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## CREATING VALUE FROM BUSINESS ANALYTICS SYSTEMS: THE IMPACT OF STRATEGY

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### Abstract

*Business analytics systems can potentially contribute to firm performance and create competitive advantage. However, these benefits do not always follow from investment in business analytics technology. This paper argues that dynamic capabilities, enabled by business analytics technology, lead to value-creating actions and ultimately to improved firm performance. We develop a theoretical model that explains how organizational strategy relates to both business analytics technology and organizational structure, and impacts value-creating actions. We use the theoretical model to explain the implementation of a CRM system for one type of strategy.*

*Keywords: Business Analytics, Resource-Based View, Dynamic Capabilities, Strategy.*

## 1 INTRODUCTION

Business analytics systems can potentially contribute 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 2007, Kohavi et al. 2002, Piccolo and Watson 2008). However, there are few studies that clearly articulate a theoretically grounded model that explains how use of business analytics systems leads to improved firm performance (Sharma et al. 2010, Shanks et al. 2010).

In this paper we extend the work of Sharma et al. (2010) and Shanks et al. (2010), and focus on how organizational strategy impacts the creation of value from business analytics systems. Research on this topic is important for two reasons. First, business analytics systems are becoming an important strategic investment for many firms. Organisations are investing large amounts of money in business analytics systems (AMR Research 2008) and ‘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 (Gartner 2008). Second, although much is known about how enterprise-wide information systems bring benefits to organizations (for example Gattiker and Goodhue 2005, Seddon et al. 2010), this does not generalise to business analytics systems. The benefits of enterprise-wide information systems are often felt enterprise-wide and rely on process standardization and optimisation. In contrast the benefits from business analytics systems are distributed throughout organisations, rely on entrepreneurial activities in local contexts, and are incremental in nature (Sharma et al. 2010).

Prior literature on deriving business value from information technology investments has argued that information technology assets, such as business analytics systems, do not directly lead to business benefits. Rather, benefits are achieved in conjunction with other organizational and human capabilities (Aral and Weill 2007, Deveraj and Kholi 2003). However, much of this literature explores the relationship between information technology capabilities and firm performance, ignoring the key role that managers play in creating value through identifying opportunities, orchestrating assets and taking actions (Helfat et al. 2007, Teece et al. 1997). The concept of dynamic capabilities addresses this limitation and focuses on the role of managers and other decision-makers in creating value from business analytics technology.

In this paper, we combine insights from both the dynamic capabilities literature and the information technology strategy literature (Ross et al. 2006) to generate a theoretical framework that explains how dynamic capabilities, enabled by business analytics technology, lead to value-creating actions and ultimately to improved firm performance (Wade and Hulland 2004, Nevo and Wade 2010). We focus particularly on how organizational strategy influences both business analytics technology and organizational structure, and impacts value-creating actions. We demonstrate the usefulness of the framework in explaining how a business analytics system leads to value-creating actions for one type of organisational strategy. The theoretical framework will be of value to researchers and practitioners as it extends existing work and emphasises the role of managerial decision-making and agency in creating value from business analytics systems.

The paper is organized as follows. We first discuss the background to the study, focusing on business analytics systems and their impact within organisations. We then describe the theoretical framework, and develop two propositions that relate business analytic technology and organisational structure to value-creating actions. We argue that the strategy impacts both business analytics technology and organizational structure, and therefore value-creating actions. We then use the theoretical model to explain the implementation of a CRM system in a case study with the replication type of strategy. Finally implications of the theoretical model for practice and future research are discussed.

## 2 BUSINESS ANALYTICS SYSTEMS

Business analytics systems enable managers and other decision-makers 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 and its use is now widespread in business analytics applications (Davenport and Harris 2007).

