2012

The Impact of Strategy on Business Analytics Success

Graeme Shanks
The University of Melbourne, gshanks@unimelb.edu.au

Nargiza Bekmamedova
The University of Melbourne, nbek@unimelb.edu.au

The Impact of Strategy on Business Analytics Success

Graeme Shanks
Nargiza Bekmamedova
Department of Computing and Information Systems
University of Melbourne
Victoria, Australia
Email: gshanks@unimelb.edu.au
nbek@unimelb.edu.au

Abstract

Business analytics systems are an important strategic investment for many organisations and can potentially contribute significantly to firm performance. In this paper we develop a theoretical model, based on the resource-based view, that explains how business analytics capabilities lead to benefits. We argue that the type of strategy, represented as enterprise architecture, moderates the benefits achieved. Two case studies are then presented, each with a different type of strategy, and we explain how and why benefits were achieved from business analytics systems in each. We then identify the similarities and differences between the two case studies and discuss these using five dimensions that emerge from the case studies: strategic alignment, governance, people, organizational culture and data and technology infrastructure.

Keywords

Business Analytics, Strategy, Enterprise Architecture, Resource-based View, Case Studies.

INTRODUCTION

Many organisations have made significant investments in information technology (IT) to strengthen the efficiency of business processes and improve firm performance (Aral and Weill 2007). Recently, there has been strong interest in the use of business analytics (BA) systems to provide benefits to organisations (Davenport and Harris 2007; Davenport et al. 2010). BA systems include technology and applications, skilled people and practices for the exploration of past business performance, to generate new business insights and drive business planning. Business analytics systems support decision-making and involve the collection, storage and interpretation of large amounts of high quality data, typically in a data warehouse. Decision-makers use comprehensive reporting, dashboarding and online analytical processing (OLAP) technologies to improve and enhance their decision-making capabilities. BA systems also include the use of more sophisticated statistical analysis techniques for simulation, optimisation, forecasting and data mining (Davenport and Harris 2007; Davenport et al. 2010). BA systems can provide benefits to organisations by enabling improvements to business processes and firm performance, and can create competitive advantage (Davenport and Harris 2007), leading to overall success. A number of case studies have explored the use of BA systems and reported performance gains (Carte et al. 2005; Kohavi et al. 2002; Piccoli and Watson 2008) and highlighted the importance of embedding data-driven decision-making with organisation's overall strategy (Kettinger et al. 2011). Similarly, industry reports have also reported significant benefits achieved from the use of BA systems (e.g. Kiron et al. 2011). However, there are few studies that clearly articulate a theoretically grounded model that explains how the use of business analytics systems provides value to organisations (Shanks et al. 2011).

In this paper we extend the work of Shanks et al. (2011) and propose a theoretical model that explains how organisational strategy impacts the creation of benefits from business analytics systems. Our theoretical model is based on the resource-based view of the firm (Nevo and Wade 2010; Wade and Hulland 2004) and argues that organisational, human and technological capabilities enabled by business analytics systems (Davenport and Harris 2007) provide benefits to organisations. We argue that the type of strategy, represented as enterprise architecture, moderates the benefits achieved with business analytics systems (Ross et al. 2006). We use the theoretical model to explain how and why business analytics capabilities provide benefits to organisations in two case studies, each with different types of strategy. We identify a number of similarities and differences between the two case studies and discuss these using five dimensions that emerge from the data: strategic alignment, governance, people, organisational culture and data and technology infrastructure.

Research on this topic is important for three reasons. First, business analytics systems are an important strategic investment for many firms (Davenport et al. 2010) and recently there have been strong interest in the use of 'big

data' within analytics. Organisations have invested significantly in business analytics to create value and provide competitive advantage (Kiron et al. 2011). Business intelligence was recently ranked as the fifth most important technical priority, and the third most important business priority for Chief Information Officers (Gartner 2010). Within an increasingly turbulent business environment and with rapidly changing technologies, organisations are using BA systems to facilitate innovation with data-driven insights, online communication with customers, integration with supply-chain partners in real-time, further efficiencies in internal value chains and digitalized information strategies (Davenport et al. 2010). Second, although much is known about how enterprise resource planning systems bring benefits to organisations (Gattiker and Goodhue 2005; Seddon et al. 2010), this does not generalise to business analytics systems with their strong emphasis on data management and decision support. The benefits of enterprise-wide information systems are often enterprise-level and rely on process standardisation and optimisation. In contrast, the benefits from BA systems are distributed throughout organisations, are evolutionary in nature and rely on local entrepreneurial managerial actions (Sharma et al. 2010). Third, little is known about how strategy influences the benefits achieved with BA systems (Shanks et al. 2011).

