

## INNOVATION CAPABILITY AND ITS IMPACT ON FIRM PERFORMANCE

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### ABSTRACT

The paper tests several hypotheses within a Best Innovation Management (BIM) model using quantitative data, gathered from a large random sample in a mail survey of companies in the Australian manufacturing, services, construction, and software sectors. A total of 220 responses were obtained, which represents a response rate of 15 per cent. Our results revealed that three factors explain 42 per cent of the variation in innovation performance: Leadership and Strategy; Innovation Capability and New Product Development. E-Commerce and Sustainable Development Orientation were significantly associated with innovation performance. However, the two constructs were not significant differentiators between high and low innovating organisations. The research findings have significant implications for managers by providing an in-depth understanding of key evidence on how to create innovation driven companies.

### INTRODUCTION

The next battlefield that will drive the international competitiveness and business outcomes of Australian firms is innovation. Australia's best firms, such as Cochlear and Varian have already stepped up to this challenge, but Australia lacks widespread innovation capability and lags behind the world's most innovative firms, such as Sony, 3M and Hewlett Packard (IMD/World Economic Forum, 2006). As pressures for innovation have increased, new enabling factors and drivers have also evolved: e-commerce, sustainable development and a focus on accelerating new product development are taking leading roles in helping to transform knowledge into new products, processes and services (Lawson and Samson, 2001). Innovation is not a simple or single factored concept, as it involves many aspects of management, leadership, and technical aspects as well as strategic resource allocation, market knowledge, organisational incentives etc. Despite the volumes of research on innovation in organisations, there are no clear, agreed guidelines for creating innovation driven organizations. Numerous studies have attempted to isolate the important variables facilitating innovation outcomes (Damanpour, 1991). However, there is still much we do not know about how firms can innovate faster and better. We do know that effective innovation requires the construction of an overarching framework of factors conducive to creativity.

This paper further develops the innovation construct, based on an extensive literature review, beyond the initial work of Lawson and Samson (2001), and tests these in the field. In particular the paper is focused on the roles of e-commerce, sustainable development and new product development and how these factors, link with general notions of innovation capability, leadership and business strategy. The paper develops and validates Best Innovation Management (BIM) model for the creation of innovation-driven companies (Clark & Fujimoto, 1991). The paper focuses on the development of an integrative model of innovation management, and provides a theoretical understanding of the complex relationships between innovation capability, e-commerce, sustainable development and new product development. Managers receive the rhetoric via government policy and management theory that innovation is key to continued success. Often the advice focuses on simply telling organizations to provide a larger research budget and to protect their innovations through patents. Research results do not provide any consistency across industry or firm size (Wolfe, 1994; Afuah, 1998) into the

management of both product and process innovation. Therefore, the research question motivating this study is: *What are the key drivers of innovative organisations from a product and process innovation perspective?*

## LITERATURE REVIEW

An extensive literature review was conducted to identify important variables and to document research findings from earlier research that will serve as a basis for the development of a theoretical model, within which hypotheses are formulated and tested (Sekaran, 1992). A number of authors assert that much of the innovation research literature has focused on technical product innovation to the neglect of process and organizational innovation (Damanpour, 1991). There is a lack of research in testing the relationship between practices in managing innovation and performance outcomes. The study of innovation appears in different literatures such as sociology, education, management etc. We have chosen the domain of innovation management research developed by researchers in areas of organisational theory and strategic management, where the organisation is used as a unit of analysis.

### Leadership and Innovation Strategy

Scott and Bruce (1994) argue that innovative organizations are oriented towards creativity and change with support for employees as they engage in the search for new approaches to problem solving. Using an innovative scale developed by Kanter (1989b), they found innovative behavior correlated positively with strong leader role expectations ( $r=0.33$ ,  $p<.001$ ), supporting the notion that leadership plays a strong role in encouraging innovative behavior. Rogers (1999) found a positive link between communication and productivity in British workplaces, leading to the conclusion that greater employee input through improved communication leads to higher innovation levels. Martensen and Dahlgaard's (1999) case study of a large technology organization found successful leaders must communicate strategies, goals, and actions to all employees to strengthen organizational coordination and increase the likelihood of innovation.

The contributions of these authors emphasize the importance of the leader developing an organizational structure that allows the message of innovation to go directly to employees. A common bond in all of these studies is the emphasis on leaders building systems of communication that encourages organizational innovativeness, rather than being the creative force behind the origin of the innovation. Norrgren and Schaller (1999) assessed leadership style via a survey and concluded innovative learning requires a willingness by leaders to share responsibility and the ability to focus on team objectives. In a large interview based study of innovation, Rice, O'Connor, Peters and Morone (1998) discovered that champions of change and innovation played a major role in creating innovative activities. These authors found that successful innovating organizations had the presence of multiple champions playing a different role. There was rarely a single person performing multiple roles, possibly due to the competing pressures on their time and resources. From the results of these studies and the apparent fit between transformational leadership theory and innovation studies, the leadership focus appears justified. The results of a quantitative study such as this will demonstrate that leadership need not be a set of abstract concepts, but a set of testable concepts with practical application.