Many 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 applications in marketing, finance, human resources and manufacturing (Kohavi et al. 2002, Davenport and Harris 2007). Some of the mechanisms through which business analytics systems have achieved improved firm performance include:

- Quick identification of emerging trends in revenue prediction by Hewlett-Packard enabling prompt action (Davenport and Harris 2007)
- Accurate costing and pricing of products and services, and accurate assessment of customer profitability by Royal Bank of Canada (Davenport and Harris (2007)
- Accurate estimate of customer's future value (Piccoli and Watson 2008)
- Analysis of customer data to design more effective marketing campaigns (Kohavi et al. 2002)
- Identify of 'best value' inventory items to drive sales of items with better fill rates, and reduce inventory (Carte et al. 2005)

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

- Exploitation of business analytics systems is dispersed throughout organisations involving multiple users from many functional areas;
- Value creating actions are essential for obtaining performance gains: business analytics systems are enablers of these actions;
- Value creating actions and performance gains are often the outcomes of entrepreneurial activities in a local context, they are rarely planned or predicted;
- The impact of value-creating actions enabled by business analytics systems is 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, they do not provide theoretical explanations as to how and why the value-creating actions were achieved. Recent theoretical developments in dynamic capabilities and the role of managers and decision-makers in creating organisational value provide a means of explaining how and why organisations can achieve benefits with business analytics systems. The dynamic capabilities literature places managerial agency at the heart of the theory of how organisational resources generate improved firm performance (Helfat et al. 2007). This perspective is particularly suited to business analytics systems as they deliver value from a stream of innovations over a period of time (Kohli 2007).

Another important influence on business analytics systems is strategy, operationalised as enterprise architecture (Ross et al. 2006). This view of strategy is based on the level of standardisation and integration of organisational processes and data, and influences business analytics technology and organizational structure (Shanks et al. 2010). We combine strategy with insights from the dynamic capabilities perspective to develop a comprehensive framework for understanding how business analytics systems lead to value-creating actions and ultimately to improved firm performance.

### 3 THEORETICAL FRAMEWORK

The theoretical framework is based on the resource-based view of the firm (Barney 1991, Wade & Hulland 2004) and the work of Sharma et al. (2010) and Shanks et al. (2010). The resource-based view proposes that organisational resources are the basis for improved firm performance. Organisational resources may be tangible or intangible, and comprise organisational, human and technical capabilities. To be of strategic importance, resources must possess certain properties, viz. valuable, rare, inimitable and non-substitutability (Barney 1991, Nevo and Wade 2010). In this paper we focus on *dynamic* capabilities rather than *operational* capabilities, as we are interested in how business analytics systems enable managers and decision-makers to undertake value-creating actions that improve firm performance. We also focus on the distributed and entrepreneurial actions taken by managers and decision-makers.

Our theoretical framework is shown below in Figure 1, where our core argument is as follows. First, given inter-firm heterogeneity and intra-firm heterogeneity (which seems highly likely), the extent of dynamic business analytics capabilities will differ across business units within organisations and across competing organisations (Sharma et al. 2010). Within this context, dynamic business analytics capabilities (routines for identifying needs and opportunities and allocating resources for them) lead to the initiation of value-creating actions. Value-creating actions then affect firm performance. Therefore, value-creating actions *mediate* the relationship between business analytics resources and firm performance (Sharma et al. 2010).