The paper is organized as follows. We first discuss the background to the study, including business analytics systems and their impact within organisations, resource-based view of the firm and enterprise architecture as strategy. We then describe the theoretical framework, explaining the constructs and relationships. The following section describes the multiple case study research approach we used. Next we present the two case studies, using the theoretical model to explain how and why benefits were achieved. In the following section we present a cross-case analysis discussing the similarities and differences between the two cases. We finally conclude the paper, identifying implications of the theoretical model for practice and future research.

BACKGROUND

In this section we review three relevant research streams. First, we discuss previous work that explains how BA systems provide value to organisations. Second, we discuss the resourced-based view and describe how capabilities lead to benefits. Third, we discuss how strategy can be conceptualised as enterprise architecture, and explain four different types of operating model.

Business Analytics Systems

Managers and other decision-makers use business analytics systems to interpret organisational data to improve decision-making and optimise business processes (Watson and Wixom 2007). The use of data to support decision-making is consistent with management theorists who argue for the use of 'evidence-based management' in business (Davenport and Harris 2007; Pfeffer and Sutton 2006). Business analytics technology includes data warehouses and data marts, on-line analytical processing, visualization, and data mining. This technology has matured over the last decade from the early attempts to plan and implement data warehouses to enhanced data quality and optimization solutions, and its use is widespread in many businesses today (Watson and Wixom 2007). A number of published case studies report the benefits achieved from the use of BA systems within variety of industry sectors using a variety of mechanisms. These include marketing applications aimed at reducing customer attrition, increasing customer profitability and response rates of marketing campaigns (Kohavi et al. 2002). Other industry sectors where analytics has been utilised include manufacturing and production planning for order delivery (Kohavi et al. 2002), and supply chain operations (Trkman et al. 2010). Also, Davenport et al. (2007; 2010) present a large number of case studies that describe how business analytics can be used within an organisation to achieve business value. The authors highlight the critical role of data, enterprise orientation, leadership, strategic targets and business analysis (DELTA) in order to explain how organisational benefits can be achieved with business analytics (Davenport et al. 2010).

A number of insights can be inferred from previous empirical research. First, BA systems are providing value in many functional areas of organisations involving multiple users, and need to be embedded within organisational process and routines. Second, much of value-creation relies on innovative and entrepreneurial actions of local decision-makers (Shanks and Sharma 2011). Third, the impact of BA systems is incremental rather than radical and therefore different than with other enterprise-wide initiatives (e.g. ERP systems). Fourth, few studies clearly articulate a theoretically grounded model that explains how BA systems provide value to organisations. In particular, there is no research that explains how different types of strategy impact the benefits achieved from BA.

Resource-based View

We adopt the resource-based view (RBV) of the firm, where capabilities that are valuable, rare, and difficult to imitate and substitute are developed from organisational, human and technological resources (Barney 1991; Wade and Hulland 2004). The resource-based view is presently the dominant theoretical perspective in the strategic management literature. It argues that capabilities are a critical determinant of organisational

performance (Aral and Weill 2007). Davenport and Harris (2007) identify a number of BA capabilities, which lead to benefits:

- Organisational BA Capabilities: Business processes and routines that embed BA insights, governance mechanisms to manage human and technological BA resources, allocation of resources to BA initiatives.
- Human BA Capabilities: Executives, managers, analysts and other employees with BA skills and management expertise, use of data in decision-making.
- Technological BA Capabilities: High quality data, BA technologies and operational systems integration.

Strategy as Enterprise Architecture

Strategy defines the long-term direction within an organisation to remain competitive, and may be conceptualised as enterprise architecture (Ross et al. (2006). Enterprise architecture is defined as "*the definition and representation of a high-level view of an enterprise's business processes and IT systems, their interrelationships, and the extent to which these processes and systems are shared by different parts of the enterprise*" (Tamm et al. 2011, p2). It serves to translate the broader principles and goals established in a business strategy into systems, processes and data. Different types of enterprise architecture support different types of strategy. Ross et al. (2006) provide a means of defining different types of enterprise architecture through the concept of operating model.

