The impact of strategy and maturity on business analytics and firm performance: A review and research agenda

Graeme Shanks
University of Melbourne

Rajeev Sharma
University of Melbourne, rajeev@uow.edu.au

Peter Seddon
University Of Melbourne

Peter Reynolds
University Of Melbourne

The impact of strategy and maturity on business analytics and firm performance: A review and research agenda

Abstract

Business analytics involves interpreting organizational data to improve decision-making and to optimise business processes. It has the potential to improve firm performance and increase competitive advantage. Although many case studies have been reponed that describe business analytics applications and speculate about how they might contribute to firm performance, there is no clearly articulated and theoretically grounded model in the literature. This paper proposes a theoretical framework jor understanding how and why business analytics technology and capabilities can lead to value-creating actions that lead to improved form performance and competitive advantage. We jocus particularly on how strategy and maturity impact business analytics and firm performance. A number oj propositions are developed from the framework and a research agenda jor empirical evaluation and enhancement of the framework is proposed.

Keywords

analytics, business, maturity, firm, performance, impact, review, research, agenda, strategy

Disciplines

Engineering | Science and Technology Studies

Publication Details

The Impact of Strategy and Maturity on Business Analytics and Firm Performance: A Review and Research Agenda

Graeme Shanks
Rajeev Sharma
Peter Seddon
Peter Reynolds
Department of Information Systems
The University of Melbourne
Victoria, Australia
Email: gshanks@unimelb.edu.au

Abstract

Business analytics involves interpreting organizational data to improve decision-making and to optimise business processes. It has the potential to improve firm performance and increase competitive advantage. Although many case studies have been reported that describe business analytics applications and speculate about how they might contribute to firm performance, there is no clearly articulated and theoretically grounded model in the literature. This paper proposes a theoretical framework for understanding how and why business analytics technology and capabilities can lead to value-creating actions that lead to improved form performance and competitive advantage. We focus particularly on how strategy and maturity impact business analytics and firm performance. A number of propositions are developed from the framework and a research agenda for empirical evaluation and enhancement of the framework is proposed.

Keywords

Business Analytics, capabilities, strategy, maturity, firm performance, competitive advantage.

INTRODUCTION

The relationship between information technology (IT) investments and firm performance has been of interest to information systems practitioners and researchers for many years (Aral and Weill 2007). Early research failed to explain how IT investments led to improved firm performance. This was particularly evident in the so-called "IT productivity paradox" (Brynjolfsson 1993), and in research from Alavi and Joachimsthaler (1992), and others, who found that investment in decision support systems (DSS) during the 1980s did not always yield benefits. More recent research has unbundled IT investments into various categories (for example infrastructure, transactional, informational and strategic (Weill and Broadbent 1998)), used more precise measurement of firm performance, and established generally a positive relationship between IT investment and firm performance (Aral and Weill 2007).

In this paper we focus on the relationship between the use of business analytics (BA) systems (a modern-day type of DSS) and firm performance. Research on this topic is important for three reasons. First, business analytics systems are becoming an important strategic investment for many firms. According to AMR Research (2008), organisations are investing large and increasing amounts of money on business analytics. Further, according to Gartner (2008), 'business intelligence applications' was the most important *technical* priority and 'increasing the use of information and analytics' was the eighth most important *business* priority for Chief Information Officers (CIOs) in 2008.

Second, it has recently been argued that business analytics can contribute significantly to firm performance and create competitive advantage (Davenport and Harris 2007). A number of case studies describe business analytics applications and speculate about how they might contribute to firm performance (Carte et al. 2005, Davenport and Harris, Kohavi et al. 2002, Hamm 2009, Piccolo and Watson 2008). However, there is no clearly articulated and theoretically grounded model that explains how use of business analytics systems leads to improved firm performance (Sharma et al. 2010).

Third, although much work has been completed explaining how enterprise-wide information systems provide benefits to organizations (Davenport, et al. 2004; Gattiker and Goodhue 2005, Seddon et al. 2010), this does not generalize to BA systems. Enterprise-wide systems, such as enterprise resource planning (ERP) systems, are transactional in nature and lead to benefits through functional fit, and process standardization and optimization. Their benefits are often felt enterprise-wide. In contrast the benefits from BA systems are distributed throughout

organisations, rely on entrepreneurial activities in local contexts, and are incremental in nature (Sharma et al. 2010).

