

Building the capacity to innovate: the role of human capital

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NATIONAL VOCATIONAL EDUCATION
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EVALUATION PROGRAM

RESEARCH REPORT

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About the research

Building the capacity to innovate: the role of human capital

Andrew Smith, Jerry Courvisanos, Jacqueline Tuck, University of Ballarat, and Steven McEachern, Australian National University

This report examines the link between human resource management practices and innovation. It is based on a conceptual framework in which 'human resource stimuli measures' – work organisation, working time, areas of training and creativity – feed into innovative capacity or innovation. Of course, having innovative capacity does not necessarily mean that a firm will be innovative.

One of the issues of this approach is that, while innovation can be directly observed, innovative capacity is a more abstract concept. The study comprises a survey of firms as well as some case studies, and the survey captures data on innovative capacity through a series of questions relating to a firm's perception of its capacity to innovate. Based on the survey data, the authors find that certain human resource practices do improve innovative capacity (or at least firms' prediction of their capacity) but they have a very weak link with innovation directly. Therefore appropriate human resources practices and the capacity to innovate can be thought of more as necessary conditions for innovation rather than as sufficient. This leads to thinking about the mediating factors that transform the capacity to innovate into innovation. The purpose of the case studies was to throw some light on these mediating factors.

Key messages

- Human resource practices, creativity management and knowledge management impact on innovation indirectly through their effect on innovative capacity rather than impacting directly.
- Three sets of management practices assist the development of innovative capacity:
 - people management; for example, practices such as team-based work organisation, support for training and flexible work practices
 - the development of a learning culture
 - external linkages, especially with educational institutions.
- In the case studies the one factor that appears to assist innovative capacity translating to innovation is links with the tertiary education sector. Assistance from universities or the VET system can facilitate training and recruitment and the development of applied research to assist product innovation.

Tom Karmel
Managing Director, NCVET

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Executive summary

The Australian economy is highly dependent on a small number of major industries, but to survive in the international marketplace Australia will need to diversify its economic base. A crucial element in the process of industrial and economic diversification is innovation. Although much has been written on the importance of human capital factors in innovation, until now there has been no study that has attempted to draw human factors together into one coherent model or framework.

The aim of the research project is to elaborate a theory of human capital that builds innovative capacity in enterprises, in the process identifying the human resource management practices that build this capacity. In particular, this study investigates how enterprises can develop their human capital internally through better human resource management and learning and development practices, and externally through engagement with the tertiary education system.

The model for this research was derived from the literature that proposes that the innovation process begins as a result of the stimulus provided by two parallel factors – technological capital and human capital. These two factors encourage the development of innovation capacity in national, regional and sectoral innovation systems. By innovation capacity we mean the ability of enterprises to acquire, develop and exploit new knowledge. In turn, the extent of the capacity held by organisations determines its innovation performance. The model that combines these three elements that lead to innovation – stimulus; (innovation) capacity; (innovation) performance – is termed the Stimulus-Capacity-Performance model of innovation. The three key factors (stimuli) identified as instrumental in developing human capital for enterprise innovation are people management, knowledge management and creativity management.

Method

The study comprised three phases. Phase 1 involved a series of expert interviews with relevant federal and state government departments, industry bodies, the Australian Council of Trade Unions and an academic expert in the field. The responses and subsequent discussion from these interviews relating to innovation in enterprises informed the development of the survey.

The second phase of the project was a national survey of enterprises, held in 2010. The survey asked about innovation performance, practices and strategies; human resource practices; and the learning and development practices of enterprises. From the results we were able to identify the practices that develop innovative capacity within enterprises. The final phase of the project involved seven case studies of enterprises, where some of the issues arising from the survey were pursued in depth. More detailed information on human resource practices, learning and development practices and interaction with stakeholders was gathered through the case studies. This third phase enabled the researchers to take the descriptive statistical data from phase two and use it to identify how management practices in enterprises impacted on innovation capacity. The enterprises that participated in this phase ranged in size from fewer than 200 to almost 400 000 employees and were drawn from the manufacturing, information and communications technology and financial services sectors.

Results of the research

From the survey, three sets of management practices were identified that relate to the development of innovative capacity.

- people management, in particular, the bundling of high performance work practices, including team-based work organisation, support for training and learning and the use of flexible work practices
- learning and development, more specifically the development of learning cultures within enterprises – not simply the provision of training
- external linkages, in particular, linkages with educational institutions, which were significant stimuli for building innovation capacity.

The Australian case studies presented a very limited source for innovation, with, in general, a low level of product and process innovation performance. In terms of management practices, most of the companies had established human resource management and learning and development policies and practices; however, these tended not to be aligned with strategic organisational goals and there was little evidence that they were designed to develop innovative capacity within the organisation. There were, however, two exceptions, the companies Technology and Metals,¹ both of which had introduced significant product and process innovation in recent years. In the case of Technology, a multinational organisation, innovation is one of the three core organisational values and management practices, with human resource management and learning and development structured to foster innovation and creativity. In the case of Metals, a much smaller company with a domestic focus, the human resource management systems were still quite rudimentary, although the company had created a learning culture with an emphasis on training and development and the extensive use of nationally recognised training for new and existing workers. In both companies, external links were important in the innovation process. For Technology, links to universities were critical for the training and recruitment of new staff and for the development of applied research, which supported the company's product innovation. At Metals, the links to the tertiary system were increasing, with well-developed connections to the vocational education and training (VET) system and the beginnings of relations with universities.

Metals and Technology tended to conform to the principles of the Stimulus-Capacity-Performance model of innovation as suggested in the survey. The companies low on innovation tended not to have the human resource management stimuli, learning and development system alignment and the external linkages that were identified by the model as critical to the development of innovation capacity and innovation performance. The case studies provided a deeper appreciation of the practices and systems that initially emerged from the findings of the survey and which are needed to build innovative capacity. From the case studies, conclusions can be drawn about the development of innovation capacity. Enterprises need to:

- align their human resource management practices into complementary bundles that focus on innovation
- create a climate of learning that is supported by learning and development programs so that employees feel that they can share their creativity within the organisation
- forge linkages outside the company, particularly with education institutions.

¹ Pseudonyms are given to the case study organisations; their names align with their particular industry.

Introduction

The ability of enterprises to innovate depends on various factors, including both the technological and human resource management aspects of innovation. The aim of this research project is to identify the role of human capital formation (and its component parts) in promoting innovation in Australian enterprises. While recognising the critical role of technology in innovation, this research is concerned with human resource management (including the learning and development system and its links to the tertiary education system). The central model used in this project, based on the available literature, takes the view that there is a range of stimulus factors (human and technological) affecting the capacity of enterprises to innovate. The model, termed the Stimulus-Capacity-Performance model of innovation, combines these three elements – stimulus; (innovation) capacity; and (innovation) performance. That is to say, the effective use of innovation capacity will lead to increased 'innovation performance'.

While much research has examined specific aspects of this model from a human resource management perspective, there has been no study which has attempted to bring the component parts together in an overall approach, in terms of building an innovation capacity with a strategic focus and designed to lead to innovation performance. In particular, there has been a paucity of research in the area in the Australian context.

'Innovation can be defined as the creative application of knowledge to increase the set of techniques and products commercially available in the economy' (Courvisanos 2007, p.46). Kalecki (1954, p.158) identifies such knowledge application as making '... necessary new investment in productive and transportation facilities etc.' and, as a consequence, stimulating economic activity. Harnessing this process for business enterprise and economic development requires an appreciation of the factors that produce knowledge and creativity. However, innovation as a process is complex and poorly understood: it is deeply rooted in the uncertainty of the future world with its yet unknown products, processes, movements, organisations and sources of raw material. All that is known is that innovation brings change, and something 'new' emerges, which cannot be precisely modelled. A framework of analysis that guides the researcher through the complexity of innovation presents itself as the best approach.

Innovation has long been regarded as essential for enabling enterprises and national economies to thrive in globalised and increasingly competitive markets (Christensen & Raynor 2003; UK Department of Trade and Industry 2003). However, the historically poor innovation performance of Australia in relation to other developed economies has recently focused the efforts of Australian researchers and policy-makers to address this issue. Against this backdrop, in 2007 the federal government made innovation a policy priority, with the creation of the Department of Innovation, Science and Research and the commissioning of the Cutler review of Australia's innovation performance (Cutler 2008). Even before the full extent of the Global Financial Crisis was recognised, the Cutler review made the strong argument that Australia's innovation performance was poor by international standards and that there was a key role for government policy in promoting innovation in enterprises.

Since this review, the global economic downturn has served to emphasise the importance of Australian industry becoming more innovative to enable it to meet the twin global challenges of the shift from debt-driven consumerism and from high-carbon emissions production into sustainable development (Stiglitz 2010). Australia is still economically too trade-dependent on a few large industries, which are vulnerable to the vagaries of the international economy (especially commodities, tourism and education), and to the international pressures for ecological sustainability.

The need to diversify in order to cushion the country from any future economic volatility and environmental destruction places enormous pressure on Australia's innovation processes. In this context we are referring to three major types of innovation: product (new goods and services); process (new ways of doing things); and organisational (new and more productive ways of organising work in order to support product and process innovation).

Research method

The study comprised three phases. Phase 1 involved a series of expert interviews with relevant federal and state government departments, industry bodies, the Australian Council of Trade Unions and an academic expert in the field. The responses and subsequent discussion from these interviews relating to innovation in enterprises informed the development of the survey.

