1 & 2: Small business tend to have a highly centralised management structure, with managers (or CEO's) making the majority of critical decisions (Mintzberg 1979). This suggests that any decision to adopt BI within the organization largely depends on the individual characteristics and opinions of the manager. Research has also identified the importance of the owner/manager of the small business in determining whether IS technologies are adopted (Mintzberg 1979; Thong 1999). As the owner/manager is the primary decision maker within the small business (Rizzoni 1991), it is reasonable to assume that their individual characteristics will play a large role in determining the business' attitude to adopting BI solutions. Therefore, external forces, financial ability, and BI skills are not the only determinants of BI adoption; the attitudes and opinion of the business' major

decision-maker/s are crucial. Business knowledge of IS has been identified as a contributor to BI adoption, this is particularly important in the case of the owner/manager. Managers with a high level of technical knowledge (Ettlie 1990) and who are innovative (Thong 1999) are more likely to embrace new technologies.

Characteristic 3: As the size of a small business increases, so does the likelihood of IT being present within the business (Australian Bureau of Statistics 2000; NOIE 2000). A possible reason for this is that as the size of the business increases so does the workload. Information technology could be seen as an enabler to support this situation. Other reasons may include greater access to capital and an existing IT infrastructure.

Characteristic 4: External pressures impact smaller organizations more than large. Changes in tax laws, government regulations, interest rates, and customer demands can often impact a greater number of expenses for small businesses (Welsh 1981; Ballantine et al. 1998). For instance, a significant customer to a small businesses may apply pressure for a particular technology's use, such as a specific brand of B-B software or electronic data interchange system (Ballantine et al. 1998).

Characteristic 5: In broad terms, relative to large organizations small businesses face 'resource poverty' (Welsh & White 1981). Strained financial resources force the small business to adopt some very different management approaches from large organizations. Small businesses are situated in a variety of industries, wholesaling, services, and retail for example. Many are in highly competitive areas, prone to price reductions, and as profit margins decrease, an increased focus is placed on liquidity. Owner/manager wages make up a large percentage of revenues of a small business, leaving minimal funds available to finance state-of-the-art purchases of IT-based accounting and forecasting tools. Resource poverty has significant implications for the small business in terms of their ability to adopt new technologies, as small business often lacks ability to produce adequate financial capital for major purchases (Welsh & White 1981; Blili & Raymond 1993).

Characteristic 6: Resource poverty may also contribute to the small business' ability to employ specialised staff with adequate knowledge to implement BI solutions (Blili & Raymond 1993) and lead to implementing inferior solutions (Thong et al. 1996). Often small business employees are equipped with general skills, rather than specialist knowledge, this is arguably due to small employee numbers and a need to cope with a wide range of business tasks.

Characteristic 7: Resource poverty may also lead to small businesses lacking knowledge of modern decision support tools and technologies (Neidleman 1979; Lederer & Mendelow 1986; Lees 1987; DeLone 1988; Montazemi 1988; Ballantine et al. 1998).

Characteristic 8: Information systems research acknowledges that the evaluation of IT investment must be closely aligned with the business' overall strategy towards information technology. Small businesses tend to lack any specific strategic plan towards information systems (Lederer & Medelow 1986; Hagman & McCahon 1993; Ballantine et al. 1998).

Characteristic 9: Further to this, a recent study identified 40% of business owners have acknowledged the need for general computer skills training, prior to any specialized training in a specific IT skill, such as business intelligence applications (NOIE 2000).

Characteristic 10: Zuboff (1998) identifed small businesses greater emphasis on using IT/IS to automate, rather than 'informate'. A large majority of investment is in software helping to streamline business processes, such as accounting packages and point of sale software. A small business focus on operational and administrative tasks, rather than strategic decision-making is reflected in the work of a number of researchers (Malone 1985; Lincoln & Warberg 1987; Hashmi & Cuddy 1990; Kench & Evans 1991; Khan & Khan 1992; Chen & Williams 1993; Fuller 1996; Zuboff 1998; Bridge & Peel 1999).

Research Framework and Agenda

This paper has identified ten factors or characteristics affecting the adoption of BI technologies in small business: access to capital resources, ability to implement BI, IS and BI knowledge, IS strategy, business size, emphasis on operational systems (automated and administrative tasks), influence of major customers, computer and information system skill, owner/manager knowledge and attitude towards BI, and manager innovativeness. To guide further research, this section develops a set of propositions that constitutes a research agenda for business intelligence adoption in the small business.