There is a strong need to understand how and why business analytics systems can contribute to firm performance. This paper addresses this need by proposing a theoretical framework for understanding how business analytics systems may be implemented to achieve improved firm performance and competitive advantage. In developing the framework, we draw on the resource-based view of the firm (Barney 1991, Wade and Hulland 2004, Nevo and Wade 2010), in particular, the concepts of capabilities and organisational routines; the work of Ross et al. (2006) in viewing enterprise architecture as strategy; the work of Aral and Weill (2007) in measuring firm performance; and the work of Davenport and Harris (2007) for concepts specific to BA systems and maturity in BA resources. This paper begins by analyzing the literature on business analytics systems and how business analytics relates to firm performance and competitive advantage. We then describe the theoretical framework and develop a number of propositions. Finally we propose a research agenda for empirical evaluation and enhancement of the framework.

BUSINESS ANALYTICS AND FIRM PERFORMANCE

Business analytics involves interpreting organizational data to improve decision-making and to optimise business processes (Watson and Wixom 2007). The data normally resides in data warehouses and data marts. Data analysis uses techniques including on-line analytical processing, visualization, and data mining. Explanatory and predictive models are used to support decision-making, consistent with management theorists who have recently argued strongly for the use of 'evidence-based management' in business (Davenport and Harris 2007, Pfeffer and Sutton 2006). Although early adopters had considerable difficulty in implementing data warehouses (Watson et al. 1999), the technology has matured and high quality integrated data is available from enterprise systems including ERP and customer relationship management (CRM) systems (Shanks et al. 2003, Shanks et al. 2009).

A number of case studies of business analytics applications and how they have impacted firm performance have been reported (Davenport and Harris 2007, Kohavi et al. 2002, Wixom and Watson 2001). These include marketing applications that reduce customer attrition, increase customer profitability, and increase the response rates of marketing campaigns (Kohavi et al. 2002). Business analytics systems have also been used in manufacturing and production to "provide insights about the performance of suppliers and partners, accuracy of sales forecasts, accuracy of production plans, and accuracy of plans for order delivery" (Kohavi et al. 2002 p47). Successful business analytics applications in finance, human resources and research and development have also been reported (Davenport and Harris 2007). A summary of some published business analytics applications and the mechanisms through which they achieved improved firm performance is presented in Table 1.

Four insights may be inferred from the published case studies of business analytics (Sharma et al. 2010).

1. Business analytics involves multiple users from many functional areas within organisations: exploitation of business analytics systems is dispersed throughout organisations;

2. Processes, or competitive actions, are essential for obtaining performance gains: the business analytics systems are enablers of these actions;

3. Performance gains are rarely planned or predicted: they are often the outcomes of entrepreneurial activities in a local context;

4. Performance gains from business analytical systems are incremental rather than radical and therefore different than with other enterprise-wide initiatives, such as enterprise resource planning systems.

Although these case studies highlight the potential of business analytics applications to improve firm performance and create competitive advantage, they do not provide theoretical explanations as to how and why the benefits were achieved. Recent theoretical developments in the relationship between IT assets and organisational capabilities and improvements in measurement of firm performance and competitive advantage have provided convincing evidence of the positive benefits of IT (Aral and Weill 2007, Nevo and Wade 2010, Sharma et al. 2010). Together with the insights listed above, these provide the basis for the theoretical framework proposed below.

Table 1. Business analytics applications in industry (adapted from Sharma et al. (2010))

Application	Mechanisms contributing to performance gains and competitive advantage	Source
HP's development of an algorithm for revenue prediction that improved upon the previous algorithm	"Quickly identify emerging trends, make predictions, and take prompt action."	Davenport and Harris (2007, p.61)
Insurance underwriting process	Speed up underwriting process, reduce costs and attract more customers. Optimal pricing of insurance policies to better reflect risks.	Davenport and Harris (2007, p.62)
Activity-based costing system developed by Royal Bank of Canada enabling fine-grained analysis of customers, products, channels and transaction types	Accurate costing of products and services. Accurate pricing of products and services. Accurate assessment of customer profitability.	Davenport and Harris (2007, p.66)
Analysis of customer data to reward loyalty	Accurate estimate of customer's future value	Piccolo and Watson (2008)
Analysis of customer data to create models of spending patterns and profitability	Target customers to improve marketing efficiency and firm performance	Piccolo and Watson (2008)
Analysis of customer data to determine the effectiveness of a marketing campaign	Design more effective marketing campaigns	Kohavi et al. (2002, p.46)
Analysis of clickstream data generated by a Web site	Reduce shopping cart abandonment Improve ad effectiveness	Kohavi et al. (2002, p.46)
Human resources function: identify work force trends and perform HR management tasks	Attract and retain talent	Kohavi et al. (2002, p.48)
Price optimization	Optimize revenue and profits	Kohavi et al. (2002, p4.8)
IBM's options trading application for a financial services company	Optimize profits from arbitrage	Hamm (2009)
Identify "best value" inventory items guaranteed for availability	Drive sales of items with better fill rates, and reduce inventory	Carte et al. (2005)