The second phase of the project was a national survey of enterprises, held in 2010. The survey asked about innovation performance, practices and strategies, human resource practices and the learning and development practices of enterprises. From the results we were able to identify the practices that develop innovative capacity within enterprises. The final phase of the project involved seven case studies of enterprises, where some of the issues arising from the survey were pursued in depth. More detailed information on human resource practices, learning and development practices and interaction with stakeholders was gathered through the case studies. This third phase enabled the researchers to take the descriptive statistical data from phase two and use it to identify how management practices in enterprises impacted on innovation capacity. The enterprises that participated in this phase ranged in size from fewer than 200 to almost 400 000 employees and were drawn from the manufacturing, information and communications technology and financial services sectors.

A literature review was conducted by the authors in conjunction with this project (Smith et al. 2011), a synopsis of which can be found in the support document. The theoretical framework developed as a result of the literature review formed the basis of the empirical investigation on the nature of human capital formation in medium-to-large Australian enterprises in this research project.

Aims and research questions

Despite all that has been written on the importance of human capital factors in innovation, most of the research literature is prescriptive. The dilemma is that humans in their daily activity are creatures of habit and routine, yet innovation requires recognition and responsiveness to change. Courvisanos (2007, p.42) argues that 'the research problem that emerges is how to identify ... a realistic and sustainable theory of human action in the innovation process'.

The aim of the research project is to elaborate a theory of human capital that builds innovative capacity in enterprises and to identify the actual human resource management practices that will build this capacity. In particular, this study investigates how enterprises can develop their human capital internally through better human resource management and learning and development practices, and externally through engagement with the tertiary education system.

Adopting the Stimulus-Capacity-Performance conceptual model of innovation, the project research questions are as follows:

- What is the role of human capital formation through the human resource management and learning and development practices in enterprises that promote/inhibit the development of innovative capacity?

- What part does enterprise engagement with the tertiary system, both vocational education and training (VET) and higher education, play in the formation of human capital and the development of innovative capacity?
- What guidelines can be developed that can be used by managers in enterprises to promote innovative capacity through better human capital formation?
- What role is there for intermediary bodies, particularly industry skills councils, in developing innovative capacity in their industry sectors?

Main themes from the literature review

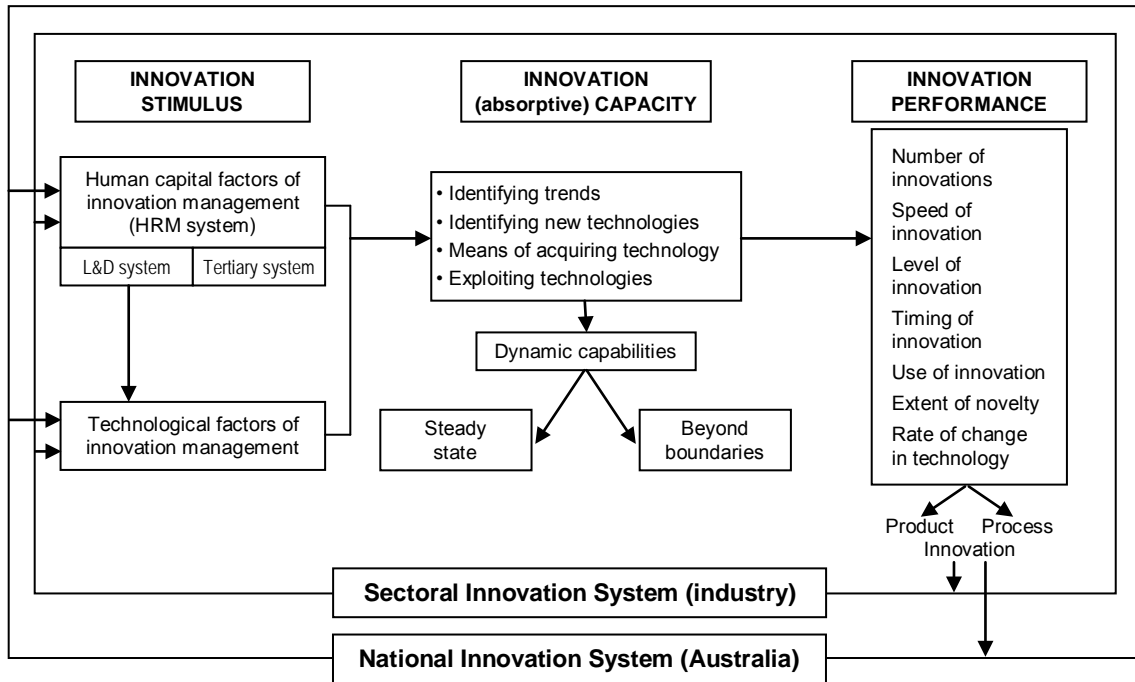
The conceptual model (or framework) used in this project takes the view that a range of stimulus factors (human and technological) affect the capacity of enterprises to innovate. The model posits that innovation capacity, when effectively utilised, will lead to increased 'innovation performance'. While acknowledging the critical role of technology in innovation, the review of the literature (Smith et al. 2011) is concerned with the human factors. These human factors within enterprises appear in the form of human resource management (HRM) systems and practices, including the learning and development system, and their links to the tertiary education system.

Macro framework of innovation

Figure 1 represents a macro framework of the enterprise innovation process, incorporating internal factors (technological and human) and external factors (for example, the industry, government policies to stimulate innovation etc.), based on the research literature on innovation in business enterprises. This model is an adaptation and extension of Prajogo and Ahmed's (2006) Stimulus-Capacity-Performance approach. In this framework, technological and human capital stimulate the development of innovation capacity, and the role of learning in the innovation process is highlighted. Figure 1 shows that innovation capacity builds dynamic capabilities in both steady state (leading to incremental innovation) and beyond boundaries (leading to radical innovation) innovation, thus creating ambidextrous innovative capacity in the enterprise; that is, the capacity for both types of innovation (Tidd, Bessant & Pavitt 2005). This innovation capacity in turn determines the effectiveness of the innovation commercialisation process.

Many studies support the macro framework of managing both technological and human capital formation to build innovation capacity and confirm that such capacity building leads to stronger innovation performance. Other research highlights the need to integrate the human factors into technology management in order to deliver effective innovation performance from enterprises, with a number of commentators arguing that the ability to innovate depends on the effective management of human resources and, in particular, the learning and development practices of enterprises. In figure 1, the human capital factors are underpinned by the internal learning and development system and the external tertiary education system that supports the internal learning and development system.

Figure 1 Macro framework of innovation



Human resource management, training and innovation

Enterprises now recognise the skills and abilities of their employees as a source of future competitive advantage and that their skills are the only real source of sustainable competitive advantage, when other resources such as technology are easily imitated by competitors. Human resource management is therefore vital to the creation of an organisational climate or culture in which employees' skills and abilities can be harnessed for building innovation capacity. However, any analysis of the role of human resource management in innovation needs to identify not only the human resource management practices and systems with the capacity to prompt innovation, but also two ancillary services. One is the learning and development system and the other is the tertiary education system. These three systems – the human resource management system, the tertiary education system and the learning and development systems – interact to build innovative capacity.

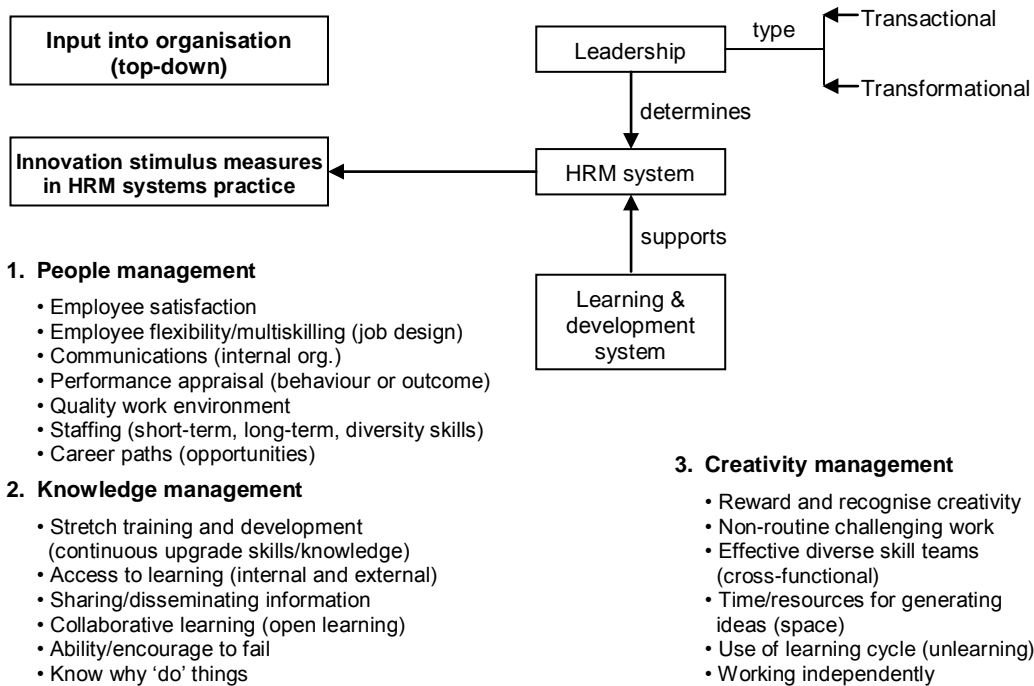
Four key points emerge from the literature on the relationship between HRM, training and innovation:

- There is an indirect link between human resource management and innovation performance, mediated through organisational capacity.
- In the context of innovation performance, both the soft and hard aspects of human resource management need to be incorporated. 'Soft' models emphasise the importance of training employees to secure their commitment to the enterprise, and thus improve business outcomes, while the 'hard' approach to human resource management links human resource management directly to business strategy.
- The importance of the bundling of human resource practices for innovation performance has been acknowledged. Individual human resource management practices need to work together in self-reinforcing 'bundles' to create unique and dynamic bundles of human resource capabilities based on the skills and attitudes of employees and to provide maximum benefit to the enterprise.
- Training is crucial for innovation – creating organisational cultures and management capabilities which stimulate and sustain innovation.