Operating models are defined in terms of the level of standardisation of business processes and the level of integration of business processes. Organisations with a high level of standardisation use the same business processes across all business units, regardless of who executes the process. Organisations with a low level of standardisation have few similar processes, and local innovation is encouraged. Organisations with a high level of integration have significant sharing of data between business processes and between business units. Organisations with a low level of integration choose not to integrate data across business units and process boundaries. Combining the two levels of standardisation and the two levels of integration results in four types of operating model: unification, coordination, replication and diversification (see Figure 1).

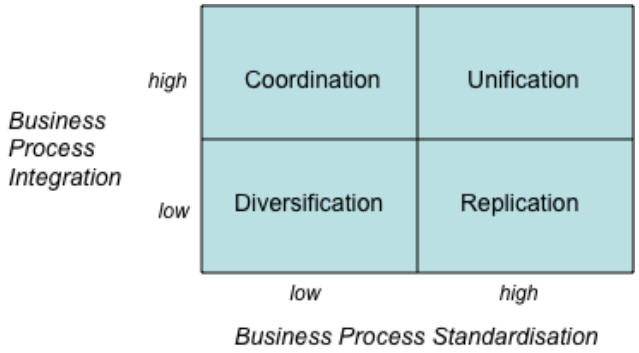

Figure 1: Types of Operating Model

We now discuss the characteristics of each type of operating model (Ross et al. 2006):

- *Unification*: (high standardisation and high integration). Organisations have shared processes and data, business units are tightly coupled and management is highly centralised. Standardised and integrated data is of high quality for use in BA applications. BA technology is shared amongst business units and hence well understood and supported.
- *Coordination*: (low standardisation and high integration). Organisations have shared data but processes are designed within business units. Integrated data will provide opportunities for leveraging existing customers across business units, but these business units will be autonomous.
- *Replication*: (high standardisation and low integration). Organisations have standardised and centrally controlled processes, but data is not shared. Business units are highly autonomous, but operate in a highly standardised way.
- *Diversification*: (low standardisation and low integration). Organisations have no need for standardisation of processes or integration of data, and business units have their own autonomous management and decision-making structures.

Information is used differently by organisations to achieve benefits. Some organisations strengthen their control strategies by using timely and accurate data to monitor both operational and management processes, while others sense market opportunities through data-driven decision-making (Shanks et al. (2012). We argue that a firm's operating model may affect the way BA capabilities are utilised to achieve organisational benefits. Our research question is:

How does the strategy impact business analytics success?

THEORETICAL MODEL

We synthesise concepts from the resource-based view and strategy as enterprise architecture to develop our theoretical model. We focus at the organisational level and argue that organisational, human and technological BA capabilities lead to benefits. We also argue that strategy, conceptualised as enterprise architecture, moderates the influence of BA capabilities on benefits. The theoretical model is shown in Figure 2 below.

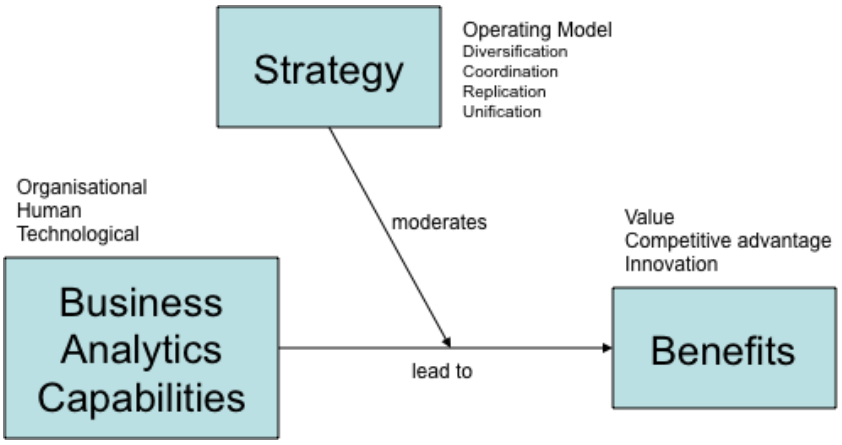

Figure 2: Theoretical Model

Business Analytics Capabilities

BA Capabilities are collections of BA organisational, human and technological resources that are applied to tasks. Details of typical BA resources are provided in the 'Resource-based View' section above. BA capabilities are created by the synergistic combination of BA technologies with other organisational capabilities (Nevo and Wade 2010).