The focus of current strategic thinking considers the unique knowledge embedded in the firm as the key to outpacing rivals (Kim and Mauborgne, 1999). Strategy combines with innovation to provide growth opportunities by improving current processes or developing new products (Afuah, 1998). There are numerous works on the importance of having an openness to risk taking and a willingness to attempt new things (Rothwell, 1994; Utterback, 1994; Ahmed, 1998). However, there is little work on translating these orientations into outcomes, for example, whether it is more effective to be riskier in technical, or process aspects of the organization. Top performing strategic leaders use creativity and innovative action to access and leverage underlying organisational potential. At the same time, they continuously reinvent their business models and renew their relationships to increase value and stay competitive. A deliberate, systematic and results oriented knowledge creation and innovative action cycle offers the best approach for achieving this goal. A new economy arises out of the interlocking and dynamic forces of expanding globalisation, accelerating technology and shifting demographics. In this new environment, performance improvement through deliberate, systematic and results oriented knowledge creation and innovative action provides a "meta strategy" which leverages organisational talent and capabilities and hedges against risks in order to grow and create new wealth. Strategic innovation involves making knowledge creation and innovative action a way of life, seeking to create and expand markets rather than just reacting to customer demand, and redirecting resources from

profitable but dwindling lines of business to support emerging lines that are potentially more profitable. Therefore, this leads us to our first hypothesis H1:

Hypothesis H1: *Leadership and business strategy construct has a positive and significant association with innovation performance.*

### **Innovation Capability**

Lawson and Samson (2001) used the Resource-based View of the firm to develop a framework for managers showing that the process of innovation can be managed, systematised and replicated within organisations. This view characterises the firm as a collection of resources and capabilities. “Innovation capability” is a higher-order integration capability, or the ability to mould and manage multiple capabilities. The dynamic capabilities approach represents the identification of the dimensions of firm-specific capabilities that can be sources of competitive advantage and the explanation of how combinations of competences and resources can be developed, deployed, and protected. Because this approach emphasizes the development of management capabilities, and difficult-to-imitate combinations of organizational, functional and technological skills, it integrates and draws upon research in such areas as the management of R&D, product and process development, technology transfer, intellectual property, manufacturing, human resources, and organizational learning. The major characteristics of organisational innovation capability may be summarised as follows: (Lawson & Samson, 2001).

- Vision and strategy;
- Harnessing the competence base;
- Leveraging information and organisational intelligence;
- Possessing a market and customer orientation;
- Creativity and idea management;
- Organisational structures and systems;
- Culture and climate;
- Management of technology.

The authors explain that developing innovation capability is based on elements of “hard innovation” and “soft innovation.” Hard innovation is concerned with the organisation putting in place structures for innovation such as ideas and reward schemes. Soft innovation is concerned with the proper management of the hard aspects of innovation such as managing the culture and climate of the organisation. Given that innovation is inherently risky and complex, organizations still seek a set of directions to help them focus on defining innovative activities. Testing innovation capability as part of the BIM model will provide valuable insights as to how the innovation capability construct can be further developed, and will also provide valuable practitioner guidelines. The elucidation and validation of the innovation capability construct will add significantly to the bodies of knowledge in each of the three fields, and in the central innovation management literature. The innovation model is expected to be based substantially in the dynamics capability literature (Teece, Pisano & Shuen, 1997) and cover aspects of many disciplines, as innovation is not a “single discipline” phenomenon, which may partially explain the paucity of comprehensive models and research on innovation management and strategy.

Kanter (1989a) argues that organisations are most effective where the different resource needs of the “mainstream” and “newstream” are recognised and their management largely autonomous. Definition of newstream is *the ability to continuously transform new knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders*. This new model assumes that the organisation is focused on innovation and innovation outputs as their primary competitive strategy. Kanter argues that managing the different needs of the mainstream and the newstream independently is unlikely to be successful in a dynamic and turbulent operating environment. Integration of the mainstream and newstream is the innovation capability of the organisation. Further research should be directed at identifying and refining measures for different forms or degrees of innovation capability. For example, there may be different emphasis on elements required for radical versus incremental innovation, and the integration of e-commerce, new product development, and sustainable development. Building on the dynamic capabilities literature, an “innovation capability” (IC) construct will be proposed. This leads to the second hypothesis to be tested H2:

*Hypothesis H2: Innovation Capability has a positive and significant association with innovation performance.*