Innovation stimuli

The top left-hand box of figure 1, under the heading 'innovation stimulus', is expanded in figure 2 to illustrate the three human capital factors and their associated stimulus measures that build an enterprise's workforce innovation capacity: people, knowledge and creativity management. Since employees are an enterprise's most vital and necessary resource in delivering innovative outcomes, there needs to be careful study of these three stimulus factors, which in combination build innovation capacity towards innovative performance.

Figure 2 Innovation stimulus factors



People

People management practices need to create and maintain an environment that supports innovation, one that motivates employees and provides them with the opportunities to innovate. The management practices identified in the literature which stimulate innovation include: human resource planning, teamwork and work organisation, performance appraisal, reward systems and career management and training. To foster innovation, enterprises need to recruit, hire and retain the right people, people with a variety of personal characteristics, knowledge, expertise and skills.

Knowledge

Knowledge management is the second human capital stimulus by which enterprises can enhance their capacity to innovate. Importantly, an organisation's knowledge is only an asset if it is used efficiently and continually enhanced. To effectively work through the innovation process requires harnessing new and unique knowledge – beginning with harnessing knowledge to create the initial innovation idea (imagining), through to incubating and demonstrating the idea. Thus, an enterprise's potential for innovation is dependent upon the prior accumulation of knowledge.

Creativity

Creativity is the generation of new and useful ideas by individuals, and innovation is the successful implementation of such ideas. For human resource management scholars and practitioners the differentiation between creativity and innovation is critical, because it is the management of employees, the individuals in the enterprise, that elicits creativity, whereas innovation – the implementation of creative ideas – operates at the group and organisational level.

An enterprise requires managers to pay attention to the individuals they hire and to attend to the environments they create for employees. Although expertise and creative skills determine creative ability, it is the motivational component which determines what an individual will actually do. Task motivation is therefore necessary for creativity. However, intrinsic motivation (personal desire to create) needs to be differentiated from extrinsic motivation (organisational recognition and rewards to create). While intrinsic motivation enhances creativity, extrinsic motivation, if not supportive of creativity, may in fact stifle it. Creativity requires time for employees to think and the necessary organisational resources for generating new ideas. Employees need space to be creative, both in terms of resources and opportunities. The literature has identified six categories of human resource practices which affect creativity: challenge, freedom, resources, work-group features, supervisory encouragement and organisational support.

Survey results

The survey, the results of which are reported in this chapter, comprised the second phase of the study. During the first stage 15 experts were interviewed, of which three interviews were conducted face to face and 12 by telephone. Interviews were held with representatives from:

- Department of Employment, Education and Workplace Relations (DEEWR)
- Department of Industry, Innovation, Science and Research (DIISR)
- Queensland Department of Employment, Economic Development and Innovation (DEEDI)
- Victorian Department of Industry, Innovation and Regional Development (DIIRD)
- New South Wales Department of Industry and Investment (DII)
- Australian Industry Group (AIG)
- Business Council of Australia (BCA)
- Australian Council of Trade Unions (ACTU).

We also interviewed an academic expert from the University of Technology, Sydney. The interview discussions were used to further refine our thoughts and for the further development of the survey questionnaire.

The purpose of the survey was to investigate whether and how enterprises develop their innovative capacity, internally, through better human resource management and learning and development practices, and, externally, through engagement with the tertiary education system. The study model is based on the idea that human resource management – through the three innovation stimuli of people, knowledge and creativity management – builds innovation capacity, resulting in both product and process innovation. Put simply, specific management practices lead to innovative capacity, which results in innovation performance.

The survey was developed in late 2009 and administered from April to June 2010. In order to maximise response rates, three waves of mailouts were completed, in April, May and June 2010. Of the 1875 surveys distributed, 143 were returned. Excluding the 313 'return to sender' returns, this resulted in a final response rate of 9.15%. A further nine returned responses were excluded as they reported a lower number of staff than the target organisational size of 50 staff or greater. This resulted in a final sample for analysis of 134 responses. For further details of the sample and the method of administration refer to appendix A in the support document.

The survey was designed to identify the relationships between: innovation capacity and innovation performance; innovation stimulus and innovation performance; and innovation stimulus and innovation capacity. The survey examined six main topic areas: organisational characteristics; innovation practices and strategies; human resource practices; learning and development practices; human resource performance; and organisational context. A copy of the survey is included in appendix D in the support document.

The final achieved sample size for the project did limit the potential analyses that could be conducted. In general, it would be preferable to consider each of these relationships within a single model, using a technique such as structural equation modelling. However, this was not possible, given

the small final sample size, which also has implications for the reliability of the survey results, due to the larger confidence intervals associated with this sample size.

It was decided therefore to analyse the paths in the conceptual model separately, and thus the results should be considered as indicative only. More detail on the measures used for the analysis of the survey is contained in appendix A in the support document. The indicative findings from the survey analysis were considered further in the case study phase of the research.

Innovation capacity and innovation performance

To explore the relationship between innovation capacity and innovation performance, we first consider the correlations between each of the six derived innovation capacity and performance measures. These correlations are presented in table 1.

Table 1 Innovation capacity and innovation performance measures: correlation matrix (N = 134)

Variable	1	2	3	4	5	6
1. Product innovation performance	–					
2. Process innovation performance	.481**	–				
3. Incremental process innovation capacity	.374**	.567**	–			
4. Radical process innovation capacity	.396**	.469**	.651**	–		
5. Incremental product innovation capacity	.597**	.485**	.646**	.517**	–	
6. Radical product innovation capacity	.556**	.468**	.486**	.670**	.651**	–

Notes: ** Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis shows a clear relationship between innovation capacity and innovation performance. Table 1 indicates that most of the correlations between these measures show at least moderate correlations ($r \geq 0.4$), and all are statistically significant ($p < 0.01$), suggestive of the presence of a relationship between capacity and performance. This is consistent with comparable studies. Prajogo and Ahmed (2006) found that innovation performance is a function of the organisation's innovation stimuli, while Subramaniam and Youndt (2005) demonstrated the relationship between similar innovation stimuli measures and the capacity to innovate.

Looking more closely at particular relationships, some differences however do emerge. Notably, the correlations between the product innovation capacity and performance measures are somewhat stronger than those of the equivalent process innovation relationships. The results show that incremental process capacity is strongly correlated with higher levels of process innovation performance ($r = 0.567$), while the relationship between radical process innovation capacity and process innovation performance is somewhat lower ($r = 0.469$).

What then of the contrasting influences of process innovation factors on product innovation (and vice versa)? In terms of *product innovation*, higher process innovation performance is correlated with radical product innovation performance ($r = 0.468$). This suggests that process innovation and product innovation may emerge in parallel in some cases. Product innovation capacity, whether radical or incremental, is also correlated with higher levels of product innovation performance.

So, while the capacity of an organisation to innovate in terms of new products is strongly correlated with performance in both radical and incremental product innovation, there is only a strong relationship between incremental process innovation capacity and process innovation performance.

Innovation stimulus and innovation performance

The conceptual model used in this project presumes that the effect of innovation stimuli on an organisational innovation system is to improve innovation capacity, which in turn improves innovation performance (that is, an indirect relationship). The presence of an association between innovation capacity and innovation performance means it is important to consider the direct relationship between the innovation stimuli (human resource practices, creativity management and knowledge management) to assess whether they impact directly on innovation performance, or only on the capacity to innovate.

One method for testing this question is to compare the relationship between each of the innovation stimuli measures and performance. To achieve this, a correlation analysis was first conducted using the human resource, knowledge and creativity stimuli measures, with the results shown in table 2. This analysis suggests that there are some weak relationships between the knowledge and learning stimuli measures (training attitudes, learning and linkages) and innovation performance ($r < 0.3$, $p < 0.01$), and no relationships between human resource stimuli measures (work organisation, working time, areas of training, and creativity) and innovation performance.

These results provide an indication that the relationship between innovation stimuli and performance is negotiated through innovation capacities, as the conceptual model proposes, although this result would need to be tested using causal modelling methods (such as structural equation modelling) with a larger sample. In testing for direct relationships between innovation stimuli and innovation performance, there were few direct relationships uncovered. The only stimulus factors that appeared to have a direct impact on innovation performance were measures of knowledge exchange and learning and development. The next section therefore considers the relationship between innovation stimulus factors and innovation capacity.