Benefits

There are many benefits that accrue from BA systems. These include *value*, measured using financial, behavioural and perceptual indicators (Wheeler 2002). Typical measures include increased revenue, decreased operational costs, increased customer loyalty and satisfaction, more efficient processes and reduced inventory (Carte et al. 2005; Davenport and Harris 2007; Piccoli and Watson 2008). Increased *competitive advantage*, that is, an organisation's ability to make above average profits within a given industry sector, is a possible benefit (Davenport and Harris 2007). Finally, *innovation*, or revenues from new and modified products and services is another possible benefit (Aral and Weill 2007). Specific measures will depend on the nature of the business analytics-driven initiatives undertaken within the organisation.

Strategy

Strategy defines the long-term direction within an organisation and is conceptualised as enterprise architecture. It is operationalised as one of four operating models according to the level of standardisation and integration of business processes: unification, coordination, replication and diversification.

Business Analytics Capabilities *lead to* Benefits

According to the RBV it is an organisation's capabilities that lead to benefits. If those capabilities are valuable, rare, and difficult to imitate and substitute they can provide competitive advantage and innovation (Barney 1991; Wade and Hulland 2004). We argue for a relationship between specific BA capabilities and benefits, addressing concerns about the empirical use of RBV (Kraaijenbrink et al. 2010).

Strategy *moderates* Business Analytics Capabilities leading to Benefits

We argue that strategy moderates that degree to which BA capabilities lead to benefits. We focus on the moderation of the unification and coordination operating models, as these are relevant to our two case studies.

The high level of integration and standardisation within the unification operating model will ensure a high quality and integrated data resource for use in BA systems. Organisation-wide BA initiatives will be feasible due to the centralised management philosophy and shared BA technologies. The low level of standardisation and high level of integration within the coordination operating model will lead to a shared data resource that is complex and not standardised. BA initiatives will need to address data quality issues and leveraging BA technologies across business units may be difficult.

RESEARCH APPROACH

We use an explanatory multiple case study research approach. Case studies are particularly useful for in-depth studies of contemporary phenomena within their organisational context (Yin 1994). They provide a rich and detailed description of the phenomena and explain how and why outcomes occur. We used theoretical replication and examined BA initiatives within two large Australian organisations. One organisation, Resourceco, has a unification operating model and the other, University, has a coordination operating model, enabling cross-case comparison for the different strategy types.

In each case study we were provided with ready access to the key stakeholders, including senior managers, BA technical experts and BA business experts. Data collection included semi-structured interviews and access to relevant documents. Interviewees were selected using heterogeneity sampling to enable triangulation (Miles and Huberman 1994). The interview protocol was designed to gain a longitudinal understanding of the evolution of BA capabilities and their value and also included questions about concepts from the RBV. We took extensive notes during each interview and used thematic analysis to identify common patterns and themes emerging from the data.

At Resourceco, we examined the implementation of a global data warehouse and reporting system. We conducted fifteen interviews with key participants over a period of eight months. At University, we examined the implementation of a University-wide customer relationship management (CRM) system. We conducted fifteen interviews with key participants over a period of two years. Each case study interview lasted about one hour.

CASE STUDY DESCRIPTIONS

Resourceco Case

Resourceco is a large international exploration and mining company that focuses on finding, mining and processing natural resources including aluminium, copper, diamonds, iron ore, minerals and energy. It is a complex, global organisation operating in many countries with significant manpower, equipments and other assets. Prior to 2005, Resourceco was effectively a 'holding company' that owned many subsidiary companies, with little standardisation and integration of information technology, data and processes. This case study concerns the implementation of a global data warehouse and reporting system including standardised metrics.

Implementation of the Global Data Warehouse and Reporting System

The implementation of the global data warehouse and reporting system is structured into three phases: global conceptual design, incremental build and release and refinement and enhancement. In the *global conceptual design* phase (2004-2006), seven core global business processes were defined: Contract to Cash, Health, Safety and Environment, Manage People, Manage Physical Assets, Manage Mining and Processing, Plan and Manage and Purchase to Pay. A management team involving a business owner, business process leader and a global process architect supported each of the processes. These formed project governance. Data definitions for key metrics and dimensions were also established. Data definitions were established at three levels: core (globally standardised); common (to several business units); and operational (specific to the local context). Nine core, global dimensions were defined to accommodate Resourceco's diverse business needs and reporting requirements. These included operating responsibility, person, location, time, reporting entity, account, asset, and process.