### **New Product Development**

Most empirical work on NPD has focused on the relationships between various success factors, including new product strategies, and performance measures and risk (e.g., Cooper & Kleinschmidt, 1995, 1996; Firth & Narayanan, 1996). As a result, we know for example that firms that emphasised market innovativeness in their product introductions enjoyed higher returns than those who did not (Firth & Narayanan, 1996, p.334). Past research also indicates that critical factors of NPD are, for instance, organisation size, a clear, well-communicated new product strategy, strategic focus and synergy, an entrepreneurial climate for product innovation, adequate resources for new products, senior management commitment to and accountability for new product development, and the existence of high-quality, cross-functional development teams in the organisation (Cooper & Kleinschmidt, 1995, 1996). In particular, Mabert et al.'s (1992) comparison of six NPD projects indicated that a knowledgeable leader with sufficient time to devote to the management of the project, shorten the development time of new products. In addition, motivation (triggered by competitive pressures), aspects of teamwork (such as full-time participation and cross-functionality of team members), outside influences (such as vendor participation in the project), and systematic project control, may accelerate NPD (Mabert et al., 1992; Sohal et al., 2002). Some recent developments in innovation include the role of improvisation in new product development (NPD). Improvisation has been defined as "thinking in the midst of action," "reading and reacting in parallel" and "real time composition." Improvisation in NPD is fast growing. This leads us to the third hypothesis H3:

*Hypothesis H3: New Product Development strategy has a positive and significant association with innovation performance.*

### **E-commerce**

Most of the literature on e-commerce focused on the implementation of technologies prior to the advent of the Internet, such as EDI (Electronic Data Interchange) (e.g., Ngai & Wat, 2002). Those that compared the adoption, or intended use, of Internet-based technologies for e-commerce purposes with the level of adoption of prior technologies, found evidence that emerging Internet-based technologies are easier to adopt by organisations of all sizes than EDI (e.g., Chan & Swatman, 2000; Power, 2002). This is mainly due to the low cost of Internet-based technologies. Past research on e-commerce and the use of Internet-based technologies also found that the first step to using the Internet for e-commerce purposes has been the setting up of a Web site that provides information about the company (Chan & Swatman, 2000; Power, 2002). In addition, large firms are more likely than small ones to have e-mail and/or access to the Internet, to have their own web site, to sell on line (but no more than 21 per cent appear to do so), and buy on-line (e-procurement) (Konings & Roodhooft, 2002).

As the capabilities of information technology expand, it becomes even more difficult to be cognizant of the whole strategic picture. When considering organisational strategies for e-commerce, it becomes clear that the potential functionality is so broad that one cannot suggest a panacea for e-commerce strategy development. American Express (cited by Shop.org) research indicates that Australians show the greatest number of expected online purchases at 8 in the next 12 months. On average, Internet users plan to make 6 purchases online, with Americans intending to make 7 purchases over the next 12 months. Such data illustrate the fact that the Internet and e-commerce are increasingly important for organisations that wish to remain competitive. To enhance one's competitive position, only one principle applies: e-commerce must be central to the organisation's strategy. This leads us to the fourth hypothesis H4:

*Hypothesis 4: E-Commerce has a positive and significant association with innovation performance*

### **Sustainable Development Orientation (SDO)**

Sustainable Development (SD) has clearly begun to assert itself as a driver for innovation. Australia has the opportunity to become a world-leader in environmentally sound innovation practices. We need to better understand how the emergence of environmentalism and sustainable development impacts on firm's opportunities and capability to innovate. One of the aims of this paper is to address this

question. Ottman and Reilly (1998) suggest that firms have responded and profited with the emergence of environmentalism as a core societal value. "Green" marketing is increasingly being seen as an opportunity for innovation. Firms require knowledge on how to create new products, how to identify and capitalise on opportunities to innovate, and how to communicate effectively. Polonsky (2001) argues that going green provides a firm with strategic advantages including lower costs, differentiation and revitalisation. (Gertakis, 2001) has illustrated how the new product design process can integrate environmental factors within a commercial context. Many of these environmental technologies are more widespread in cleaner production and pollution prevention however their incorporation according to Gertakis into Australian products is not as extensive. Gertakis cites a number of exceptions to this norm. Kambrook developed a kettle that has improved energy efficiency and is designed to facilitate disassembly and recycling. Blackmores have redesigned their packaging to reduce material consumption. Dishlex have designed a dishwasher that uses less water, has improved energy efficiency, has reduced material consumption, is "light weighted" and is designed to facilitate disassembly and recycling.