Table 2 Innovation performance and innovation stimuli measures: correlation matrix (N = 134)

	1	2	3	4	5	6	7	8	9
1. Product innovation performance	–								
2. Process innovation performance	.481**	–							
3. Work organisation	.006	.020	–						
4. Working time	.128	.142	.219*	–					
5. Areas of training scale	.124	.053	.428**	.258**	–				
6. Training attitudes	.292**	.247**	.181*	.238**	.140	–			
7. Creativity management	-.152	-.223**	-.157	-.290**	-.389**	-.181*	–		
7. Learning	.223**	.294**	.295**	.369**	.390**	.680**	-.454**	–	
8. Linkages	.274**	.279**	.317**	.268**	.244**	.575**	-.345**	.626**	–

Notes: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Innovation stimulus and innovation capacity

The preceding correlation analysis results indicate that the direct relationship between innovation stimuli and innovation performance is weak (at least within the results from our sample).

This section considers the link between innovation stimuli and innovation capacity in detail, examining the relationship between innovation capacity and each of the stimuli areas (human resources, knowledge and creativity) in turn. The four innovation capacity measures to be considered are:

- incremental process innovation capacity
- radical process innovation capacity
- incremental product innovation capacity
- radical product innovation capacity.

Human resource practices and innovation capacity

The report looks first human resource practices and innovation capacity. Measures of human resource practices in the survey included five areas:

- compensation systems (Smith, Oczkowski & Selby Smith 2008)
- performance management (including appraisals and performance-based payment) (Chaplin et al. 2005)
- work organisation (Gjerding 1996)
- recruitment and selection practices (Collins & Smith 2006)
- flexible work practices (Chaplin et al. 2005).

Of these five, two areas in particular have been considered here: work organisation and flexible work practices. A correlation analysis of these two measures and the four innovation capacity measures (results not shown) indicates that there are no significant correlations between high performance work organisation methods and capacity. By comparison, flexible work practices (such as flexitime and working from home) were weakly correlated with radical process innovation and both forms of product innovation capacity ($r = 0.206$ to 0.253 , $p < 0.02$). Looking more broadly at the measures of high performance work practices, the measure of range of training activities also showed no significant relationship with any of the innovation capacities.

Given the limited influence of individual high performance work practice factors, it is worthwhile then to consider whether the combination of practices is a significant factor in developing innovation capacity. To test this, we draw on three high performance work practice cluster types (detailed in appendix A and presented in figure A2 in the support document):

- cluster one: use of flexible working time only
- cluster two: use of all high performance work practices
- cluster three: use of work organisation only.

Table 3 presents the mean level of each of the four innovation capacity measures across the three cluster types. Note that each capacity measure has a mean of zero as it has been standardised as part of the principal component analysis. Of these three clusters, only one demonstrates a significant difference in innovation capacity from the others; namely, the high performance work practice cluster in the area of incremental product innovation capacity. This indicates that organisations using a combination of high performance work practices exhibit higher levels of product innovation capacity than other organisational forms.

Table 3 Mean innovation capacities by cluster

	Cluster		
	1 – Flexible working time	2 – All HPWP	3 – Work organisation only
	<i>Mean</i>	<i>Mean</i>	<i>Mean</i>
Incremental process innovation capacity	0.071	0.0753	-0.112
Radical process innovation capacity	0.194	0.113	-0.190
Incremental product innovation capacity	0.008	0.257**	-0.280
Radical product innovation capacity	-0.019	0.248	-0.139

Note: ** Cluster significantly different ($p < 0.05$). HPWP = High performance work practices.

Looking then at these results in combination, in terms of human resource management, separate human resource practices such as work organisation and training activities were not linked to the development of innovation capacity, although positive attitudes to training demonstrated a link to product innovation capacity. The use of flexible work practices such as flexitime and working from home also showed a weak relationship to incremental product innovation capacity.

By comparison, there were some differences in innovation capacity associated with the bundling of human resource practices into high performance work clusters. In particular, the cluster of high training, high performance work organisation and flexible work practices showed a relationship to the development of innovation capacity.

Knowledge stimuli and innovation capacity

We look next at the effects of knowledge and learning stimuli. Table 4 presents correlations between each of the knowledge stimulus measures (attitudes to training, range of areas of training, and organisational learning approach) and the four innovation capacity measures. Of these, the general attitudes to training and organisational learning both demonstrate a weak but statistically significant relationship, with correlation coefficients generally around 0.3 ($p < 0.01$). There is also a strong correlation between the attitudes to training and organisational learning measures ($r = 0.680$, $p < 0.01$), suggesting that there may be a common 'learning orientation' underlying these two measures that is also likely to be related to innovation capacity.

Table 4 Innovation capacity and learning and knowledge stimuli: correlations matrix (N = 134)

	1	2	3	4	5	6	7
1. Training attitudes	–						
2. Areas of training scale	.140	–					
3. Learning	.680**	.390**	–				
4. Incremental process innovation capacity	.320**	.102	.303**	–			
5. Radical process innovation capacity	.246**	.147	.315**	.651**	–		
6. Incremental product innovation capacity	.355**	.163	.344**	.646**	.517**	–	
7. Radical product innovation capacity	.289**	.139	.375**	.486**	.670**	.651**	–

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Creative management and innovation capacity

Table 5 shows the correlations between the four capacity measures and the two creativity management measures – organisational creativity management and external organisational linkages. These results show that the relationship between creativity management and innovation capacity measures is very weak, with all correlation coefficients ('r') less than 0.3 and negative. By comparison, the use and extent of external organisational linkages appears to have a much stronger relationship to all innovation capacity measures, with the lowest correlation coefficient being 0.359 ($p < 0.01$).

Table 5 Capacity measures: correlation matrix (N = 134)

	1	2	3	4	5	6
1. Creativity management	–					
2. Linkages	-.345**	–				
3. Incremental process innovation capacity	-.213*	.375**	–			
4. Radical process innovation capacity	-.215*	.359**	.651**	–		
5. Incremental product innovation capacity	-.270**	.420**	.646**	.517**	–	
6. Radical product innovation capacity	-.259**	.384**	.486**	.670**	.651**	–

Notes: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

To explore these linkage effects further, additional analyses were conducted by looking at external relationships between the organisation and nine different external stakeholders (see question 5 of the questionnaire, appendix D in the support document).

Analysis of variance was used to test the relationship between higher levels of interaction with each of these stakeholder types and the four innovation capacity measures. The results (not shown here) indicated that higher levels of regular interaction and participation with certain stakeholders – particularly customers, suppliers and TAFE organisations – were related to higher levels of innovation capacity, although the type of capacity improvement varied by stakeholder type. There was also an indication that interaction with particular stakeholders (for example, universities and cooperative research centres) was very limited in the sample, with generally less than 20% of organisations having regular contact with these stakeholder groups.

Conclusions from the survey

The analysis in this section explored the relationships between innovation stimuli, innovation capacity and innovation performance, using correlation analysis. While the strength of the findings are limited because of the low sample size, there is indicative evidence that:

- Innovation capacity measures that absorb knowledge, other than radical process innovation, are strongly correlated with innovation performance ($r > 0.556$, $p < 0.01$).
- Innovation stimuli factors arising from management practices are weakly correlated with innovation performance ($r < 0.30$, $p < 0.01$).
- The correlation of human resource innovation stimuli with innovation capacity varies by the type of capacity under consideration.

Notably, the major human resource stimuli appear to mediate innovation capacity through external organisational linkages to support creativity; there is also statistical support for organisational learning measures leading to better attitudes towards training within large enterprises. High performance work organisation and knowledge exchange practices were also associated with incremental product innovation capacity, but not radical.

These conclusions are consistent with the macro innovation framework (figure 1), but the strength of these relationships varies in the Australian large enterprise context. The few who responded to the survey could be assumed to be knowledgeable and experienced in human resource management practices for building innovation capacity into their organisations.

Findings from the case studies

The third and final phase of the project involved seven organisational case studies. The case studies examined in more detail the issues of innovation and human resource management and also explored the findings of the survey using the Stimulus-Capacity-Performance conceptual model. The organisations that participated in the case studies were drawn from three industry areas:

- manufacturing
- information and communications technology (ICT)
- financial services.

The case studies were carried out through semi-structured interviews with vertical slices of organisational members, covering in most cases the CEO or senior manager; a senior human resource manager/director or equivalent; the learning and development manager or equivalent; a line manager; and two focus groups of non-managerial employees. The interview questions are provided in appendix C in the support document.

Twenty-six individual interviews and seven group interviews were undertaken across the seven cases. A total of 46 people participated in the interviews and the average interview length was 42 minutes. Details of the interviews conducted for each case are provided in table 6. The case studies ranged in size from organisations with fewer than 200 employees, to one with almost 400 000 employees.

Table 6 Summary of case study interviews

Company	Industry	Individual interviews	Group interviews	Average interview length (mins)
Finance	Banking & finance	4	0	46
Telco S	ICT	3	2	54
Telco L	ICT	2	0	54
Technology	ICT	4	2	45
Board	Manufacturing	4	0	27
Metals	Manufacturing	4	3	39
Parts	Manufacturing	5	0	34
Total		26	7	42

The case study organisations

'Finance'

This is a large financial organisation based in Australia but with a growing international presence. Finance employs some 40 000 people and its operations cover the full span of banking, insurance and finance services. The organisation is divided into a number of divisions, including business banking and personal banking. This case focused on the business and personal banking operations of the organisation. Finance is renowned for its flexible work practices and learning culture. In recent years a key driver of innovation for this organisation has been its strong agenda for changing the organisation's reputation, with a new focus on corporate responsibility. Finance is a conservative organisation with long-standing cultural issues, which impedes innovation. Both product and process innovation are

evident, although this is not the norm across the organisation. Although Finance espouses open innovation, this has yet to be achieved across the organisation in a holistic manner.