> *"In the beginning, we spent much time getting strict definitions of the data…"* (Head of Applications Support)

In the *incremental build and release* phase (2006-2008), a large development team implemented a data warehouse using three-layer architecture to provide a flexible and scalable data warehousing solution. The system was incrementally released, with the first 'go-live' in 2006. Although the system release initially was IT-

driven, after the initial functionality was implemented, subsequent releases became more business driven. As business requirements were satisfied, use of the system for reporting became routine and 'sticky'.

> *"Once the foundation was built, we could then shift the focus toward the business, core processes and team leaders to make it sticky."* (Lead Technical Architect)

Over several years, the data warehouse was incrementally implemented and many globally standardised metrics became available for reporting. The global process management teams developed into a crucial means of identifying new user requirements and prioritising and funding their implementation. Members of the teams had authority to provide resources for initiatives (business owner), to provide feedback on BA systems and requirements for new reporting initiatives from business users (business process leader) and BA technical expertise for feasibility and cost estimates of new initiatives (global process architect). Resourceco had many very experienced people with extensive technical knowledge about the data warehouse environment and also software tools used for reporting purposes, together with a deep knowledge of the business context. Many of the key staff have worked with Resourceco for many years, ensuring well developed and mature skills. The balance between business and technical skills is well recognised.

> *"You need a leadership group for analyzing and viewing the world, and a group of people to translate those business needs into design layout and technical requirements." (Global Process Architect)*

In the *refinement and enhancement* phase (2008 onwards), the data warehouse had been successfully implemented and was providing reports throughout the organisation, included aggregated reporting to the Board, management reporting within each of the seven core business processes, and other reporting within subsidiary businesses. Reporting included standard reports together with more sophisticated dashboards, scorecards and multi-dimensional data analysis. Reporting is now business driven and the governance structure established to manage the data warehousing environment has proven to be very effective. The data warehouse provides Resourceco with a high quality, integrated source of data.

Benefits Achieved

Many significant benefits have accrued from use of the global data warehouse and reporting system including higher quality, standardised and integrated data, more timely reporting, and increased use of scorecards, dashboards and data visualisation in decision-making, leading to better decisions. Of particular importance is a monthly report to the Board comprising aggregated global data for key metrics. This has enabled Resourceco management to better monitor and manage the performance of its global subsidiaries. Other benefits have accrued in each of the seven core business processes. For example, health, safety and the environment is particularly important for Resourceco and high quality, timely reporting about incidents, injuries, illness and risk assessments have enabled better monitoring of improvement plans. In human resource management, BA reporting systems support workforce planning, training and talent management. Common metrics have enabled managers to more readily benchmark their performance against other areas within Resourceco and to industry best practices.

University Case

University is a large Australian research and teaching university that initiated a major restructuring of its courses resulting in the provision of six broad and flexible undergraduate courses, and an increased number of postgraduate courses, in 2008. Students undertake the post-graduate courses for professional training in areas including law, medicine, engineering and information technology. The Australian university sector is dependent on international student fees for a substantial proportion of its income. University therefore needs to grow its graduate coursework student numbers significantly within the next few years. Within this turbulent context, University management established a CRM initiative to better manage new student recruitment and the admissions lifecycle, from initial enquiry to enrolment, and subsequently to graduation and alumni.

Implementation of the CRM Initiative at University

The implementation of the CRM initiative is structured into three phases: planning and review, proof-of-concept and release and refinement. In the *planning and review* phase (2007-2008), the CRM project was initiated within a central marketing group. The Brand Marketing Manager commented: *"there didn't appear to be any client or customer strategy"*. There were few metrics associated with marketing campaigns, little evidence of the use of market segments in recruitment and little knowledge of marketing and sales processes. An experienced CRM analyst was recruited to the project. A decision was taken to implement a CRM capability to improve student recruitment processes. A customer strategy for University from "birth to bequest" was defined and the Brand Marketing Manager identified the need for a *"large culture change"*. University needed to improve its student recruitment processes, in particular responding to potential student enquiries and improving service levels. Traditionally, University had attracted students based on its reputation as an elite research-based university.

There was considerable resistance from some senior staff who were unconvinced of the need for the CRM system.