Researchers agree that there is no one set of practices that comprises SD practices and that apply to all enterprises across all industries (Goldsmith & Samson, 2002; Hunt & Auster, 1990). This is partly because the appropriate mix of practices that maximises the SD needs and the strategic objectives for one organisation may not be appropriate for another. Examples of SD practices are waste minimisation, recoverable manufacturing, and supplier protocols. Cerin and Karlson (2002) showed that the emission costs per net sales were generally higher for manufacturing companies (e.g., home appliance, IT and Telecom, vehicle manufacturer, chemistry, electric power, and mining), than for service products (e.g., broadcasting and mobile telecom provider), but exceptions existed (e.g., airline and road transport). Therefore, sustainable development is of great importance to all industries, but possibly most directly to the manufacturing industry. Goldsmith and Samson, (2002) developed an interim construct of sustainable development orientation (SDO) and proposed a model of the relationships between sustainable development practices and business success that took into account differences between industries: "*SDO describes the degree to which the organisation culture and its set of SD practices are efficient and effective both in meeting economic, environmental and social needs and in supporting the strategic direction of the business, hence providing greater opportunity for long term superior business success.*"

Goldsmith and Samson proposed that enterprises with higher SDO are more likely to be successful in the long term, but not necessarily in the short-term. However, their proposition was not tested. This leads us to the fifth hypothesis H5:

Hypothesis H5: *Sustainable Development Orientation has a significant and positive association with innovation performance.*

### **Literature Synthesis**

A number of authors assert that much of the innovation research literature has focused on technical product innovation to the neglect of process and organizational innovation (Moenaert, Caeldries, Lievens and Wauters, 2000; Roberts, 1998; Damanpour, 1991). There is a lack of research in testing the relationship between practices in managing innovation and performance outcomes.

## **THEORETICAL MODEL**

Based on the extensive review of the literature, several variables have been identified that are hypothesised to be critical in creating innovative organisations. The BIM model (shown below) was developed within which the hypotheses articulated throughout the literature review are tested, to identify the drivers of innovative organisations. The above Model was developed by Terziovski as part of an Australian Research Council (ARC) project to assess innovation models affecting innovation driven companies.

This model was used to design the survey instrument which subsequently produced the quantitative data used in this paper to test the hypotheses. The BIM model describes how innovation enablers (e.g. new product development, e-commerce or e-business, and sustainable development) contribute to innovation capability (e.g. leadership/strategy, people competency base, information and organisational intelligence, market and customer orientation, creativity and ideas management,

organisational structures/systems, culture and climate, and management of technology). This in turn leads to innovation performance (e.g revenue from new products, innovativeness, time to market, customer satisfaction, productivity, employee morale, and research and development as a percentage of sales).

### METHODOLOGY

Twelve industry codes based on the Australian Standards Industry Classification (ASIC) system were used. The sample of organisations was stratified so that the sample contained approximately the same number of small, medium and large companies. A data base of 2000 companies was purchased from Dunn and Bradstreet. Three size categories defined by the Australian Bureau of Statistics (1999) were adopted in this paper across the 12 sectors: “small” (20-49 employees), medium (50-99 employees) and large (100 or more employees). A total of 130 independent variables and 8 dependent variables were included in the survey instrument. The majority of questions in the survey instrument were designed using variations of the 5-point modified Likert scale in order to capture varying degrees of respondent perceptions regarding the independent and dependent variables.

#### Survey Instrument

The Survey Instrument was pilot tested in 25 organisations chosen at random. Based on the feedback from the Pilot study, the final version of the survey was 12 pages in length. Questionnaires were sent with letters of appreciation and instructions for completing the survey. The cover letter informed respondents of the aims of the project and the main benefits of undertaking such a large study. It informed participants about the sampling methods and issues of privacy relating to sensitive business information. Also contained in the envelope was a letter from the InnovationXchange Network’s CEO giving support to the study suggesting the benefits that may result. After sufficient time, follow up calls were made and further surveys were sent to those who required them in electronic format. A total of 220 responses were obtained, which represents a response rate of 22 per cent.