THEORETICAL FRAMEWORK

We base our theoretical framework on the Resource-Based View (RBV) of the firm (Barney 1991; Wade & Hulland 2004) and the work of Sharma et al. (2010). The RBV proposes that organisational resources are the basis for improved firm performance and competitive advantage. Organisational resources are tangible or intangible resources that organisations either own, control, or have access to. The strategic potential of an organisational resource depends on four properties: value, rarity, inimitability and non-substitutability (Barney 1991, Nevo and Wade 2010). This means that the resource is of value to the organization in realising opportunities, it is not widely available to rivals, it is difficult to imitate, and cannot be easily substituted by other organisational resources. When used in the context of IT investments, organisational resources may be conceptualised as combinations of IT capabilities and IT assets (Aral and Weill 2007, Nevo and Wade 2010).

Business Analytics Capabilities

IT capabilities are an interlocking set of practices, routines, processes, IT skills and IT management quality (Aral and Weill (2007). They therefore exist at both the organisational level (routines for example) and the individual

level (IT skills for example). In the context of BA, relevant capabilities include BA skills and management competency (Davenport and Harris 2007, Aral and Weill 2007), practices and routines for using BA in decision-making, and the existence of fact-based or evidence-based culture in management (Davenport and Harris 2007). Furthermore, as performance gains and competitive gains from BA systems result from the accumulations of small performance gains arising from the entrepreneurial actions of many dispersed actors (Sharma et al. 2010), dynamic capabilities are important. These extend the notion of organizsational capabilities in response to the need to establish new resource configurations in response to environmental change. Dynamic capabilities are 'meta-level' capabilities that are important in dispersed, entrepreneurial environments (Teece et al. 1997).

Business Analytics Technology

IT assets are the hardware and software tools in which organisations invest, as well as the data stored in their information systems (Nevo and Wade 2010). IT assets may be categorised as infrastructure, transactional, informational, and strategic (Weill and Broadbent 1998). In the context of business analytics, the assets are informational and include both the BA technology platform and high-quality data (Davenport and Harris 2007).

Business Analytics Resources

Business Analytics technology does not by itself have the four properties of RBV resources described above: value, rarity, inimitability and non-substitutability. However, BA technology may be combined synergistically with BA capabilities to form IT-enabled resources (Nevo and Wade 2010). IT-enabled BA resources are complementary BA capabilities and BA assets that combine synergistically such that the whole is greater than the sum of the parts (Nevo and Wade 2010).

Value-creating Actions

We draw on the work of Sambamurthy et al. (2003) and the insights gained from the analysis of published case studies of BA systems (Sharma et al. 2010) to argue that value-creating actions are required if BA resources are to contribute to performance. Essentially, business analytics capabilities enable organisations to undertake actions that deliver improved performance and competitive advantage. Having BA technology and BA capabilities alone is insufficient; insights gained from BA must be used to initiate value-creating actions before BA contributes to firm performance. For example, using insight gained from analysing data, organisations might launch new products, develop new products, introduce differential pricing, or create new channels for customer interaction (Davenport and Harris 2007, Kohavi et al. 2007, Sharma et al. 2010). It is these value-creating actions that drive firm performance.

Firm Performance

Firm performance should be understood in terms of the purpose and goals of a particular BA initiative (Aral and Weill 2007). A variety of different performance measures exist including "productivity, consumer welfare, accounting profit, market valuation and operational performance" (Aral and Weill 2007, p771). Furthermore, performance measures trade-off with each other. For BA systems, firm performance may be assessed in terms of firm profitability (net margin and return on investment), competitive advantage (an organisation's ability to make above average profits within a given industry sector) and innovation (revenues from new and modified products) (Davenport and Harris 2007, Aral and Weill 2007), depending on the nature of the BA-driven initiatives undertaken by the firm.