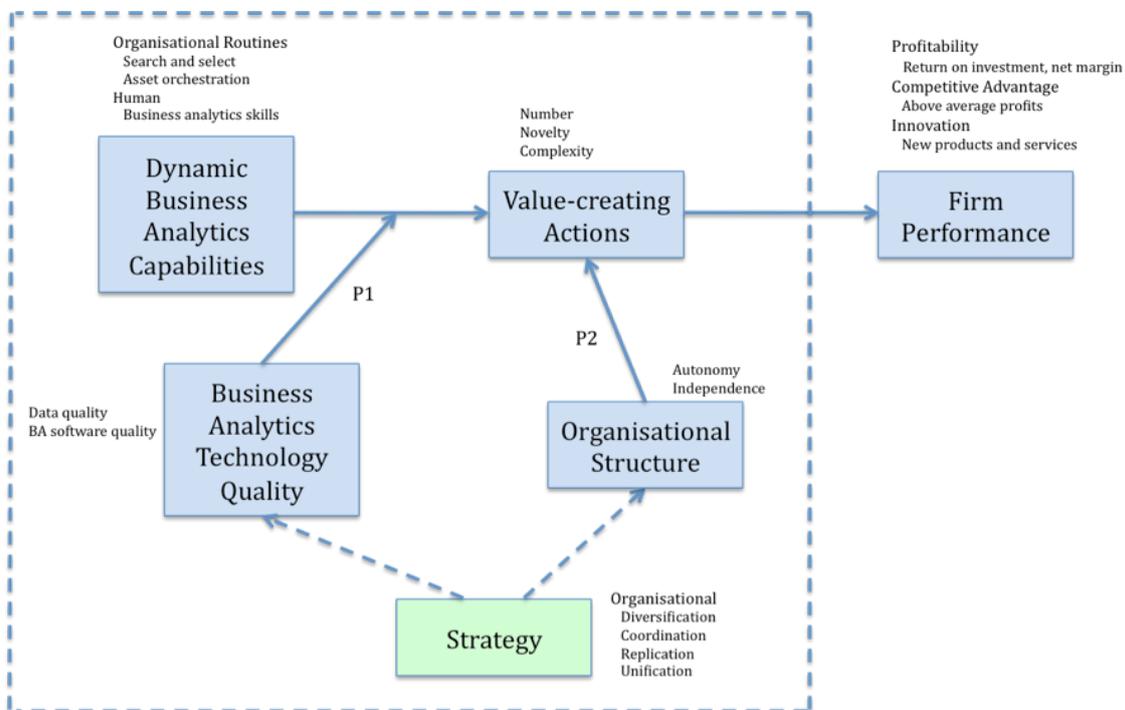


Figure 1. Theoretical Framework

In addition to the above three constructs, in this paper we extend our core argument and argue that three additional constructs—Organizational structure, Business Analytics Technology Quality, and the organisation’s Strategy—are likely to have an important influence on the extent to which business analytics capabilities lead to value-creating actions and ultimately to improved firm performance (the extension is within the dashed line in Figure 1). First, we argue that *organisational structure* (the level of autonomy and independence of business units) will impact managerial agency and the successful deployment of value-creating actions (Gavetti 2005, Sharma et al. 2010). Second, we argue that *business analytics technology quality* (software systems and data) will moderate the ability of

dynamic business analytics capabilities to initiate value-creating actions (Shanks et al. 2010). Finally, we include the categorical construct, *Strategy*, based on the work of Ross et al. (2006). Ross et al. (2006) define four types of strategy, based on the level of standardisation and integration of organisational processes and data. We argue that each type will impact business analytics technology and organisational structure differently. Each of the six concepts in Figure 1, and their relationships, is now discussed further in detail.

### 3.1.1 *Dynamic Business Analytics Capabilities*

Dynamic capabilities are defined as “the capacity of an organization to purposefully create, extend or modify its resource base” (Helfat et al. 2007, p1-4). The key role of dynamic capabilities is to enable organisations to change the way they do things (Helfat et al. 2007). In particular, we argue that an organisation’s ability to undertake value-creating actions from the use of *business analytics* systems depends on its dynamic business analytics capabilities. Dynamic business analytics capabilities are a specific dynamic capability that utilises data to develop, resource and implement value-creating actions (Sharma et al. 2010).

Two organizational routines, *search and select* and *asset orchestration* are critical for the operation of dynamic capabilities. Search processes involve identification of a need or opportunity, while selection processes involve formulating actions and allocating resources. Search and selection processes may include designing new business models, selecting configurations of co-specialized assets, selecting investments and courses of action to invest in, and selecting organisational, governance and incentive structures (Helfat et al. 2007). Asset orchestration is the ability to put search and select decisions into effect by implementing new combinations and co-alignment of assets (Teece 2009). Business analytics skills enable managers and decision-makers to effectively use business analytics technology.

### 3.1.2 *Value-creating Actions*

Value-creating actions are essential for business analytics systems to contribute to firm performance (Sambamurthy et al. 2003, Sharma et al. 2010). Having dynamic business analytics capabilities and business analytics systems alone is insufficient. It is important to recognise the key role that managers and decision-makers have in taking actions after opportunities are identified and assets orchestrated. For example, using insight gained from analysing data, an organisation 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.

### 3.1.3 *Firm Performance*

Firm performance is a much-studied topic. A variety of different performance measures exist including “productivity, consumer welfare, accounting profit, market valuation and operational performance” (Aral and Weill 2007, p771). In the context of business analytics systems, firm performance might 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/or innovation (revenues from new and modified products) (Davenport and Harris 2007, Aral and Weill 2007). Specific measures will depend on the nature of the business analytics-driven initiatives undertaken within the organisation.