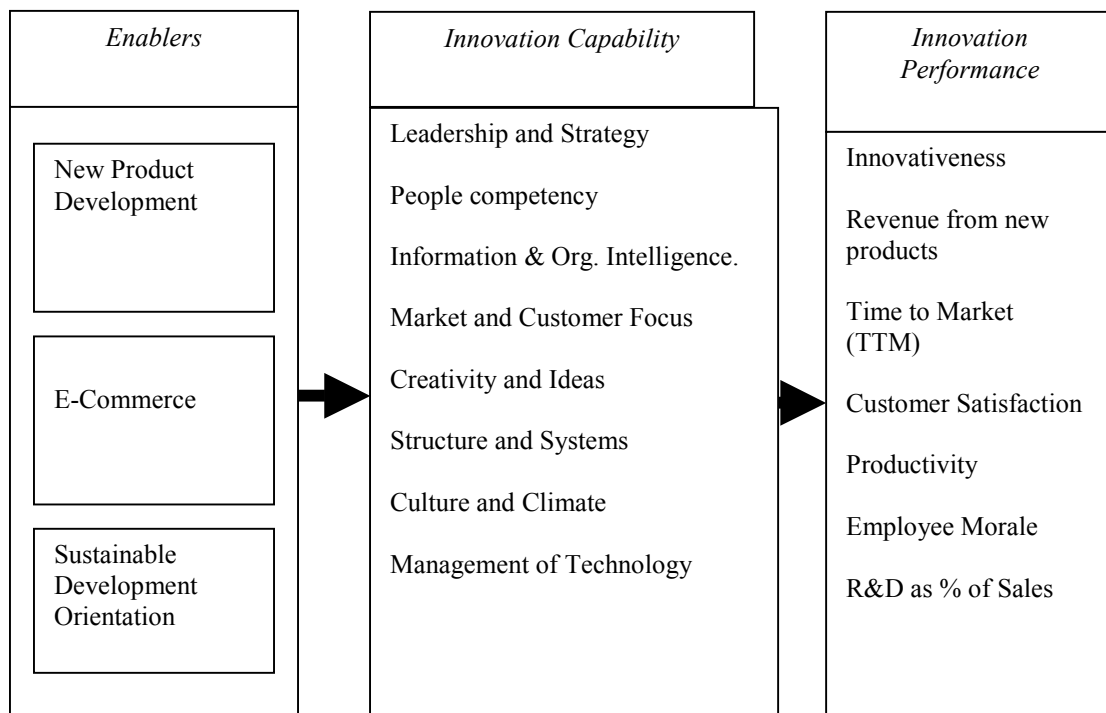


Figure 1: Best Innovation Management (BIM) model showing the hypothesised relationships between Enablers, Innovation Capability and Innovation Performance

## DATA ANALYSIS AND RESULTS

Multivariate analysis was used to test the validity and reliability of the model and the strength of the relationship between innovation practices and innovation performance. Rigorous statistical analysis was conducted in order to meet professional standards of reliability and validity. Interdependence methods (eg. confirmatory factor analysis and reliability analysis) and multivariate dependence methods (eg. multiple regression analysis) were used to quantitatively test all hypotheses. The variables were assigned to twelve constructs and subjected to Confirmatory Factor Analysis to ensure that they were reliable indicators of those constructs (Nunnally, 1978). A cut-off loading of 0.45 was used to screen out variables, which were weak indicators of the constructs. The composite reliabilities of four of the six constructs meet Nunnally's recommended standard (Cronbach Alpha  $\geq 0.70$ ) for early stage research (Nunnally, 1978). The reliabilities of the remaining two constructs: "organisational culture" and "technological capability" both fell short of this standard (0.63 and 0.45 respectively). However, further culling of variables did not improve this situation, as the reduction in the number of indicators outweighs the benefits of shedding the less reliable indicators

### Descriptive Analysis – Responding Organisations

An analysis of the ownership of companies by size (using Australian sales) shows that the majority of the private companies are under \$50 million in sales (112 out of 136 or 91 per cent); the foreign owned companies are mainly larger, with the majority (9 out of 14 or 71 per cent) having sales over \$50 million, and the public companies are both big and small, with 17 over \$50 million sales, and 15 under \$50 million sales almost all the small companies are private companies, with 86 respondents below \$10 million in sales. Sixty Five percent of the respondents were CEOs, Managing Directors and General Managers. A large number of respondents (70 per cent) did not report overseas employees. The sales distribution in the sample is indicative of a good coverage of the Australian business sector.

### Testing Hypotheses H1 to H5

Multiple Regression Analysis (MRA) was used to identify the significant factors in the model that explain the bulk of the variance in innovation performance. Bivariate Correlation Analysis (BCA) was used to determine the strength of the relationship between innovation practices and innovation performance within the BIM model. The MRA procedure is used in this section to analyse the relationship between a single metric dependent construct (innovation performance and its individual factors that formed the construct) and several metric independent constructs (F1 to F12 in Table 1 below). The result of the regression analysis is an equation that represents the best prediction of the dependent variable from several of the independent variables. The T and Sig T values are shown in Table 1 together with the Pearson correlation coefficient between each of the factors and the innovation performance construct. We make observations from Table 1 that all factors (F1 to F12) have a positive and significant correlation with the dependent construct, innovation performance. However, the strength of the Pearson correlation varied between the highest for F7: Leadership and Business Strategy ( $r=0.607^{**}$   $p=0.000$ ) and F5: Sustainable Development ( $r=0.208^{**}$   $p=0.000$ ).

These findings indicate two things. Firstly, that all constructs in the BIM model (F1 to F12) are positively and significantly associated with innovation performance. Secondly, only three constructs (F1: Innovation Capability; F7: Leadership and Business Strategy; and F8: New Product Development strategy) have correlations coefficients that were greater than 0.5. With reference to Table 1 below, the T and Sig T values indicate that the most significant difference between highly innovative organisations and less innovative organisations are: F7: Leadership and Business Strategy (T=5.300, Sig T=0.000); F1: Innovation Capability (T=3.476, Sig T= 0.001); F8: NPD Strategy (T=2.203, Sig T=0.029). The Adjusted R Sq for this model (F7,F1,F8) = 0.42, explaining 42 per cent of variation in innovation performance. The explanatory value is considered to be above average for social science research. Based on the analysis we have supported H1, H2, H3. Nine constructs (F2,F3,F4,F5,F6,F9,F10,F11,F12 in Table 1) did not perform very well in the regression analysis, all having low insignificant T values. Another way of interpreting this finding is that both high and low performing organisations are using these practices in approximately in the same proportions. Hypotheses H4 (E-Commerce, T=0.197, Sig T=0.844) and H5 (SDO, (T=1.093, Sig T=0.276), were rejected.