Core Theoretical Framework

Our core theoretical framework is shown below in Figure 1. Broadly, the theoretical framework proposes that BA resources, comprising synergistic BA assets and BA capabilities, lead to value-creating actions that impact firm performance. A number of propositions may be generated from the core theoretical model, and extend the work of Sharma et al. (2010). Earlier versions of propositions P1 and P3 are proposed in Sharma et al. (2010). The concepts BA resources, BA technology, together with proposition P2, are enhancements proposed in this paper. We include the earlier propositions for a complete description of the framework.

Business-analytics resources, comprising BA technology and the capabilities required to utilise the technology, enable organisations to undertake actions to increase firm performance. The resources alone are not sufficient: value-creating actions must be initiated to take advantage of the insights gained from business analytics.

P1: Value-creating actions *mediate* the relationship between BA resources and firm performance.

BA resources may be conceptualised as systems of BA technology and BA capabilities. They are therefore IT-enables resources with emergent properties. For example, a BA capability to segment customers may be significantly enhanced when used with integrated, high-quality customer data from the whole organization. Emergent properties will include the ability to segment a larger number of customers than previously, and potentially enable more cross selling. In this way the business value of either BA technology or BA capabilities

may not be fully realised until they are in a mutually reinforcing relationship. BA resources are synergistic when their emergent capabilities are of benefit to the organization (Nevo and Wade 2010).

P2: Organisations with compatible BA capabilities and BA technology will lead to more synergistic BA resources with positive emergent capabilities.
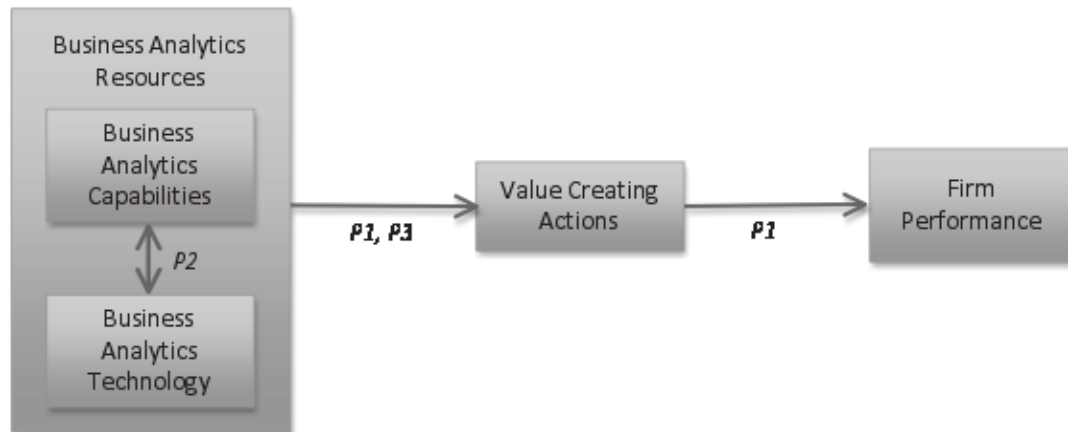

Figure 1: Core Theoretical Framework

BA capabilities encompass routines for identifying competitive actions, allocating resources for competitive actions and implementing competitive actions (Eisenhardt and Martin 2000). The extent of these capabilities will differ across the business units within organisations and across competing organisations, given inter-firm heterogeneity and intra-firm heterogeneity.

P3a: Organisations that enact formalised and well-communicated routines for *identifying value-creating actions* will be more effective (more actions, more novel actions, more complex actions) at undertaking value-creating actions.

P3b: Organisations that enact formalised and well-communicated routines for *allocating resources* will be more effective (more actions, more novel actions, more complex actions) at undertaking value-creating actions.

P3c: Organisations that enact formalised and well-communicated routines for *implementing value-creating actions* will be more effective (more actions, more novel actions, more complex actions) at undertaking value-creating actions.

Extended Theoretical Framework

Our extended theoretical framework is shown below in Figure 2. We have extended the core theoretical framework in four ways. First, we include organisational structure factors (autonomy and independence) that impact the successful development of dynamic capabilities (Gavetti 2005, Sharma et al. 2010). Second, we have included the concept of strategy as operating model and its impact on the integration, standardisation and hence quality of the data asset (Ross et al. 2006). Third, we include the impact of strategy as operating model on organisational structure factors. Fourth, we have included the concept of maturity level to reflect the longitudinal development of BA resources within organisations (Davenport and Harris 2007). Each of these concepts is now discussed and used to generate further propositions.