### 3.1.4 *Business Analytics Technology Quality*

Business analytics technology is the hardware and software tools in which organisations invest, as well as the data stored in their information systems (Davenport and Harris 2007). The hardware and software tools include special purpose hardware (for example Teradata hardware), software tools including report generators, on-line analytical processing (OLAP) tools, statistical analysis packages

and data mining tools (Watson and Wixom 2007). The data stored and used in business analytics systems should be of high quality (Price and Shanks 2007).

Business analytics technology assets provide a platform from which value-creating actions may be launched. This is consistent with Sambamurthy et al. (2003) who regard information technology assets as a generator of ‘digital options’, and Nevo and Wade (2010) who argue that synergistic information technology assets and capabilities are needed to realise business value. In Figure 1, we argue that the availability of high quality business analytics technology (data, software and hardware) is likely to make dynamic business analytics capabilities (particularly search and selection) more effective, resulting in a positive effect (greater number, more novel and more complex actions) on the value-creating actions that the organizations undertake. This argument is summarized in the following proposition:

P1 *Business Analytics Technology Quality will moderate the effect of Dynamic Business Analytics Capabilities on Value-creating Actions (number, novelty and complexity).*

### 3.1.5 Organisational Structure

Organisational structure also plays an important role in the ability of managers and decision-makers to initiate value-creating actions. Value-creating actions are initiated through an interaction between the cognition of local managers and those of corporate management (Gavetti 2005). In organisations where central management strongly control the strategies and actions of business units, the cognitions of corporate management play a more dominant role than the cognitions of business unit managers (Sharma et al. 2010) in the choice and execution of value-creating actions. In particular, two key aspects of organisational structure that affect the taking of value-creating actions are *autonomy* and *independence*. Higher autonomy implies higher discretionary allocation of resources by business units. It is expected that such business units will be more effective at initiating value-creating actions. Furthermore, business units with low dependence on other business units will also be expected to be more effective at initiating value-creating actions (Sharma et al. 2010). This argument is summarized in the following proposition:

P2 *Business units with high Autonomy and low dependence on other business units will be more effective at undertaking Value-creating Actions (number, novelty and complexity).*

### 3.1.6 Strategy

Ross et al. (2006) argue that strategy is operationalised as the operating model a firm or business adopts, where operating models are defined in terms of the level of standardisation of business processes and the level of integration of business processes in the organizational unit. Organisations with a *high level* of standardisation tend to have similar key business processes and data across all business units, regardless of who executes the process. Organizations with a *low level* of standardisation have very few identical key processes and data, and local innovation is encouraged and frequently observed. Organisations with a *high level* of integration have significant sharing of processes and data across and between key business processes and between all business units. Organisations with a *low level* of integration choose not to integrate processes and data across business unit boundaries. Combining two levels of standardisation and two levels of integration results in four types of strategy.

We now discuss the characteristics of each type of strategy (Ross et al. 2006) and explain how they influence both business analytics technology quality and the organizational structure.

- *Unification*: (high standardisation and high integration). In this operating model organisations have shared process and data, business units are tightly coupled and management is highly centralized. This will lead to business units that have low autonomy as managers and decision-makers will need to obtain central approval for actions. Furthermore, business units will have low independence as they are tightly coupled with other business units. Standardized and integrated

data will be of high quality for use in business analytics applications. Business analytics software and hardware will be shared amongst business units and hence well understood and supported.

- *Coordination*: (low standardisation and high integration). Organisations with this operating model have shared customers but business units are autonomous. Data is shared but processes are designed within business units. This will lead to business units that have high autonomy and high independence, as processes are defined within each business unit. Although data will be integrated, as it is not standardized it will be difficult to maintain high quality data. However the integrated data will provide opportunities for leveraging existing customers across business units. Business analytics hardware and software may be different in each business unit.
- *Replication*: (high standardisation and low integration). In his operating model, processes and data are standardized and centrally controlled, but data is not shared. Business units are highly autonomous, but operate in a similar way. This will lead to high autonomy in business units as although operational processes are standardized, local value-creating actions may be taken. Business units will have high independence as they are loosely coupled with other business units. Data within business units may be of high quality and although not integrated, as data is standardized, integrating organizational data should not be difficult. Business analytics software and hardware will be shared amongst business units and hence well understood and supported.
- *Diversification*: (low standardisation and low integration). In the diversification operating model there is no need for integration of data and processes, and business units have their own autonomous management and decision-making structures. This will lead to business units with high autonomy and high independence. Data within business units may not be of high quality and integrating organizational data will be difficult, as it is not standardised.