In the *proof of concept* phase (2008-2009), a prototype CRM system was developed and used in several graduate schools. Five work streams were created: the first three, business strategy, training and culture change, and CRM system design, build and test were managed by the Brand Marketing Manager within Central Marketing; the remaining two, infrastructure and support were managed by Information Technology Services. The CRM system was developed by external consultants and based on the Microsoft Dynamics package. It managed the dialogue of email messages between a client (prospective student) and staff at the University. It enables messages from individual clients (identified by email address) to be grouped and managed over time. A pilot implementation of the system was delivered in ten weeks: *"we operated in a very entrepreneurial kind of way"* (CRM analyst). Implementation of the prototype CRM system was incremental, with initial implementation involving significant training and mentoring of the marketing, events management and student enquiries staff in the graduate schools. Initial functionality of the CRM system were a single view of the client, systematic routine follow-up of enquiries, targeted marketing initiatives using data collected over time from enquiries stored in the CRM database, and measurement of the effectiveness of marketing campaigns. The graduate schools accepted the proof of concept CRM system and development of a more sophisticated production system was authorised.

In the *release and refinement* phase (2010 onwards), the CRM system was implemented with improved user interface and workflow management capabilities. A single instance of the system was implemented and shared by all graduate schools within University. The CRM system was integrated with the student information system enabling the complete lifecycle of clients (students) to be tracked, from initial enquiry to graduation and beyond. In one graduate school, the Manager of Marketing and Recruitment commented, *"…one source of information is fantastic"*. The CRM system was used to improve client service by increasing response rates to enquiries and decreasing the average response time.

> *"Prior* [to the CRM system]*…about 60% enquiries were answered and the other 40% were not*…[and] *the average response time was about 4 to 5 weeks. Now 95% of enquiries are answered within 24 hours."* (CRM Program Lead)

A CRM user group has been established, with the goal of creating a community of practice, to enable knowledge-sharing and learning. Use of the CRM system within graduate schools has become routinised and helped change the culture of client service provision in marketing within University.

Benefits Achieved

Many significant benefits have accrued from use of the CRM system within University. These include increased student satisfaction when interacting with University, improved communication with potential students, more targeted marketing campaigns, improved data quality and reliability, and increased staff satisfaction and productivity. Use of the CRM system has led to significant numbers of conversions from enquiries to enrolments within some graduate schools and helped meet targets for student numbers in some courses. The CRM system is currently used by 14 graduate schools within University, and has positioned University at the forefront of innovation in higher education relationship management.

DISCUSSION

In this section we present a cross-case analysis, and identify similarities and differences between the two cases. The key distinction between the strategic positions of the two organisations is in the degree of standardisation of processes, data and systems. Resourceco has high standardisation and University has low standardisation, while both have high integration, indicating that data can be shared across the organisations. We discuss the similarities and differences between the two cases using five dimensions that emerge from the data analysis: strategic alignment, governance, people, organisational culture and data and technology infrastructure.

Strategic Alignment

Strategic alignment concerns the alignment between the business strategy and the information technology (IT) strategy (Henderson and Venkatraman 1993). When strategic alignment is high, organisations *"apply appropriate IT in given situations in a timely way, and these actions stay congruent with the business strategy"* (Chan and Reich 2007, p300). In Resourceco, there was a clear business initiative to establish a unified global organisation, and the global data warehouse and reporting system was a key component of that initiative. There was strong senior management support and significant funding for a large scale project. A significant investment in the early development of globally agreed metrics and common dimensions was crucial to the later success of the project. Clearly, strategic alignment was very strong, because it seems that Resourceco adopted an enterprise-wide orientation (Davenport et al. 2010) towards the use of global warehousing and reporting. In University, the development of the CRM system was consistent with the integration dimension of the operating model, but the

low standardisation dimension caused some difficulties. Impetus for the CRM system was mainly from middle level managers from the central marketing group. Senior managers were not convinced of the benefits the CRM system could bring and their support was mixed. Key performance measures and other metrics emerged through use of the proof of concept CRM system. The success of the system was largely due to the persistence of the "champion" middle manager, who drove the development and implementation relentlessly.

There is a better *fit* for an organisation-wide BA system with the Unification strategy type than with a Coordination strategy type. Organisational structure and change should be complimentary to IT resources and integration (Henderson and Venkatraman 1993).

Governance

Governance is concerned with specifying the decision rights, accountability and organisational structures to ensure that value is obtained from IT investments (Weill and Ross 2004). In Resourceco, global process teams were established with technical, business and senior management representation. This enabled BA capabilities within Resourceco to be continually renewed. Regular meetings and processes were in place to identify new opportunities and requirements for reporting, to prioritise these and then orchestrate assets for their implementation. The governance functionality allows to define the new BA targets more carefully (Davenport et al. 2010) based on the combination of their business potential and whether the necessary resources, including data, are available. This governance structure effectively implemented a dynamic capability (Helfat et al. 2007) within Resourceco.