'Telco S'

This is a small telecommunications provider established in the late 1990s and based in regional Australia. Telco S was recently acquired by another regional communications provider and employs over 80 staff and contractors in its three regional operations. Telco S provides a range of services, including fixed-line phone, super-fast broadband and cable television. In recent years the major growth area for the organisation has been in the provision of business services, in addition to its existing suite of consumer-based services. Innovation within Telco S is frequently incremental and mainly consists of delivering new products that utilise existing technologies. Until recently Telco S and its parent company outsourced the human resource function, resulting in a limited view of human resource management, which was very ad hoc and silo-driven across the combined organisation. As a result human resource management and training are not well developed across the organisation.

'Telco L'

Telco L, a large telecommunications and information services company employing over 43 000 people, is a provider of telephone services, mobile services, dialup, wireless, digital subscriber line (DSL) and cable internet access. The organisation is divided into multiple business units, with learning and development coordinated at the corporate level, a shift from the previous decentralised model, where learning and development was undertaken on a business unit basis. The service delivery operations, which account for almost 30% of Telco L's employees, were the focus of this case study. Service delivery at Telco L encompasses field operations, support operations to maintain service delivery and Telco L's contact centres in Australia and overseas. The quest for productivity gains within the service area at Telco L has been a key focus for the organisation over recent years. Telco L is innovative from a network and products/services perspective; however, process innovation has been limited. Telco L has identified the need for a more customer-centric approach to its operations and for a change in the organisation's culture. Telco L is an inward-focused organisation with very few external links to educational establishments.

'Technology'

This large multinational technology organisation founded early in the twentieth century is committed to innovation as one of its three core values. Technology employs almost 400 000 people worldwide. Technology's Australian operations, where around 10 000 people are employed, were the focus of this case. Through innovation and adaptation to the rapidly changing business environment in the sector, Technology has become and maintained its status as one of the leading information communications and technology organisations in the world. Technology has a long history of product innovation. However, Technology has transformed itself from a manufacturing to a service organisation and the nature of its innovation has changed, becoming more diffuse. Technology works closely with its client base to secure innovation. In the early years Technology grew quickly and adopted a people-centred and somewhat paternalistic management style, which continues to influence the management style of Technology. The human resource and learning and development functions within Technology are focused on creating a culture for innovation. Technology has moved to an open approach to innovation and highly values collaboration with external organisations to advance its innovation agenda.

'Board'

Board is part of a privately owned packaging products manufacturing organisation employing over 5600 people in 110 sites across the world. The organisation has grown from its 1940s beginning as a small cardboard box manufacturer into a large packaging, paper and recycling organisation. The case study was carried out in Board, one of the organisation's Australian plants. Board manufactures corrugated cardboard packaging products. Board has a turnover of \$91 million and employs around 170 people at the plant. Board has been operating for fewer than ten years and as yet it is not operating at full capacity. Innovation, both product and process, at Board is very customer-driven, with a focus on customer service and production at lowest cost to consumers. Packaging is often viewed as a standardised product in the marketplace; thus, at Board the need to differentiate through business process innovation is acknowledged.

'Metals'

This is a privately owned family business, currently operating three manufacturing plants in Australia. Metals manufactures and supplies stainless steel and metal products to the food service and building industries. Metals specialises in the supply of products for commercial kitchens. In recent years Metals has grown to a large company by Australian Bureau of Statistics (ABS) standards through expansion of its operations, including the acquisition of an additional two manufacturing sites. Metals' turnover rose from around \$40 million in 2002 to around \$90 million in 2008. Metals currently employs a workforce of 375 full-time employees, including 65 apprentices. During the 1990s exports comprised a large proportion of turnover; today, however, exports only account for about 1% of turnover. Metals has grown and prospered through radical ad hoc opportunistic innovation. The paternalistic human resource management style has contributed to the success of Metals. Innovation has been driven from the top down and the leadership has concentrated on maintaining strong technological skills throughout the organisation. As Metals has become a much larger organisation, it is now recognised within the organisation that a select few can no longer provide the strategic focus required and that the culture of the organisation needs to change to ensure this is not a barrier to future innovation.

'Parts'

This is an Australian-owned manufacturer of specialist automotive parts. Parts' sole manufacturing plant is in regional Australia and it operates a small overseas warehousing facility. Parts employs around 80 workers at the manufacturing plant and six at its overseas warehouse. Parts attributes its rapid growth over the 35 years since its establishment – at that time a two-person operation – to the constant development of its product range and the superior quality of its products. Parts currently dominates the Australian market with close to a 90% share of the market and exports around 50% of its products to the United States. The significant growth and industry prominence of Parts within such a highly competitive sector is due largely to product innovation and, to a lesser extent, process and organisational innovation. In recent years the rapid growth in business volume has impeded innovation at Parts due to the limited resources available for innovating. Innovation is re-emerging as a focus for Parts and the relatively small size of the company allows Parts to be flexible and to adapt to the market as required.

Case study analysis

The seven case studies in this project have each thrown a different light on the innovation process in a range of Australian companies and in many ways confirmed the findings from the survey – that only a small number of management practices are linked to innovation in Australian companies.

Innovation in the case studies

The most important finding from the case studies was the diversity of types of innovation found in the companies and the relatively low level of both product and process innovation. Table 7 summarises the types of innovation found in each of the cases.

Table 7 Case innovation types

Company	Industry	Product innovation	Process innovation	Other innovation
Finance	Banking & finance	Medium level of new product innovation	Medium level of process innovation in branches	The company is trying to rebrand itself after the GFC
Telco S	ICT	Low level of innovation using products already developed in the ICT industry	Low level of process innovation	Re-organising in the wake of amalgamation with larger company
Telco L	ICT	Medium level of product innovation	Low level of process innovation; standard processes are followed	Frequent re-organisation focused on improving labour productivity
Technology	ICT	High level of product innovation throughout company history	High level of process innovation as the nature of the business changes	High level of internal change as company re-positions itself from manufacturing into the services industry
Board	Manufacturing	Medium level of product innovation driven by changing needs of customers	Medium level of process innovation based on improving technology and equipment productivity	Innovation related primarily to customer relationships
Metals	Manufacturing	High level of product innovation related to alternative uses for steel products	High level of process innovation based on use of lean manufacturing	High level of re-organisation after acquisition of competitor company
Parts	Manufacturing	Low level of product innovation in a stable product market	Low level of process innovation	Some innovation-based on globalisation of manufacturing in China

In most cases, with the exception of Technology (which surfaces as an exception throughout the study), the overall level of innovation is medium to low. In general this reflects incremental innovation (or improvements) in products and services rather than radical innovation (or breakthrough changes). Thus in the ICT industry, neither of the Telcos is a high-level innovator in products. In both cases, the product innovation is driven by others in the industry who set the industry standard and both companies follow with products that suit the changed market conditions. In the case of Telco L, the company does not see itself as a high-level innovator but rather one which provides the enabling technology for customers to access new products and services through the internet and the phone network. As one senior manager commented:

You know we're a technology business, we don't produce products, we produce the mechanism to deliver those products ... and in that case [services], so from a mobile network perspective, we would have the leading mobile network in the world ... So innovative, did we build it? Yes we did, but we used the technology from another company.

Telco S is an internet service provider. Here the focus has been on using the developments in technology to bring a better and cheaper service to their customers. Thus the emphasis in this case is building on innovation in the ICT industry but not pursuing product innovation for its own sake. This approach to innovation is based on improving organisational processes so that the enterprise is more efficient. As one staff member commented:

I've got a technical background and so from a technology tech perspective it's probably not very innovative you know in that, there's not a lot of innovation there. However, from a business perspective, I think the business sees it as different ... from a true technology perspective we're probably not very innovative but from a business perspective they probably see what we're doing is still, you know we're quite [innovative].

In the context of the Stimulus-Capacity-Performance model, such 'organisational' innovation occurs at the innovation stimuli stage, with various stimuli improving how the enterprise operates.

Technology has long been a product innovator. From its beginnings in the early twentieth century, Technology has been consistently at the forefront of product innovation in the ICT industry. In recent years, the company has moved from the manufacture of hardware to ICT services as the impetus for product innovation moved into the software area, where Technology was not a leader. This move has precipitated a complete change in the orientation of the company globally, with the Australian operation following suit. One senior manager summed up Technology's approach to innovation:

[Technology] is a company that started in 1914 and has been going ever since, nearly 100 years now. So it's a long history and during that time it's been largely a technology company ... it's always been a very product, technology-oriented firm, I think [Technology] wants to be an innovative firm most of all ... a track record of being enormously innovative, for instance. Technology has had I think five Nobel Laureates in the company ... [Technology] has had the most patents filed of any company in the world for about ten years in a row so we're clearly are right out there in filing patents.