Understanding the particular strategy in an organisation (or organisational unit), together with propositions one and two, is therefore useful in explaining how and why business analytics technology may lead to value-creating actions and ultimately to improved firm performance. In the next section we present a case study, selected to have a *replication* operating model, and use the theoretical model to explain performance implications of the implementation of a CRM system.

## 4 CASE STUDY

### 4.1 Research Approach

We use an explanatory case study research approach. Case studies are particularly useful for in-depth studies of contemporary phenomena within their organisational context (Yin 1984). They provide a rich and detailed description of the phenomena and explain how and why outcomes occur. We examined the implementation of a student recruitment CRM system within a major Australian university. We were provided with ready access to the key stakeholders involved in the project, including senior managers, and relevant documents.

Data collection included semi-structured interviews and access to relevant documents. Interviewees were selected using heterogeneity sampling to enable triangulation (Miles and Huberman 1994). We conducted eight interviews with key participants (see Table 1) over a period of six months, with each interview lasting about one hour.

Organisational Unit	Interviewees
Central Marketing	Chief Marketing Officer, Brand Marketing Manager, CRM Analyst (two interviews)
Graduate School A	Director of Marketing and Commercial Engagement, Manager of Marketing and Recruitment, Executive Officer Student Services, Student Services Officer
Graduate School B	Manager of Marketing and Recruitment, Admissions Officer, Enquiries Officer

Table 1. Case Study Interviews

We examined documentation about the CRM system including system descriptions and training materials. All interviews were recorded and transcribed. We used thematic analysis to identify common patterns and themes emerging from the data (Miles and Huberman 1994).

## 4.2 Case Description

University is a large Australian research and teaching university with a student population of approximately 35,000 students, over 7,000 staff and revenue of approximately \$1.5 billion. University recently initiated a major restructuring of its course offerings with a reduction in undergraduate course offerings resulting in the provision of six broad and flexible undergraduate courses. Students need to undertake a two-year post-graduate masters course to complete 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 needed to (and 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 the new student recruitment and admissions and cycle, from initial enquiry to enrolment, and subsequently to graduation and as alumni.

### 4.2.1 *The CRM Initiative at University*

Central Marketing, a university unit that reports directly to a senior executive, initiated the CRM project. The brand marketing manager started with the unit about three years previously and noted, “there didn’t appear to be any client or customer strategy” (Brand Marketing Manager). There were few metrics associated with marketing campaigns, little evidence of use of market segments in recruitment and little knowledge of marketing and sales processes. An experienced CRM analyst was recruited to the project. The CRM analyst was experienced in strategy, change management and technology of CRM systems. The original task of the CRM project was to “assess the CRM capability of the university” (CRM analyst), however, after four months management decided to implement a CRM capability to immediately improve student recruitment processes. A customer strategy for University from “birth to bequest” was defined and the need for “a large culture change” was identified (Brand Marketing Manager). Attracting graduate students required University to actively design and market courses and programs to suit market needs, while the existing culture relied on the University’s reputation as an elite university to attract students.

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 IT Services. The CRM system was developed by external consultants and based on the Microsoft Dynamics package. The CRM system manages 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). The system was piloted for five months and then went live. To date, it has been operational for around eight months.

The CRM system was implemented incrementally, with significant training and mentoring of marketing, events management and student enquiries staff in Graduate Schools. Initial goals were a “single view of client” (CRM analyst), systematic routine follow-up of enquiries, targeted marketing initiatives using data collected over time from enquiries in the CRM database, and measurement of the effectiveness of marketing campaigns.