FACTORS	FACTORS	INNOVATION PERFORMANCE CONSTRUCT	T	Sig. T
F1:	F1: Innovation Capability	$r=0.516$ ** $p=0.000$	3.476	0.001
F2:	F2: Management of technology	$r=0.256$ ** $p=0.000$	-1.054	0.294
F3:	F3: E-Commerce	$r=0.244$ ** $p=0.000$	0.197	0.844
F4:	F4: Organisational Intelligence	$r=0.247$ ** $p=0.000$	-1.195	0.234
F5:	F5: Sustainable Development	$r=0.208$ ** $p=0.000$	1.093	0.276
F6:	F6: People Competence	$r=0.262$ ** $p=0.000$	-1.413	0.159
F7:	F7: Leadership and Business Strategy	$r=0.607$ ** $p=0.000$	5.300	0.000
F8:	F8: NPD Strategy	$r=0.513$ ** $p=0.000$	2.203	0.029
F9:	F9: Intellectual Property Protection	$r=0.356$ ** $p=0.000$	0.705	0.482
F10:	F10: Knowledge Management	$r=0.216$ ** $p=0.000$	-1.125	0.262
F11:	F11: Commercialisation of Products	$r=0.338$ ** $p=0.000$	0.933	0.352
F12:	F12: TQM and Learning Organisation	$r=0.384$ $p=0.000$	-0.048	0.961

\*\* significant at the 0.01 level of significance Dependent Variable: Innovation Performance Construct

Table 1 – Bi-Variate Correlation Analysis of Independent and Dependent Factors and Multiple Regression Analysis (AdjR<sup>2</sup>=0.42)

**Significant Factors**

Independent Variable Description	Factor Loading
Is “first to market” with new products and services	0.758
We are normally the first organisation to introduce new products and services in the market	0.650
Produces a continuous stream of state-of-the art products and services	0.638
Responds to early market signals concerning areas of opportunity	0.594
Develops “best in industry” products and services	0.497

Table 2 – Leadership and Business Strategy Construct

Independent Variable Description	Factor Loading
We have effective “top down” and “bottom up” communication processes	0.699
Knowledge is freely shared in our organisation	0.687
We have eliminated barriers between departments	0.673
There is a high degree of unity of purpose throughout our organisation	0.656
Senior management actively encourage change	0.652
Senior management implement a culture of innovation	0.649

Table 3 – Innovation Capability Construct

Independent Variable Description	Factor Loading
Our organisation has a strategy for NPD	0.668
We use cross-functional team as part of our NPD process	0.610
In designing new products and services we use the requirements of Domestic Customers	0.601
New product development pathways are documented	0.578
In designing new products and services we use the requirements of overseas customer	0.539

Table 4 – New Product Development Construct

## DISCUSSION OF FINDINGS

It is important to note from these results, that we cannot suggest that for a single company, that SDO and E-Commerce should not be improved because the Sig T values are not significant. Nor can we directly say that these factors do not contribute positively to explain performance variance. The study was cross-sectional and descriptive of a sample at a given point in time. However, the relative strengths and significance of the regression coefficients coupled with the correlations (Table 1) between these factors are instructive in understanding the underlying differences between high innovative organisations and low-innovative organisations. Noting the strong correlations in Table 1, it is reasonable to conclude that the insignificant T values for E-Commerce and SDO are due to the way the least squares algorithm found the “best-fitting” regression equation. In terms of managerial insights, with reference to Tables 2,3, and 4 above, construct elements factor loadings show that leadership/business strategy (underpinned by the practice with the highest Factor Loading “*first to market*” with new products and services; innovation capability (underpinned by “*We have effective top down and bottom up communication processes*”) and New Product Development (underpinned by “*Our organisation has a strategy for NPD*”) are highly significant predictors of innovation performance, and are stronger in their predictive validity than the other factors.

### Validity and Reliability of the Model

Information about validity and reliability was necessary in order to determine whether the twelve categories of the BIM model are stable and accurate and whether they truly measure what they set out to measure. This provides assurance that the findings reflect an accurate measure of the underlying constructs (F1 to F12) and that the results are believable (Saraph & Schroeder 1991; Flynn et al, 1994). Three different types of validity were considered in this study: content, construct and criterion validity (Hair et al 1992).

#### Content Validity

A category is considered to have *content validity* if there is general agreement from the literature that the BIM model has measurement items that cover all aspects of the variable being measured. Since selection of the initial measurement items was based on the extensive review of international literature, the BIM measures were considered to have content validity.