University developed a user group as a governance structure primarily to foster sharing of experiences and learning about the CRM system as a community of practice (Wenger 1988). Many of the new developments in the CRM system are still initiated by the central marketing group, with some input from the user group. A separate steering committee has been established with senior management representation to monitor the value of the system and provide ongoing funding for the project.

The Unification strategy type provides a context within which organisation-wide dynamic capabilities can be readily established, and BA capabilities can be continuously renewed (Teece 2009) due to strong central management support and funding. The coordination strategy type is less centralised and integrated and change is more dependent on influence and learning (Wenger 1988) and considerable change-management and training efforts are needed to overcome organisational inertia (Seddon et al. 2010), when accepting the new BA system.

People

Having people with strong skills in BA technology, information management, change management skills to implement the BA system, and a sound knowledge of the business is critical to the success of BA (Davenport and Harris 2007). In Resourceco, there was a critical mass of expertise and experience in BA, together with a deep knowledge of the business, and change management. Staff working on the Data warehousing and global reporting project had been with the organisation for many years and there was low staff turnover. A particular feature of this project was the strong central management support and also the excellent leadership within the project.

University relied on a small number of very capable staff to 'champion' the CRM project. While these people had significant BA expertise and experience, overall development of the CRM system was outsourced. Furthermore, customer-facing staff in graduate schools were frequently part-time staff with a high turnover rate. Given this context, the CRM project should be considered a major success.

Clearly having the right people is crucial to the success of an organisation-wide BA system. The better *fit* with a Unification strategy type and stronger resourcing in terms of people and other funding increases the likelihood of success.

Organisational Culture

Organisational culture reflects the collective behaviour of the people who work in the organisation in terms of their values, vision, beliefs and routines (Leidner and Kayworth 2006). A particularly relevant aspect of organisational culture for BA systems is the routine use of data in decision-making, or evidence-based management (Pfeffer and Sutton 2006). In Resourceco, the acceptance of evidence-based management depended on gaining confidence in the quality of the shared data and this came over several years within the *incremental build and release* phase of the project. Extensive change management and training together with high quality data and reporting systems enabled the culture change.

University is earlier in the implementation process, however there are indications that the CRM system is becoming more routinely used in marketing and student recruitment tasks within graduate schools. This is due to

better quality data, integration of the enquiry system with the student information systems and stories of success with the system within the user group.

Evidence-based management is important for BA systems to be used by decision-makers and provide benefits. For both types of strategy, change management was completed in different ways but the change was achieved.

Data and Technology Infrastructure

A high quality data and technology infrastructure is essential to obtain benefits from BA systems (Davenport et al. 2010; Watson and Wixom 2007). Resourceco has implemented a high quality, flexible and scalable data warehousing solution with integrated and standardised global data. They have staff with deep knowledge of data warehousing and BA technologies, who frequently speak at vendor and other industry forums. They also have sophisticated reporting, dashboarding and OLAP technologies used within their reporting systems.

The CRM system within University uses much less sophisticated technology, but by the *release and refinement* phase of the project had achieved a *"single view of the client"*, with the CRM system being integrated with the student information system.

Both organisations had achieved a high quality data and technology infrastructure, however the Unification strategy type, which is based on integrated and standardised data, process and systems was clearly a better *fit*.

CONCLUSION

We have argued that organisational, human and technological BA capabilities lead to organisational benefits. Also, we argue that strategy, conceptualised as enterprise architecture, moderates the influence of BA capabilities on benefits. We have reported two case studies, selected based on theoretical replication, and discussed their similarities and differences. There are a number of limitations to the study. The two case studies are comparable as they are both organisation-wide BA initiatives, however they differ considerably in scale and the Resourceco's BA system is considerably more mature that the University case study.

Further research is required including multiple case studies for each of the four strategy types in a variety of different contexts including different industry sectors and different types of BA system. Furthermore, longitudinal case studies are required to better understand how benefits from BA systems evolve over time and in particular the role of dynamic capabilities in renewing operational BA capabilities within turbulent environments (Teece 2009).

REFERENCES

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

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

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

Chan, Y. E., and Reich, B. 2007. "IT Alignment: What Have We Learned?" *Journal of Information Technology* (22:4), pp 297-315.

Davenport, T.H., and Harris, J.G. 2007. *Competing on Analytics*. Harvard Business School Press: Boston.

Davenport, T.H., Harris, J.G., and Morison, R. 2010. *Analytics at Work*. Harvard Business School Press: Boston.