### 4.2.2 *The CRM Initiative in Graduate School A*

Graduate School A was strongly committed to the CRM project and the Director of Marketing was a member of the steering group. The CRM system was intended to “capture the interest of prospective students and have a professional way of dealing ... with their enquiries ... and ensuring appropriate

follow up” (Director of Marketing). The graduate school has a large number of students enrolled in twenty-four graduate coursework programs. Prior to the CRM system, handling enquiries was “quite unsophisticated ... and there was no concept of handling a relationship” and “there was no ability to link a specific marketing investment with a number of enquiries” (Director of Marketing). The CRM system is “about culture change ... and the services that we provide” (Director of Marketing). A key goal of the graduate school was to increase graduate program enrolments.

The marketing and student enquiry group comprise ten staff covering the marketing, recruitment and admissions functions. Many of the staff were new and had been in their position less than twelve months: “We’ve had a large changeover of staff ... four of our five marketing staff left at the end of last year” (Manager of Marketing and Recruitment). The CRM system was used by marketing staff to create promotional campaigns and measure the effectiveness of those campaigns, and by student recruiters to manage response to enquiries. The number of enquiries varies from one hundred per month in quiet times to one thousand six hundred per month at mid-year and end year peaks times. A major benefit of the CRM was its capability to group all interactions with a prospective student after the initial enquiry: “... one source of information is fantastic” (Manager of Marketing and Recruitment).

The two managers in Graduate School A drove three initiatives within the first few months of using the CRM System. The first was to use consolidated lists of prospective students in targeted email marketing campaigns. The second was to use templates for common enquiries to help standardise responses provided and to assist new staff to respond to enquiries in a timely manner. The third was to analyze the effectiveness of specific marketing campaigns and channels. One of the ways this was achieved was to associate a unique URL with a particular campaign through which prospective students could send enquiries or obtain more information. Monitoring the traffic through those URLs enabled an evaluation of the effectiveness of individual campaigns and channels.

Graduate School A plans to use the CRM more extensively in the future when it is better integrated with the new student information system: “... its not talking to [student system] at the moment ... and doesn’t create the complete picture of an applicant” (Manager of Marketing and Recruitment). It will then become possible to track an enquiry from a prospective student through the initial dialogue, the application process, initial enrolment and then progress through their selected program.

#### 4.2.3 *The CRM Initiative in Graduate School B*

Graduate School B was an early adopter of the CRM initiative. It is located within a large Faculty and currently has approximately 2000 students enrolled in one of sixteen graduate coursework programs and higher degrees by research. The graduate school was established about twelve months ago as part of the University wide initiative to substantially grow graduate student numbers. Establishment of the graduate school was accompanied by the rationalisation of existing and development of new programs to sixteen and the creation of a new web site and branding. The Faculty Manager of Marketing managed the implementation of the CRM initiative within the graduate school and participated in staff training and mentoring. Graduate School B aimed to increase graduate program enrolments by fifty percent within five years.

The marketing and student enquiry group within the Graduate School comprised seven staff, three in marketing and event management and four in student advisory roles. Many of the staff were new and had been in their position less than twelve months. The CRM system was used by marketing staff to create campaigns and by student advisors to manage email enquiries from prospective students. On average about thirty email enquiries and thirty telephone enquiries are received each day. Lists of enquiries were established daily and allocated to particular advisors for action.

The marketing manager drove three particular initiatives within the first few months of using the CRM system. The first was to create templates for common enquiries to standardise the responses provided and reduce response time. The second was to match students in the enquiry system with newly enrolled students in the student system on a monthly basis to determine which enquiries had resulted

in enrolments and which could be further followed up. The third was to create lists of prospective international students for particular locations to which faculty members were about to travel. This enabled Graduate School B to contact those prospective students and schedule them for one-on-one meetings with the faculty member. Each of these initiatives was undertaken incrementally and as a result of the entrepreneurial actions of the marketing manager.

Graduate School B plans to use the CRM system more extensively in the future as systems capabilities are further developed and the database of prospective students becomes larger. A particular requirement is for the CRM system to be seamlessly integrated with the student system. In the medium term additional benefits will be seen in the application of online marketing programs that will facilitate real time marketing interventions based upon web traffic interrogation, site traffic, downloads enquiries and application.