#### Construct Validity

A measure has construct validity if it measures the theoretical construct that it was designed to measure. The construct validity of each category was evaluated by using Principal Components Factor Analysis (Hair et al 1992). The measurement items for each of the categories were factor analysed. The results of the significant factors are shown in Tables 2,3,4 which shows that those items which had a factor loading less than 0.450 were eliminated.

#### Criterion Validity

This is also known as predictive validity or external validity. In this instance, it is concerned with the extent to which the model is related to independent measures of organisational performance. For example, criterion-related validity of the BIM model would predict future innovation success of an organisation is high if the BIM score is highly correlated with the innovation performance construct. The criterion related validity of the BIM model was determined by examining the Multiple Correlation Coefficient computed for the 12 categories and a measure of innovation performance ( $R = 0.528$ ). This indicates that the 12 categories have a reasonably high degree of criterion-related validity when taken together.

#### Reliability Analysis

Reliability is frequently defined as the degree of consistency of a measure. The internal consistency of a set of measurement items, therefore, refers to the degree to which items in the set are homogeneous. Reliability analysis is a correlation-based procedure measured by a number of different reliability

coefficients. One of the most commonly used is Chronbach's alpha. This is based on the average correlation of items within a test if the items are standardised. Internal Consistency for the seven categories of the BIM was estimated using Chronbach's alpha, which ranges between the values 0.00 and 1.00 (Nunnally, 1978). Using the SPSS for Windows reliability test program, an internal consistency analysis was performed separately for each of the categories of the BIM model. The analysis revealed that maximisation of the Chronbach alpha coefficient would require eliminating some items from each category of the BIM model. The Alphas for each construct were greater than 0.7 which meet or exceed prevailing standards of reliability for survey instruments (Hair et al., 1992).

## CONCLUSION

Based on the research question *What are the key drivers of innovative organisations from a product and process innovation perspective?* we conclude that the "best" drivers of innovative organisations in Australia are: Committed Leadership and a highly developed innovation strategy that is underpinned by a "first to market" philosophy of new products and services. Innovation Capability underpinned by an effective "top down" and "bottom up" communication processes. New Product Development strategy underpinned by cross-functional teams. This model explained 42 per cent variance in the innovation performance construct. E-Commerce and Sustainable Development Orientation were also found to be significantly associated with innovation performance. However, these two constructs were not found to be significant differentiators between high and low innovating organisations. It is reasonable to conclude that E-Commerce and SDO are innovation "enablers" that are common to high and low innovation organisations. Our results are consistent with the literature which agrees that successful leaders must communicate strategies, goals, and actions to all employees to strengthen organizational coordination and increase the likelihood of innovation.

## IMPLICATIONS FOR MANAGERS

The paper makes a significant contribution to the existing research knowledge base and to practitioners in the field of innovation and its management. We have developed and tested new theory in the field of innovation management, that leads to new conclusions of general value and practical insights for executives wishing to improve the innovation outcomes of their firms. Conversely, we also know which practices create less impact to innovation, and hence should be addressed in more detail during the commercialisation process.

*Acknowledgement: The paper is based on an Australian Research Council Discovery Project*

## REFERENCES

- Afuah, A (1998) *Innovation Management: Strategies, implementation and profits*, Oxford University Press, NY.
- Ahmed, PK (1998), "Benchmarking Innovation Best Practice", *Benchmarking for Quality Management and Technology* vol. 5, no.1, pp. 45-58.
- Cerin, P, & Karlson, L (2002), "Business incentives for sustainability: a property rights approach." *Ecological Economics* vol. 40, pp. 13-22.
- Chan, C, Swatman, PM (2000) "From EDI to Internet commerce: the BHP Steel experience", *Internet Research*, vol. 10, pp. 72-82.
- Cooper, RG, & Kleinschmidt, EJ (1996), "Winning businesses in product development: the critical success factors", *Research-Technology Management*, vol. 39, no. 4, pp. 18-29.
- Cooper, RG & Kleinschmidt, EJ (1995), "Benchmarking the Firm's Critical Success Factors in New Product Development", *Journal of Product Innovation Management*, vol. 12, no. 5, pp. 374-391.
- Clark, KB, & Fujimoto T (1991), *Product Development Performance*, Harvard Business School Press, Boston, MA.
- Damanpour, F (1991), "Organizational innovation: A meta-analysis of effects of determinants and moderators", *Academy of Management Journal*, vol. 34, no. 3, pp. 555-590.
- Firth, RW, & Narayanan, VK (1996), "New product strategies of large, dominant product manufacturing firms: An exploratory analysis", *Journal of Product Innovation Management*, vol. 13, pp. 334-347.
- Flynn, BB, Schroeder, R & Sakakibara, S (1994), "A Framework for Quality Management Research and an Associated Measurement Instrument", *Journal of Operations Management*, vol. 11, no. 4, pp. 339-366.
- Gertakis, J (2001), "Maximising environmental quality through EcoReDesign", in M Charter & U Tichner (eds), *Sustainable Solutions: Developing products for the future*, Greenleaf Publishing, Sheffield.
- Goldsmith, S, & Samson, D (2002), *Sustainable Development - State of the Art Asking the Questions*, Australian Business Foundation and The University of Melbourne, Melbourne, VIC.
- Hair, JF Jr, Anderson, RE, & Tatham, RL (1992), *Multivariate Data Analysis*, Macmillan Publishing Company, NY.
- Hunt, CB, & Auster, ER (1990), "Proactive environmental management : Avoiding the toxic trap", *Sloan Management Review*, vol. 31, no. 2, pp. 7-18.
- IMD/World Economic Forum (2006), *The Global Competitiveness Report*, World Economic Forum, Switzerland.
- Kanter, RM (1989a), "Swimming in Newstreams: Mastering Innovation Dilemmas", *California Management Review*, vol. 32, pp. 45-69.
- Kanter, RM (1989b), "The new managerial work", *Harvard Business Review*, vol. 67, no. 6, pp. 85-92.
- Kim, WC. & Mauborgne R (1999), "Strategy, value innovation, and the knowledge economy", *Sloan Management Review*, vol. 40, no. 3, pp. 41-54.
- Konings, J & Roodhooft, F (2002), "The effect of e-business on corporate performance: Firm level evidence for Belgium", *Economist-Netherlands*, vol. 150, no.5, pp. 569-581.