Earlier versions of propositions P4 and P5 are proposed in Sharma et al. (2010). The concepts operating model and maturity, together with proposition P6, P7 and P8 are enhancements proposed in this paper. We include the earlier propositions for a complete description of the framework.

Organisational Structure Factors

Organisation structure impacts the development of BA capabilities (Gavetti 2005). Value-creating actions that are entrepreneurial in nature require discretionary allocation of resources at the business unit level. This is facilitated when business unit managers are empowered with decision-making responsibility rather than in organisations where corporate management exerts strong control over the business unit managers (Sharma et al. 2010). We conceptualise organisational structure factors in terms of autonomy (the level of control of resources and decision-making of the corporate and business units) and independence (the level of sharing of resources and decision interdependencies).

P4a: Organisational units with high local autonomy will be more effective at undertaking value-creating actions (number, novelty and complexity of actions).

P4b: Organisational units with high local autonomy will deliver higher levels of firm performance.
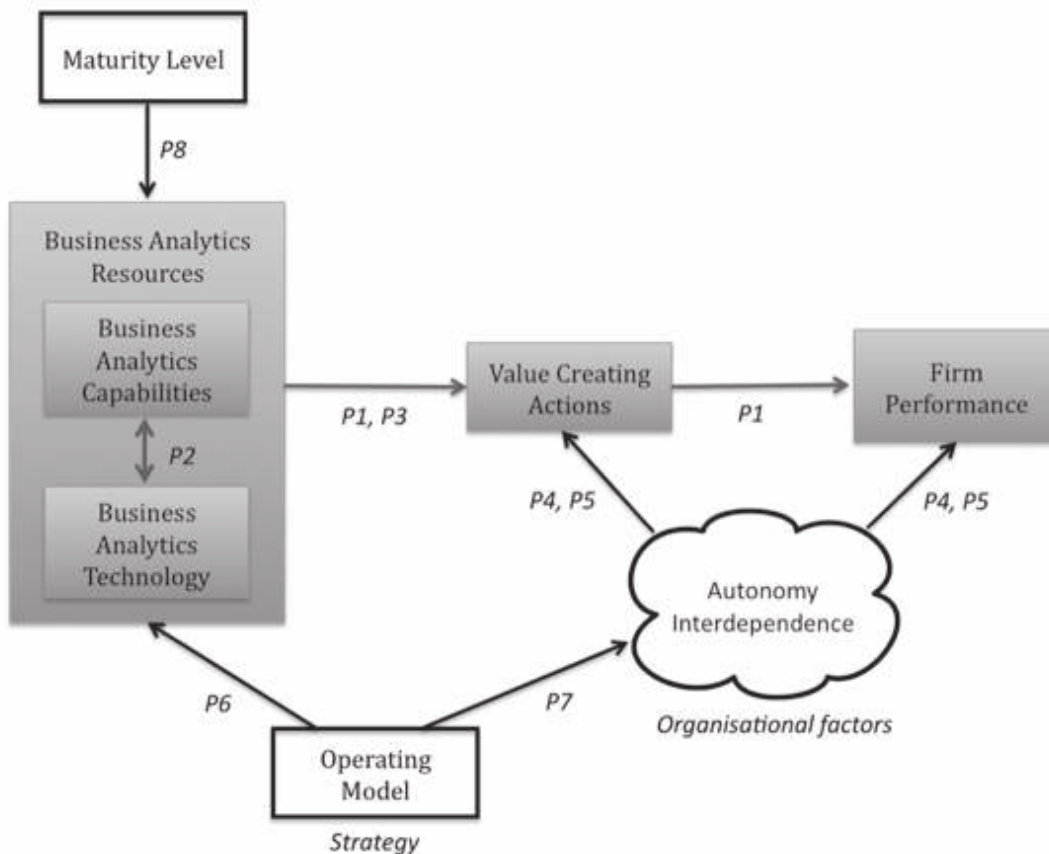

Figure 2: Extended Theoretical Framework

Furthermore, the degree of tangible interrelationships between business units impacts the development of BA capabilities (Gavetti 2005). Because they are free to move faster, it seems likely that business units that do not share resource or decision interdependencies with other business units will be more be more effective at undertaking value-creating actions (Sharma et al. 2010).

P5a: Organisational units with low tangible relationships (independence) with other units will be more effective at undertaking value-creating actions (number, novelty and complexity of actions).

P5b: Organisational units with low tangible relationships (independence) with other units will deliver higher levels of firm performance.