### 4.3 Case Study Analysis

Ross et al. (2006) provide a method for categorising the operating model of a business unit, based on their degrees of standardisation and integration. The **degree of integration** is assessed by examining the extent to which completion of one business unit's transactions depend on data from another business unit being available, accurate, and arriving at a required time. Neither graduate school A or B depended on data from any other business unit to complete their CRM transactions. Therefore, for both graduate schools integration was low. The **degree of standardisation** is assessed by examining how similar business processes are in different locations and the degree to which differences or diversity are encouraged. Standardised business processes for operational transactions within the CRM system were clearly evident but initiatives such as new marketing campaigns, providing lists of international students to academics attending overseas conferences, and measuring performance of marketing campaigns were very much local initiatives. Therefore, for both graduate schools the level of standardisation was high (although both graduate schools retained autonomy in taking actions). With high standardisation and low integration, a *replication* operating model was evident.

We observed a number of examples of dynamic business analytics capabilities that led to value-creating actions in both Graduate Schools. Two examples of the search and select capability are the need for templates when responding to enquiries and the need to better respond to international enquiries. An example of asset orchestration is in Graduate School B where the marketing manager arranged for academics travelling overseas to meet with international enquirers face to face to discuss the graduate programs. Some early indicators of improved performance are a follow-up campaign that resulted in conversion of enquiries to enrolments with fee revenue of \$600,000 (Brand Marketing Manager) and more innovative in the use of marketing channels.

We now focus in particular on how the replication strategy impacts business analytics technology quality and organisational structure, and therefore value-creating actions.

#### 4.3.1 *Impact on Business Analytics Technology Quality and Value Creating Actions*

Data definitions were standardised within the CRM system and a high quality database of enquiries was established within each Graduate School. All interactions with a particular prospective student could be grouped within the CRM system. The Manager of Marketing and Recruitment in Graduate School A noted "... one source of information is fantastic". The CRM system was implemented in each graduate school with the same data definitions and software. However, there was little integration of data between the graduate schools as the identifier for each enquiry was its email address, and these were not always consistent. There was also little integration of data from the CRM system with the student information system as different identifiers were used and matching enquiries to enrolled students could not be easily automated.

High quality data within each of the Graduate Schools enhanced the search and select dynamic capability. For example, high quality enquiry data enabled lists of enquiries at specific locations to be

routinely provided to academic staff travelling overseas. In this way dynamic business analytics capabilities were more effective in initiating value-creating actions.

#### 4.3.2 *Impact on Organisational Structure and Value Creating Actions*

Graduate Schools were free to develop their own courses (products) and marketing strategies. In this way they were autonomous from University central management. They made decisions locally and used local data and resources. Furthermore, Graduate Schools were free to make decisions independently of other Graduate Schools. For example, in Graduate School A the specific value-creating actions included targeted student lists for email campaigns and analysis of marketing campaigns and channels in leading to enquiries. Graduate School B initiated different value-creating actions including matching enquiries with enrolments in the student system to check which enquiries led to enrolments and creating lists of prospective students for travelling faculty members to contact.

These value-creating actions were initiated autonomously within each graduate school independent of each other. They could develop their own routines involving searching and selecting, and asset orchestration with both autonomy and independence. This greatly simplified the process of change management and new value-creating actions could be readily conceived and implemented.

#### 4.4 **Case Study Conclusion**

Case study data analysis has demonstrated that the three new concepts in the enhanced theoretical model developed in this study (strategy, business analytics technology quality and organisational structure) are useful in explaining how business analytics systems may lead to value-creating actions, for the *replication* operating model. The underlying logic of propositions 1 and 2 have been consistent with the patterns of cause and effect in the case study.

## 5 **CONCLUSION**

We have argued that dynamic business analytics capabilities provide a means of understanding how and why business analytics technology may lead to value-creating actions and ultimately to improved firm performance. Furthermore, we argued that organisational strategy impacts both business analytics technology quality and organizational structure, and also value-creating actions. The theoretical framework has been illustrated in the context of the implementation of a CRM system in single a case study organization, University, which has been selected to use a replication operating model.

Having shown that the model is consistent with the data in this single case study, further case study research is now required. We need to examine the power and usefulness of the theoretical framework in explaining how business analytics systems contribute to value-creating actions and ultimately to improved performance in organizations with all four types of strategy models. We also need to undertake longitudinal case studies to understand better how value-creating actions lead to improved firm performance.

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