In the small business, a manager that seeks solutions that change the structure in which a problem is embedded, solutions that are new and state of the art, is regarded as an innovator (Kirten 1976), hence the suggestion:

Proposition A: *Small businesses that have an innovative owner/manager are more likely to consider a BI solution to help make effective management decisions.*

Management decisions that are difficult for the decision maker to comprehend may be postponed or circumnavigated (Attewell & Rule 1991). Research has found that owner/managers in small businesses tend to lack a basic understanding of information systems technology (Gable 1992). This could lead to the rejection of a system before the benefits of implementation are fully understood. This suggests, that if a manager were to understand the nature of BI, the likeliness of adoption would be increased, hence:

Proposition B: *The easier a business intelligence architecture can be explained to an owner/manager, the more likely they will be to adopt it.*

Studies suggest that as the size of a small business increases, so will the likelihood of information technology being present within the organization (Australian Bureau of Statistics

2000). The reason for this is that upfront costs may be significantly reduced if there is significant IT architecture present within the business already.

Proposition C: *Small business with more employees will adopt BI technology more readily than those with fewer employees.*

Small businesses that use software to communicate with customers may find it difficult to accept another technology Ballantine et. al. (1998), suggesting that:

Proposition D: *Small businesses without business-to-business, or electronic data interchange software, will accept business intelligence more readily than those that do.*

Small businesses are often faced with limited access to finances to support the purchase of business intelligence. This may lead to BI systems only being considered if the existing infrastructure is able to cope with the software load. This could result in BI solutions that require relatively low levels of technical infrastructure, such as systems at the lower-end of the Alter taxonomy (file-drawer and analysis information systems), suggesting:

Proposition E: *Small businesses possessing existing technical infrastructure suitable to adopt an appropriate BI solution are more likely to adopt.*

As an effect of having limited access to capital resources, small businesses are unable to employ specialized staff. This may lessen their ability to implement any BI architecture within the firm. Systems purchased are likely to be off-the-shelf packages that require little knowledge to implement, and have some form of technical support provided with the product as a part of the licensing. As small business would therefore be constrained by ready-made solutions from software vendors, the ability to innovate would be hindered. This could be interpreted as:

Proposition F: *Small businesses are more likely to adopt systems that are easy to install, manage, and maintain, to help them cope with their limited technical capacity.*

Small businesses are limited in their information system and business intelligence knowledge and skills, suggesting:

Proposition G: *Small businesses will rely on the knowledge of external parties to obtain information on business intelligence technologies.*

Research identifies that strategic planning processes are scarce within small businesses and that this is likely to lead to a lack of clear strategic business objectives within the organization. The recognition of the benefits of business intelligence to aid in decision-making is not likely. Therefore, any investment into IS by the small business is likely to have faults, due to the failure of any clear decision-strategy, or documentation being evident. A lack of focus on IS and IT strategy within the small business implies that:

Proposition H: *Small business decision makers adopt less formal BI decision-making processes than their larger counterparts.*

Business with little or no basic skills in computer use may face too large a hurdle to successfully adopt and use BI to support their decision-making. Alternatively, businesses that are competent in the use of IT, and already have IS/IT in place within the organization are more likely to be comfortable with using BI, and have less of a learning curve than others. Small business employees are often ill equipped with the information technology skills required to use BI. This implies that:

Proposition I: *Small business that have IT skills engrained into their core business activities are more likely to successfully use business intelligence solutions.*

Small business spends a large majority of their IT investment in software to streamline business operations, especially accounting packages (Zuboff 1998). This focus on cost efficiency should be incorporated into the evaluation of any proposed BI system implementation. This would help the small business stakeholder identify BI system benefits important to them. The small business IT focus on automate rather than 'informate' suggests that:

Proposition J: *BI systems that demonstrate clear financial benefits are more likely to be adopted by a small business.*

To confirm or disconfirm the above propositions, the next phase of this research would be to empirically test each proposition. The results of these tests would enable the formulation of hypotheses. Galliers' (1991) taxonomy of information systems research approaches is a useful tool in identifying appropriate empirical testing methods. His paper reviews the range of research methods that have been advocated within IS as suitable approaches. Using this taxonomy to identify possible theory testing methods suggests a number of possible techniques to carry out further research in small business BI adoption. The most suitable considered being a combination of both survey and case study research methods. Propositions A, B, C, D, and J would benefit from survey research, while propositions E, F, G, and I could be tested with a combination of survey and case study methods. Proposition H could be tested with multiple case studies. Clearly there are a number of issues that would need to be addressed before undertaking empirical testing, such as the decision whether or not to test each proposition individually or in combination.

Concluding Comments

This paper has explored reasons why business intelligence applications are not widely used within the small business sector. It provides an overview of business intelligence and identifies technologies used to support decision-making processes in large organizations. Based on supporting academic and government research, it develops a model that may help explain small business BI adoption. A research agenda to investigate this issue is also presented.

This research is important for two major reasons. The first is the economic importance of the small business sector. The exploitation of BI technology is important in the development of the sector, especially from an efficiency perspective. The second is from a socio-economic perspective. If large organizations are to continue to exploit the latest decision-supporting technologies, and small businesses continue to tread wearily in terms of adopting modern business intelligence, the power gap will only continue to widen. If the power differential between large and small businesses persists to enlarge, small businesses will find it increasingly difficult to compete in a modern economy with resulting significant social and economic destabilization.

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