The notion of innovation has recently been brought into sharp relief in Technology through the company's adoption of a new set of corporate values. In order to embed innovation more firmly and widely in the company, the notion of innovation has become one of the three key values for the company worldwide. In 2003, Technology decided to revisit its six core company values and conducted a wide-ranging and highly participative internet-based conversation within the company, known as a 'values jam', to refashion its values statements to more accurately reflect the values of a service organisation. From this process the company came up with three new values:

- dedication to every client's success
- innovation that matters, for our company and for the world
- trust and personal responsibility in all relationships.

The central importance not only of innovation but of every employee contributing to innovation is clear from the inclusion of innovation as the second of the three company values. However, the emphasis on innovation is driven by the overseas headquarters and has little to do with the Australian Innovation System, except insofar as Technology has developed strong links with research and higher education training in Australian universities.

Two of the three manufacturing companies in the case studies were not high-level product innovators: Board and Parts. At Board the source of innovation was the close relationship between the company and its customers, who primarily served the retail industry. Here the driver of packaging innovation

was the requirement by major supermarkets for new shelf-ready packaging. Board's customers needed to comply with the requirements of the supermarkets, so Board had to adapt its manufacturing processes with different forms of packaging. This was a European form of packaging which had been researched by Board, but it was the requirements of the supermarkets that drove the decision to innovate.

New product lines tended to drive process innovation in Board. The relative stability of Board's commercial environment over time led the company to emphasise the extraction of higher levels of productivity from their machines and their employees to drive down costs. Board has appointed a New Work and Design Manager, whose responsibility is to drive process innovation through higher machine utilisation and through work redesign. As one senior manager commented:

Process innovation no doubt. We're working on that every single day, in the sense of how can we improve, looking at jobs and you know a lot of it comes across my desk as well, just efficiencies in workloads and the like as well as making life, whether it be easier for us or easier for our customer, reducing pallet footprints etc. Just depending on what the customer, nine times out of ten driven by the customer; those one out of ten occurrences that we do in house to make our own lives easier. So if it's a three-colour job can I make it a two-colour job? Will the customer have an issue? Possibly not. It's smarter, we get more speeds, more efficiency, and cost reductions and then we take them to the customer at the end of the day. So that's driven internally rather than externally.

Parts produces harmonic balancers for the automotive industry, a relatively standard product. The level of product innovation has historically been quite low, as the company has not moved out of its particular segment of the industry. Some innovation takes place in terms of refinement of the product. As one senior manager commented:

We actually do a lot of development ... it's not just new products, it's re-development of old products as well. We spend a lot of time on trying to stay in front ... that's probably the best part about this company is that they actually, we do try to stay in front of our competitors but also in front of our quality. We try and make sure that everything is right and the best that it can be and if we see an improvement, put it in place. So, and that's not just on the materials, it's on the process as well and even the machinery you know.

In recent years, some process innovation had taken place. The same interviewee explained this:

As far as processes through the way we bond our parts, the way we prepare our parts, new innovation in how we clean them, how we bond them, how we blast them, all that time, all those little processes have changed ever so minutely.

Innovation at Parts has been largely through the offshoring of production to China in an effort to control costs. This worked well for the company but the company has been careful to offshore only basic manufacturing operations in order to avoid product piracy and to control quality. More sophisticated machining to finish the basic products is still carried out at the Australian factory.

Metals is the manufacturing exception. It has been an innovator in both products and processes since its establishment in the 1950s. The company began with two product lines, domestic hot water systems and stainless steel fabrication, but the competitiveness in the hot water systems market from larger established companies led to concentration in subcontracting fabrication, which required dependence on flexible design and skilled sheet metal workers. The company concentrated on the subcontract trade in the commercial building industry, and then expanded into Sydney and Melbourne as a subcontractor in kitchens and architectural facades. This also included manufacturing plants in Sydney from 1987 to

1998. This strategy came under pressure as Metals attempted to negotiate the post-Sydney Olympics excess kitchen equipment capacity crisis. Metals met this challenge by buying a competitor and moving into domestic kitchen products with a recognised brand name acquired with the new site. This has led to a 30% change to its product line in the last five years. To achieve this product innovation, Metals has also been involved in substantial medium-level process innovation. All the manufacturing sites use modern but standard CAD drafts, CAD/CAM modelling, CNC-controlled machinery, an ERP (enterprise resource planning) ordering/logistics system (called 'M1'), as well as implementing lean manufacturing tools (LMT) that connect to all individual machinery on the sites. Despite all this innovation, the nature of the industry means that it is regarded as low-to-medium technology and is not driven to high-technology innovation as is evident in the biotechnology or ICT industries.

Finance, like many larger organisations in the finance industry in recent years, has moved from being a purely service organisation into one that offers an array of new financial products for customers. Finance has developed new ways of dealing with customers, given this vast array of products and packages. However, much of the product innovation at Finance has been in keeping with developments at other financial institutions – new forms of savings accounts, new forms of online banking etc. These product innovations have not been new to the market and have served essentially to keep Finance competitive in the market. A number of comments from interviewees stressed the conservative approach of the company to innovation and the rather patchy innovation process in the organisation:

My impression is from a people and culture point of view ... in parts we're very innovative, and in other parts struggling with innovation and change ... but I think possibly the most innovative piece for us is the genuine commitment to community.

Another senior manager went on to explain:

I think it's banking traditionally, I wouldn't say particularly innovative. I think though the Global Financial Crisis has shifted the paradigm of what does a solid bank look like? So I think the organisation has had to be a lot more responsive.

This was confirmed by an R&D team leader who explained:

I think [Finance] takes a pretty sporadic approach to R&D. I think generally, you know we're quite a conservative risk-averse business ... we are sort of leading the market in terms of particular innovations; however, as a general rule I don't think R&D is an area that really gets as much focus as it possibly could.

Although Finance recognised the need for greater levels of innovation, there were identifiable barriers that existed in the organisation that hindered innovation and which were related to the size and bureaucratic nature of this very large organisation.

Five of the companies in the case study sample exhibited relatively low levels of product and process innovation. Moreover, this was not confined to one industry sector, but appeared to be the norm across the three sectors from which the case studies were drawn. However, innovation in the broader sense was not uncommon. What has been termed 'organisational' innovation was quite frequently observed. Telco L had undergone frequent large-scale organisational change largely as a result of changing government telecommunications policies. Metals was engaged in the absorption of a new company into the organisation through acquisition. Telco S, having been acquired by a larger organisation, was at the time of the research undergoing a de-merger process. Technology, on top of the high level of product and process innovation, was also undergoing a major internal transformation associated with the acquisition of a consulting company as part of its service reorientation.

Human resource management and innovation

In relation to the mediated model of innovation, whereby innovation stimulus through human resource management builds innovation capacity, the case studies in general reveal that the role of human resource management policies and practices in innovation was not high. All of the companies in the case studies supported a significant level of human resource management activity, which would be expected in larger organisations. However, the case studies indicate that in general the role of human resource management was still regarded as largely operational, with little alignment of the strategic goals of the organisations to innovation capacity building. This was true in some of the larger organisations in the sample.

At Finance, for instance, the company had a well-established and resourced human resource management system. However, although the organisation was attempting to develop a new and more collaborative organisational culture, there was little connection between the human resource management system and the promotion of innovation. The role of the human resource management function in this company was more focused on developing future managerial talent within the organisation and developing a service culture for customers rather than stimulating innovation capacity. As one manager commented:

So I think there's a big focus on let's get the people proposition right, particularly around the right culture which we want to have, very aggressive on bringing talent through the organisation and invest in people.

At Telco L, the focus for human resource management was improvement in labour productivity. The company had undergone major organisational change in recent years, but the focus had been on cost-cutting and improving service delivery. This productivity focus in some ways ran counter to human resource policies that might have improved innovation and creativity. As one senior human resource officer put it:

I don't think we have HR policies that stimulate innovation at all. They probably stifle creativity I would suspect. And maybe for good reason. But I think we have a culture that's getting to that point where we want to try to do things differently. So it might not be a technological innovation. But I think we have a culture within our business that says that we can do things better. And I think we're tapping into that more and more.

In the smaller companies, human resource management's role was definitely operational. At Telco S, for example, the human resource management function had been outsourced from the time of the company's acquisition by another interstate company in 2007, until mid-2010. This has resulted in a traditional view of the role of human resource management in the company, exemplifying the financial focus of the board and the limited value placed on the human resource function.

At Metals, the innovative culture was supported by the human resource policies of the company but innovation did not appear to be a central focus for human resource management. The nature of the company – family-owned – meant that a rather paternalistic management culture had developed. While this fostered a sense of workforce solidarity and identification with the aims of the company, it did not necessarily nurture the critical edge in thinking, which is the basis of high levels of innovation.

In relation to human resource management and its impact on innovation, the overseas-controlled multinational Technology was the exception among the case companies. Here, embedding innovation in the three key values of the company had provided the management with a stimulus for human resource management to play a much larger role in building innovation capacity. In order to encourage a participative and inclusive innovation culture, the company promoted a number of tools.

'Thinkplace' was an online program that encouraged staff to submit suggestions for innovation, and a number of ideas have been developed through this program. This concept has recently been refined into the notion of 'Innovation Hubs'. These are locations throughout the world where ideas will be evaluated more systematically and developed.

A major tool for innovation was the 'Innovation Jam' concept. In this initiative the company opened a 'window' for an online conversation that involved large numbers of staff, who were able to contribute to conversations relating to new ideas in the company.