Operating Model (Strategy)

Ross et al. (2006) define enterprise architecture as strategy and argue that the first thing a firm should do when developing their 'foundation for execution', or 'IT infrastructure and the digitized business processes that automate a company's core capabilities' (Ross et al. 2006, p4) is to develop an operating model. The operating model is based on defining the necessary levels of *standardisation* and *integration* of business processes (and data). Standardisation means that a process remains the same regardless of who performs it and where it is performed. Integration concerns the seamless sharing of data between processes. Both standardization and integration can be either High or Low, leading to a two-dimensional model with four quadrants (Ross et al. 2006).
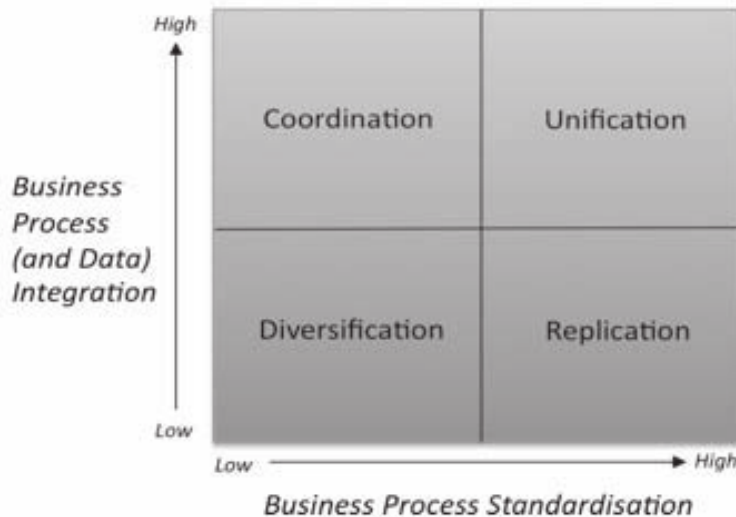

Figure 3: Four Operating Models (adapted from Ross et al. 2006, p29)

The four operating models will impact the data assets that are used in BA systems differently. In the unification operating model data is globally integrated and databases are centrally mandated. In the replication operating model data definitions are standardised but data is locally owned with little aggregation at corporate level. In the coordination operating model data is integrated allowing seamless access to shared data. In the diversification operating model there is little data standardization and little data sharing with unique processes across business units.

P6a: Organisations with a unification or coordination operating model will have integrated data assets, enabling high quality BA data assets.

P6b: Organisations with a replication operating model will have standardised data definitions but little integration, enabling good quality BA data assets.

P6c: Organisations with a diversification operating model will have little need to share data assets and their operations are independent, leading to difficulty and expense in creating organisation-wide, high quality BA data assets.

The four operating models will impact the organizational factors, conceptualized as autonomy and interdependence, differently. We argue that business process integration is closely related to the autonomy of business units. A low level of business process integration will be reflected in a high level of autonomy between business units, as they will have separate and possibly different decision-making processes. Similarly, a high level of business process integration will be reflected in a low level of autonomy between business units, as they will have interwoven decision-making processes.

We also argue that business process standardisation is closely related to the independence of business units. A low level of business process standardisation will be reflected in a low level of independence between business units, as they will each develop their own processes independently. Similarly, a high level of business process standardisation will be reflected in a high level of independence between business units, as they will share standardized business processes.

Therefore, we argue that organizational factors, concepualised as autonomy and independence, *mediate* the impact of operating model (strategy) on competitive actions and firm performance.

P7a: Organisations with a low level of business process integration (diversification or replication operating models) will have high local autonomy between business units.

P7b: Organisations with a high level of business process integration (unification or coordination operating models) will have low local autonomy between business units.

P7c: Organisations with a low level of business process standardisation (unification or replication operating models) will have low tangible relationships (independence) between business units.

P7d: Organisations with a high level of business process standardisation (unification or replication operating models) will have high tangible relationships (independence) between business units.

Maturity

We define three stages of *maturity* for capabilities, adapted from Davenport and Harris (2007). The stages depend on what the firm wants to achieve with business analytics, the extent to which processes that use business analytics are implemented within the firm and the extent to which business analytics is used within organisational units or enterprise-wide. The three stages are:

- Localised analytics: Functional management builds analytics momentum and executives' interest through application of basic analytics;

- Analytical companies: enterprise-wide analytics capabilities are under development – top executives view analytic capability as a corporate priority.

- Analytical competitors: organisations routinely reaping the benefits of their enterprise-wide analytics capability and focus on continuous analytics renewal.

P8: Organisations will *progress* through three stages of BA maturity as their BA resources develop over time.