Gattiker, T., and Goodhue, D. 2005. "What Happens After ERP Implementation: How Interdependence and Differentiation Affect Plant Level Outcomes", *MIS Quarterly* (29:3), pp 561-587.

Gartner, 2010. "CIOs Plan on Same Budgets as 2005, but Technology Priorities Show Significant Change". Retrieved 21 November, 2011, from http://www.gartner.com/it/page.jsp?id=1283413.

Helfat, C.E., Finkelstein, S., Mitchell, W., Peteraf, M.A., Singh, H., Teece, D.J., and Winter, S.G. 2007. *Dynamic Capabilities: Understanding Strategic Change in Organizations*, Carlton: Blackwell.

Henderson, J.C., and Venkatraman, N. 1993. "Strategic Alignment: Leveraging Information Technology for Transforming Organizations", *IBM Systems Journal* (32:1), pp 4-16.

Kettinger, W.J., Zhang, C., and Marchand, D. 2011. "CIO and Business Executive Leadership Approaches to Establishing Company-wide Information Orientation", *MIS Quarterly Executive* (10:4), pp 157-174.

Kiron, D., Shockley, R., Kruschwitz, N., Finch, G., and Haydock, M. 2011. "Analytics: The Widening Divide: How Companies are Achieving Competitive Advantage through Analytics", *MIT Sloan Management Review*, Fall, pp 1-19.

Kraaijenbrink, J., Spender, J.C., and Groen, A.J. 2010. "The Resource-based View: A Review and Assessment of its Critiques," *Journal of Management* (36:1), pp 349-372.

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

Leidner, D.E., and Kayworth, T. 2006. "A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Conflict", *MIS Quarterly* (30:2), pp 357-399.

Miles, M., and Huberman, M. 1994. *Qualitative Data Analysis: An Expanded Sourcebook*. Sage Publications.

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

Pfeffer, J., and Sutton, R. 2006. "Evidence-Based Management", *Harvard Business Review* (84:1), pp 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), pp 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), pp 305-328.

Shanks, G., and Sharma, R. 2011. "Creating Value from Business Analytics Systems: The Impact of Strategy", *Proc. 15th Pacific Asia Conference on Information Systems (PACIS)*, Brisbane.

Shanks, G., Bekmamedova, N., and Sharma, R. 2011. "Creating Value from Business Analytics Systems: A Process-oriented Theoretical Framework and Case Study", *Proc. Australasian Conference on Information Systems (ACIS)*, December, Sydney, Australia

Shanks, G., Bekmamedova, N., Adam, F., and Daly, M. 2012. "Embedding Business Intelligence Systems within Organisations", in: Fusing DSS into the Fabric of the Context, Burstein, F., and Respicio, A. (eds.). IOS Press: Amsterdam, NL.

Sharma, R., Reynolds, P., Scheepers, R., Seddon, P., and Shanks, G. 2010. "Business Analytics and Competitive Advantage: A Review and a Research Agenda", in: *Bridging the Socio-Technical Gap in DSS-Challenges for the Next Decade*, Respicio, A., Adam, F., and Phillips, G. (eds.). IOS Press: Amsterdam, NL, pp 187-198.

Tamm, T., Seddon, P., Shanks, G., and Reynolds, P. 2011. "How Does Enterprise Architecture Add Value to Organisations?" *Communications of the AIS* (28:10), pp 141-168.

Teece, D.J. 2009. *Dynamic Capabilities and Strategic Management: Organizing for Innovation and Growth*. Oxford: Oxford University Press.

Trkman, P., McCormack, K., de Oliveira, M.P., and Ladeira, M.B. 2010. "The Impact of Business Analytics on Supply Chain Performance", *Decision Support Systems* 49, pp 318-327.

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), pp 107-142.

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

Weill, P., and Ross, J. W. 2004. IT Governance: How Top Performers Manage IT Decision Rights for Superior Results. Harvard Business School Press: Boston.

Wenger, E. 1988. *Communities of Practice: Learning, Meaning and Identity*. Cambridge University Press: NY.

Wheeler, B. 2002. "NEBIC: A Dynamic Capabilities Theory for Assessing Net-Enablement", *Information Systems Research* (13:2), pp 125-146.

Yin, R.K. 1994. *Case Study Research: Design and Methods*. Sage Publications: Thousand Oaks.

ACKNOWLEDGEMENTS

An Australian Research Council discovery grant funded this research.

COPYRIGHT