Technology also initiated a series of innovation awards that are presented in collaboration with major clients. The involvement of clients in the innovation awards emphasised the place of user-led collaboration in the new approach to innovation in supporting incremental innovation outcomes. The promotion of collaboration was seen as a key driver for human resource policies in the company. So too was the drive towards greater diversity in the workforce. Enhancing the diversity of the workforce was not only concerned with meeting diversity targets or reflecting the population that uses Technology's products and services but also with encouraging greater diversity of thinking. As a senior manager put it:

I need diversity of thinking, so I need mechanisms, but I actually need the diverse people in the first place. And so from a HR point of view, there was a very strong diversity agenda that says the usual things of, you do need different people in your business who can speak up from different angles, and provide the ah-ha's, and you will get caught in corporate think if you don't allow them to speak up. And that's got to be innovation, and what I call diversity of thought.

Although the company does not have innovation policies as such in its human resource approach, the underlying drive of much of the approach to human resource management was to stimulate innovation. Hence the emphasis in Technology's human resource management approach is on the importance of developing a culture that reflects the three key values of the organisation – including innovation. Yet all of this is driven by a culture of innovation coming out of the parent company located in a major advanced economy, not from any innovation culture in Australia.

To sum up, with the exception of the multinational Technology, because of a lack of organisational focus on innovation, human resource management did not play a major mediating role as a stimulus in building innovative capacity in the case study companies. The role of human resource management was generally regarded as merely operational and, to the extent that it contributes to innovation, the role of human resource management was generally concerned with the recruitment of creative and innovative individuals into companies rather than the development of innovative and creative capacity in the existing workforce. Only in Technology did human resource management play a central and highly visible role in the development of the company's innovation capacity. Overall, none the enterprises in the case studies adopted any human resource strategies that bundled work practices into dynamic capabilities for creativity and innovation.

Learning and development and innovation

A similar picture emerged for learning and development in the case companies, being largely regarded as an operational activity with a focus on skills development but with no special role as a mediating stimulus for building innovation capacity. Telco L, for example, has a well-developed training function focused on the normal skills development needs of a large organisation. However, even here the emphasis in the company was on productivity improvements using learning and development programs, rather than producing innovative activity. The overall conclusion in this company was that

the learning culture in the company is still lacking, although a learning and development manager agreed with the importance of developing a strong learning culture for innovation. The learning and development manager emphasised the need for top-down as well as bottom-up learning and development interventions and the alignment with business strategy.

At Metals, the Managing Director was a passionate advocate of training. In recent years Metals had moved towards using nationally recognised training at all levels in the organisation. This was particularly true for trades training, where Metals had recently moved into school-based apprenticeships, with the result that the company was able to recruit skilled workers with an in-depth knowledge of the organisation. The commitment of the company to training created a significant learning culture in this trade organisation. While training may not have been geared towards innovation specifically, the level of skills development that took place in the company created conditions of trust amongst employees, with the potential to encourage creativity and innovation if management were to develop a strategic intent towards innovation as competitive advantage.

Technology similarly had a serious company commitment to learning and development but with a more structured and strategic approach. Technology invested heavily in the training of its employees and also operated a graduate development program. As graduates entered the company they underwent initial induction and were then offered various forms of developmental activities to support them in their careers. This included mentoring and membership of an associate network, a management development program and an executive development program known as 'Talent Pool'. Beyond the graduate induction program, staff were offered a variety of training programs, most of which were online.

Although the human resource management approach and philosophy are based on the development of a corporate culture that encourages the three key values of the company, including innovation, the learning and development programs are not specifically geared towards building innovation capacity. However, as with Metals, the in-depth nature of the learning and development provided at Technology created a culture primarily related to skill development designed to increase understanding of current technology processes, as opposed to the extension of the technology to new, more radical solutions. While creativity and innovation were expected to emerge in some impromptu way from the learning skill culture established in both Technology and Metals, there was no specific strategy for supporting a learning and development program that would stimulate the development of a creative climate to mediate innovation capacity, as proposed by Howkins (2009). The implications of this limited role for innovation are discussed in the final chapter.

External links and innovation

The third area of inquiry in the case studies was the relationship between the external links that companies developed and innovation. Once again, the picture from the case study research depicts a very limited role for innovation by comparison with the stated importance of innovation expressed in the survey results. Most of the case study companies did not have enduring relationships with external organisations – especially not educational institutions. The two exceptions were Metals and Technology.

Three levels of educational relationships external to Metals were identified. The first was at the apprenticeship level at the local SkillsTech TAFE college, with the Metals' Apprentice Manager monitoring teaching practices in relation to the workplace environment. The second level of education was also with SkillsTech TAFE. This is a Diploma of Engineering and Competitive

Manufacturing, which allowed transference from hard to some soft skills. The Managing Director explained:

So Gary and I developed, with the help ... of our TAFE college. We developed a diploma course in Engineering because we identified opportunities for career paths for younger persons in the office to ... trade background ... to take this through and go further up the tree. So we worked with TAFE, developing a Diploma in Engineering course, and grabbed another nearby manufacturer, not competitive to us, in the air conditioning industry [to make the course viable to teach].

There are currently nine staff from Metals enrolled in this diploma. The third level of education collaboration was only preliminary. The training consultant indicated that some staff completing the diploma could be encouraged to go on to an engineering degree. So, rather than ad hoc enrolment, he wants to see some collaboration with a university to articulate from the diploma to a degree suitable to Metals.

Technology actively involved its clients and other organisations, such as suppliers, in its innovation system. In a services environment, innovation is driven, with and through, the clients of the company. This approach contrasts with the previous history of the company, when it sought to innovate in-house and supply the results of the innovation process to its client base. As the company has moved to a more open system of innovation, it has developed its relationships with a range of external organisations – particularly educational institutions – the aim being to facilitate the company's development. A case in point is Technology's collaboration with a regional university, which was successfully achieved with the support of state and federal governments and the educational support of the university, which produces a supply of highly trained IT professionals with experience of working in the company, many of whom are subsequently employed in the company. This collaboration has developed from the initial concept of Technology staff teaching the IT programs at the university, to the extension of Technology's operations at the university's technology park and the development of a research laboratory. The collaboration has benefited all parties, with Technology's successful location of a major service hub in the region, the university increasing its enrolments in its IT programs and the regional city benefiting from the over 1200 new jobs created at the Technology locations in the university's technology park.

A recent example of collaboration between Technology and universities has been the establishment of Technology's eighth research and development laboratory and its first global research lab in Melbourne in partnership with another university. The lab will focus on innovation as part of Technology's 'smarter planet' initiative. Technology views collaboration with universities as a key element in the company's open innovation approach, one which will benefit the company and the university as well as the broader community. As one senior manager put it:

Do we see universities as important? Yes I think we do because we're realising we can't and shouldn't try to do all of the innovation in a closed sense now. We believe in open innovation and therefore we need to collaborate with universities. The collaboration with universities is because we want it that way because the university environment is more focused on innovation and in process innovation we have to work with the university to come up with some idea and then we'll have to adapt it.

Conclusions from the case studies

The case studies examined the strategic intentions of the seven companies through the lens of the Stimulus-Capacity-Performance model of innovation established through the literature review and also used as the basis of the survey. In most of the companies examined, the level of product and process innovation was relatively low. In the five low-to-medium innovation companies:

- Human resource management had a largely operational role, with no specific focus on innovation or on learning and development.
- Although often well organised and geared to skills development, the human resource function lacked an innovation objective.
- Any real involvement with external institutions, especially educational organisations, was lacking.

This lack of innovation can be attributed to a culture of leadership that values operational efficiency above strategic innovative advantage.

The two exceptions to this limited picture of innovation were Technology and, to a lesser extent, Metals. In these cases, significant product and process innovation was underpinned by:

- human resource management systems and learning and development activities that created a culture of learning, if only at an incremental innovation level, which was also evident in the survey
- company encouragement of employees to be innovative and creative, even if the systems were not strategically focused on the development of innovative capacity.

In the case of Technology, adoption of innovation as one of the company's three core values meant human resource management was geared towards developing the innovation skills of employees. In both cases, the companies had developed strong external relationships with educational institutions, and in the case of Technology these relations also covered research and innovation. However, Technology is a wholly overseas-owned multinational company and Metals has a top-down paternalistic company structure in a small highly competitive niche industry, which may explain these companies' atypical practices. None of the case studies followed the practice of human resources bundling for creative capabilities, indicating that Australia is a long way off being an 'enterprising nation' (Karpin 1995).

Discussion and conclusions

This project investigated the effect that management practices, specifically human resource management, a learning and development culture within an organisation, and relationships with external stakeholders, particularly education institutions, have on the processes of innovation in companies. The macro framework of innovation (see figure 1) proposed that management practices and other stimuli such as the adoption of new technologies would have an impact on innovation performance through the mediating effect of developing innovation capacity.

The results from the employer survey of human resource managers familiar with innovation outcomes tend to support that this model was, indeed, a good representation of best practice in a range of Australian companies. The survey results showed that management practices did not have a direct strategic influence on innovation but, rather, developed the innovation capacity of companies, which then prompted innovation performance, as identified in other studies in advanced developed economies (see Prajogo & Ahmed 2006).