DISCUSSION

The theoretical framework developed in this paper explains how BA resources lead to improved firm performance. It synthesises concepts from a number of existing frameworks including the earlier work of Sharma et al. (2010). A key aspect of the framework is its inclusion of value-creating actions as mediators between BA resources and firm performance. This is consistent with Kohavi et al. (2002) and Sharma et al. (2010) who argue that BA must produce results that are actionable to be effective. The perspective of BA resources as a system including BA technology and BA capabilities is important (Nevo and Wade 2010). This reflects the view that BA technology assets alone do not bring benefits, but when BA technology assets are compatible with BA capabilities, benefits are more likely to follow.

The framework in Figure 2 builds on earlier work of Sharma et al. (2010) and identifies the important factors that influence BA systems success. These include the compatibility of BA technology and BA capabilities, the capabilities to identify and allocate BA resources, and capabilities to implement value-creating actions based on the outcomes of BA systems. Organisational-structure factors include a high level of business-unit autonomy and independence from other business units. Furthermore, the operating model chosen when designing a firm's enterprise architecture is argued to impact the quality and level of integration of the BA data asset. The operating model also impacts the level of business unit autonomy and independence, with these organisational factors mediating the impact of operating model (strategy) on competitive actions and firm performance. Finally, it is proposed that the BA resources within organisations will evolve through several maturity levels as the organisation gains experience and expertise with BA.

Research Agenda

The theoretical framework developed here will be evaluated and enhanced in future empirical research comprising three phases. The first phase will refine and enhance the theoretical model using contextual interviews and in-depth, inductive case studies. The second phase will use deductive multiple case studies to assess the theoretically validity and applicability to practice of the theoretical model in a longitudinal empirical study over a three year period. The third phase will analyse longitudinal data from the empirical studies and develop a final theoretical model.

Several pilot studies have been completed that have highlighted a number of challenges that will be faced during empirical testing of the framework.

First, consistent with comments in Davenport et al. (2010), we have found there is limited current use of BA systems in organisations beyond reporting. Most BA initiatives that we have seen have focused on the development of a high quality BA data asset that is used in the replacement of existing reporting systems. Despite

some well-publicised case studies of BA being used to support value-creating actions (for example the Harrah's casino case study in Davenport and Harris (2007)), we have found little evidence of this to date.

Second, measuring firm performance in relation to BA systems initiatives is challenging. It is difficult to identify a common set of metrics when the measurement of firm performance differs across different sections of organisations and when the measurement should be related to the purpose of the BA initiative. We will continue to explore this issue.

Third, many organisations still seem to see BA systems as an IT initiative when most of the work required has been to change existing processes and routines in order to take advantage of BA technology assets. It seems that BA capabilities are not well developed and many organisations might be at the initial localised analytics stage of maturity (Davenport and Harris 2007). The planned longitudinal empirical studies will clarify this and should help us understand how organisations mature in their use of BA systems.

Fourth, many of the theoretical concepts we are using are not well developed. For example the concept of emergent, dynamic capabilities resulting from the compatibility of BA capabilities and BA technology assets is the result of recent theoretical developments (Nevo and Wade 2010). In-depth and longitudinal case studies are required to better understand these concepts and the nature of the causal relationships in the theoretical framework.

CONCLUSION

In this paper we present a theoretical framework that explains how BA resources lead to improved firm performance. We also discuss the impact of strategy and maturity on the relationship between BA resources and firm performance. There are two implications for practice. First, by understanding the business analytics capabilities that lead to improved firm performance and their relationship to strategy and maturity, organisations can use the theoretical model in Figure 2 to plan for business analytics systems implementation. Second, the development of instruments to measure business analytics capabilities, strategy (realised as operating model) and firm performance will enable project managers to undertake more accurate cost-benefit analyses and post-implementation reviews for business analytics implementation projects. We look forward to the outcomes of our empirical research program to identify further uses of the framework in practice.