- Lawson, B, & Samson, D (2001), "Developing Innovation Capability in Organisations - A Dynamic Capabilities Approach". *International Journal of Innovation Management*, vol. 5, no. 3, September, pp. 377-400.
- Mabert, VA, Muth, JF & Schmenner RW (1992). "Collapsing new product development times: Six case studies" *Journal of Product Innovation Management*, vol. 9, no. 3, pp. 200-212.
- Martensen, A & Dahlgaard, JJ (1999), "Integrating business excellence and innovation management: developing vision, blueprint and strategy for innovation in creative and learning organizations", *Total Quality Management*, vol. 10, no. 4/5, pp. S627-S635.
- Moenaert, RK, Caeldries, F, Lievens, A, & Wauters, E (2000), "Communication Flows in International Product Innovation Teams", *Journal of Product Innovation Management*, vol. 17, no. 5, pp. 360-377
- Ngai, EWT & Wat, FKT (2002), "A literature review and classification of electronic commerce research", *Information & Management*, vol. 39, no. 5, pp. 415-429.
- Norrgren, F & Schaller, J (1999), "Leadership Style: Its Impact on Cross-Functional Product Development", *Journal of Product Innovation Management*, vol. 16, pp. 377 - 384.
- Nunnally, J (1978), *Psychometric Theory*, McGraw-Hill, NY.
- Ottman, JA & Reilly, WK (1998), *Green marketing : opportunity for innovation*, NTC Business Books, Lincolnwood, IL.
- Polonsky, MJ (2001), "Reevaluating Green Marketing: A Strategic Approach", *Business Horizons*, vol. 44, no. 5, pp. 21-31.
- Power, D (2002), "Application of established and emerging B2B e-commerce technologies: Australian empirical evidence", *Integrated Manufacturing Systems*, vol. 13, no. 8, pp. 573-585.
- Rice, MP, O'Connor, GC, Peters, LS, & Morone, JG (1998), "Managing Discontinuous Innovation" *Research Technology Management*, vol. 41, no. 3, pp. 52-58.
- Roberts, R (1998), "Managing Innovation: The pursuit of competitive advantage and the design of innovation intense environments", *Research Policy*, vol. 27, pp. 159-175.
- Rogers, M (1999), *The Performance of Small and Medium Enterprises*, Melbourne Institute Working Papers, The University of Melbourne, Melbourne, VIC.
- Rothwell, R (1994), "Towards the Fifth-Generation Innovation Process", *International Marketing Review*, vol. 11, no. 1, pp. 7-31.
- Saraph, JV, & Schroeder, RG (1991), "The Effects of Organisational Context on Quality Management: An Empirical Investigation", *Management Science*, vol. 37, pp. 1107-1240.
- Scott, SG & Bruce, RA (1994), "Determinants of Innovative Behaviour: A path model of individual innovation in the workplace", *Academy of Management Journal*, vol. 37, no. 3, pp. 580-607.
- Sekaran, U (1992), *Research Methods for Business: A Skill Building Approach*, 2nd edn, John Wiley and Sons, USA.
- Sohal, AS, Terziovski, M, & Zutshi, A (2002), "Team based strategy at Varian Australia: a case study", *Technovation*, vol. 23, pp. 349-357.
- Teece, DJ, Pisano, G, & Shuen, A (1997), "Dynamic capabilities and strategic management", *Strategic Management Journal*, vol. 18, no. 7, pp. 509-533.
- Utterback, JM (1994), *Mastering the Dynamics of Innovation*, Harvard Business School Press, Harvard, MA.