There were three sets of management practices that appeared to most strongly relate to the development of innovation capacity:

- *People management*: high performance work systems theory predicts that human resource management practices implemented in isolation will tend to have a significantly lesser impact on organisational performance than if human resource practices are bundled into complementary sets that reinforce one another (see Colombo, Delamastro & Rabbiosi 2007). This bundling of human resource practices also appeared to be important in terms of building innovation capacity, in particular, the use of team-based work organisation, support for training and learning and the use of flexible work practices (see Boxall & Purcell 2008).
- *Learning and development*: organisations that supported a learning culture, not simply provided training, also showed a higher level of innovation capacity (see Lau & Ngo 2004).
- *External linkages*: as companies interact with external organisations, their capacity for innovation grows. External linkages are the conduits that allow companies to take advantage of innovations (see Tidd & Bessant 2009). The survey showed that companies that fostered links with educational institutions in particular tended to be more successful in developing innovative capacity than more inwardly focused companies.

Although the survey results reflected the Stimulus-Capacity-Performance model of innovation to a limited extent, when the specific stimuli from figure 2 were examined at the micro-firm level through the case studies, what emerged was a highly limiting role for innovation and its relationship to management practices, which reflects the concern expressed by Karpin (1995) and Cutler (2008). Generally, the level of product and process innovation in the seven case study companies was low and incremental. Although most of the companies had undergone significant organisational change and innovation, there was little evidence that radically new organisational forms were emerging or that new products and processes were being implemented.

Similarly, in terms of management practices, most of the companies had established human resource management and learning and development policies and practices but these tended not to be aligned to the company's objectives, and there was little evidence that they were fashioned with a view to improving innovation performance. There were two exceptions to this limited view of innovation in

the case companies – Technology and Metals. In both of these cases the companies had introduced significant product and process innovation in recent years. In the case of Technology, innovation had been defined globally as one of the three core values of the organisation. This had the effect of structuring management practices – human resource management and learning and development – around the fostering of innovation and creativity in a large foreign-based organisation with great success. In the case of Metals, a much smaller company with a domestic focus, the human resource management systems were still quite basic and ‘top down’, although the company had created a learning culture with an emphasis on training and development and its extensive use of nationally recognised training for new and existing workers. In both companies, external links were important in the innovation process. For Technology, links to universities were critical both for the training and recruitment of new staff and for the development of applied research, which helped to underpin the company’s product innovation. At Metals, the links to the tertiary system were growing, with well-developed connections to the VET system and emerging relations with universities.

Despite the relatively low level of innovation found amongst most of the case study companies, Metals and Technology tended to conform to the model of innovation developed through the literature review and confirmed through the survey. The companies low on innovation tended not to have the human resource management and learning and development system alignment and the external linkages that the model identifies as critical to the development of innovation capacity and ultimately to innovation performance. Thus the case studies tend to confirm the messages from this research. In order to develop innovation capacity, companies need to:

- align their human resource management practices into complementary bundles that focus on innovation
- create a climate of learning that is supported by learning and development programs so that employees feel that they can share their creativity with the organisation
- forge linkages outside the company, particularly with education institutions.

Project research questions answered

- What is the role of human capital formation through human resource management and learning and development practices in enterprises that promotes/inhibits the development of innovative capacity?

The literature and the survey demonstrate that human resource management, together with learning and development programs, provides the stimulus to build innovation capacity in the enterprise (see figure 1). However, to maximise the extent of innovation capacity, the stimulus needs to be strategically focused and directed. By this we mean enabling employment conditions that promote creativity and knowledge acquisition, such as the bundling of high performance work practices, including team-based work organisation, support for training and learning, and the use of flexible work practices.

- What part does enterprise engagement with the tertiary system, both VET and higher education, play in the formation of human capital and the development of innovative capacity?

Two of the case studies demonstrated strong enterprise engagement with the tertiary education system, at least at the incremental innovation level (and supported by the survey). As such, innovation capacity can be seen to have strongly developed, in that skills relating knowledge and creativity are integral to the workforce. This can be from VET courses at the bottom of the employment structure to university degrees and programs further up. However, given the lack of

demand for such programs from the vast majority of enterprises, the responsibility lies with the tertiary education system to create and stimulate demand for innovation-building courses, from 'user led' incremental innovation, to, most critically, 'blue oceans' radical innovation.

- What guidelines can be developed that can be used by managers in enterprises to promote innovative capacity through better human capital formation?

The micro-based research framework (see figure 2) provides specific guidelines on the people, knowledge and creativity management needed to stimulate the capacity to innovate in medium-to-large enterprises. However, to be able to do this, the strategic intent, as specified in the first question, and the tertiary education programs, as in the second question, need to be addressed.

- What role is there for intermediary bodies, particularly industry skills councils, in developing innovative capacity in their industry sectors?

Given the unresponsive landscape in the Australian corporate world when it comes to innovative strategy and capacity, intermediary bodies like industry skills councils and departments of education and innovation throughout the country need to be proactive in altering the philosophy of VET and universities from the 'meeting demand' perspective, to the 'creating demand' perspective, as identified in second question. Further, skills councils forums and government agencies have a potentially influential role in encouraging, supporting and advising enterprises on how to build innovation capacity – both incremental and radical – through the micro-based framework of figure 2. This was successfully done in the early part of twentieth century, with advisers and scientific organisations like CSIRO providing the proactive basis for innovation in the agriculture industry. This needs to be implemented on a broader scale throughout all industries in Australia now.

Implications for enterprises, VET and other external organisations

A number of concerns arise from this study. For the large enterprises themselves it is the lack of understanding of, and experience in, the role of human resource management for innovation that flies in the face of the idea that Australia can be an innovative economy. Despite previous studies and reports regretting the lack of 'enterprise' by large companies in this country, very little has changed in the last 20 or so years. The notion of 'the lucky country' coined by Donald Horne in his 1964 book still rings true today, as profits are made from production provided by nature-based commodities rather than from creativity-based innovation (Cantwell 1999). This has implications for external organisations in the National Innovation System, especially VET and universities. Such educational institutions must not wait for the Metals-type enterprises to come to them, because there are so few of them. There needs to be a strong proactive effort by VET and universities to promote, cultivate and extend external linkages with capacity-building measures of the type outlined in this study. Such proactive efforts will often fail and, like all innovation, there will be more failures than successes.

Strengths and limitations of study

The strengths of this study are twofold. One is the unique and powerful macro-innovation framework that pulls together all the research literature on innovation. From the technology management perspective, this type of framework is unsurprising but realistic. From the human resource management perspective, this framework is more holistic and complex than any devised previously. The framework has the potential to provide VET and universities, along with public servants dealing

with innovation policy at all levels of government, with a tool for developing measures that encourage, teach and support innovation capacity building by enterprises in Australia.

The other strength is the qualitative in-depth interviews that provided, along with supporting documents, evidence of the type of human resource management measures that do work for innovation. There are limitations to case study research that are exaggerated by quantitative 'positivist' researchers. The few cases examined in this study provide clear patterns, identified in the previous chapter, that fit neatly into the framework and which are supported by many previous case studies and reports. It is the cumulative build-up of these compelling patterns that provides behavioural understanding of the lack of capacity building for innovation in Australia.

The survey has already been identified as a serious limitation from a quantitative statistical perspective. Two points emerge from this limitation. One is that, despite the small number of respondents, the survey questionnaire (see appendix D in support document) contains a great deal of detail relating to human resources innovation capacity building, such that all the respondents provided exceptionally knowledgeable feedback on how to create innovative capacity in larger enterprises. This in itself is useful, as it confirms the theoretical framework, but stands in contrast to the case studies. The second point is a methodological one. To gain such detailed information, the size of the questionnaire inevitably had to be large. However, in this survey-fatigued, busy corporate environment, gaining strong statistical response rates for a detailed survey like this one is virtually impossible. The best we can do is gain authoritative responses. This has been attempted here. In future surveys, improvements to response rates can be achieved by using online surveys, addressed by name to human resource managers, and providing more user-friendly questionnaires.

The case studies also had limitations. In some enterprises the researchers were not able to interview as many staff in the organisations as planned due to manager reluctance to organise interviews, and busy staff being unable to allocate time for these interviews. Gaining permission to conduct the case studies was also difficult, with many enterprises unwilling to participate or to respond to invitations, despite the research team developing strong networks in these industries to induce positive responses.

Future directions for research

An important future direction is new research on the issues this study has raised. Problems in not understanding *how* to build innovative capacity into the board members, managers and employees of Australian enterprises in the culture of the 'lucky country' have led to production-based rather than innovation-based profit-making. Such research is long overdue but little has been done. Further, we suggest research conducted by government and researchers within the public service on the sort of innovation policies that might awaken Australian enterprises from their slumber to take action towards innovation. Further down the line, VET and other education institutions need policies and actions that induce in the young a desire to be curious, creative and innovative.

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Support document details

Additional information relating to this research is available in *Building the capacity to innovate: the role of human capital – support document*. It can be accessed from NCVER's website <http://www.ncver.edu.au/publications/2474.html> and includes:

Appendix A: Survey methodology

- Survey design and measurement
- Measures and summary statistics
- Generation of composite measures by topic area

Appendix B: Synopsis of the literature

- Macro framework of innovation
- Human resource management, training and innovation
- Innovation stimuli
- Conclusions from the literature review

References

Appendix C: Interview questions

Appendix D: Survey questionnaire

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