REFERENCES

AMR Research (2008). Spending on Business Intelligence and Performance Management to Top $57.1B in 2008, http://www.amrresearch.com/Content/View.asp?pmillid=21481 (viewed Jan 2009)

Aral, S. and Weill, P. (2007) IT Assets, Organisational Capabilities and Firm Performance: How Resource Allocations and Organisational Differences Explain Performance Variation, *Organization Science*, 18:5, 1-18

Barney, J. (1991) Firm Resources and Sustained Competitive Advantage, *Journal of Management*, 17: 1, 99-120

Blyler, M. and Coff, R. (2003) Dynamic Capabilities, Social Capital and Rent Appropriation: Ties and Split Pies, *Strategic Management Journal*, 24, 677-686

Brandon, D. and Hollingshead, A. (2004) Transactive Memory Systems in Organizations: Matching Tasks, Expertise and People, *Organization Science*, 15:6, 633-644

Brynjolfsson, E. (1993) The productivity paradox of information technology, *Communications of the ACM*, 36:12, 66–77

Carte, T., Schwarzkopf, A., Shaft, T. and Zmud, R. (2005) Advanced Business Intelligence at Cardinal Health, *MIS Quarterly Executive*, 4:4, 413-424

Davenport, T. H., Harris, J. and Cantrell, S. 2004. Enterprise systems and on-going process change, *Business Process Management Journal,* 10:1, 16-26.

Davenport, T.H. and Harris, J.G. (2007) *Competing on Analytics*, Cambridge, MA: Harvard Business School Press

Davenport, T.H., Harris, J.G., and Morison, R. (2010) *Analytics at Work: Smarter Decisions, Better Results*, Cambridge, MA: Harvard Business School Press

Gartner (2008) Australian and New Zealand CIOs Expect Lower Than Average IT Budget Growth in 2008, http://www.gartner.com/it/page.jsp?id=606007 (viewed Jan 2009)

Gavetti, G. (2005) Cognition and Hierarchy: Rethinking the Micro-foundations of Capabilities' Development, *Organisation Science*, 16:6, 599-686

Gattiker, T.F. and Goodhue, D.L. 2005. "What happens after ERP implementation: Understanding the impact of inter-dependence and differentiation on plant-level outcomes", *MIS Quarterly* 29:3, 559-585.

Hamm, S. (2009) IBM Roars into Business Consulting, Business Week Online.

Kohavi, R., Rothleder, N., and Simoudis, E. (2002) Emerging Trends in Business Analytics, *Communications of the ACM*, 45:8, 45-48

Nevo, S. and Wade, M. (2010) The Formation and Value of IT-Enabled Resources: Antecedents and. Consequences of Synergistic Relationships, *MIS Quarterly*, 34:1, 163-183

Pfeffer, J. and Sutton, R. (2006) Evidence-based management, *Harvard Business Review*, 84:1, 62-68

Piccoli, G. and Watson, R. (2008) Profit from Customer Data by Identifying Strategic Opportunities and Adopting the "Born Digital" Approach, *MIS Quarterly Executive*, 7:3, 113-122

Ross, J, Weill, P. and Robertson, D. (2006) Enterprise Architecture as Strategy, *Harvard Business School Press*

Seddon, P., Calvert, C. and Yang, S. (2010) A multiproject model of key factors affecting organizational benefits from enterprise systems, *MIS Quarterly*, 32: 2, 305-328Shanks, G., Seddon, P.B. and Willcocks, L. (eds.) (2003) *Second Wave Enterprise Resource Planning Systems: Implementation and Effectiveness*, Cambridge University Press.

Shanks, G., Jagielska, I. and Jayaganesh, M. (2009) A Framework for Understanding Customer Relationship Management System Benefits, *Communications of the AIS*, 25:26, 263-288

Sharma, R., Reynolds, P., Scheepers, R. Seddon, P. and Shanks, G. (2010) "Business Analytics and Competitive Advantage: A Review and Research Agenda" in *Bridging the socio-technical gap in DSS - Challenges for the next decade*, IOS Press, Amsterdam.

Sharma, R. and Yetton, P. (2007) The Contingent Effects of Training, Technical Complexity and Task Interdependence on Successful Information Systems Implementations, *MIS Quarterly*, 31:2, 219-238

Teece, D.J., Pisano, G. and Shuen, A. (1997) Dynamic Capabilities and Strategic Management, *Strategic Management Journal*, 18, 7, 509-533.

Wade, M. and Hulland, J. (2004) The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research. *MIS Quarterly*, 28:1, 107-142

Watson, H.J. and Wixom, B.H. (2007) The Current State of Business Intelligence, Computer, 40:9, 96-99

Wenerfelt, B. (1984) A resource-based view of the firm, *Strategic Management Journal*, 5:2, 171-180

Wixom, B.H. and Watson, H.J. (2001) An empirical investigation of the factors affecting data warehousing success, *MIS Quarterly,* 25:1, 17-41

ACKNOWLEDGEMENTS

COPYRIGHT