



**Australian Workforce
and Productivity Agency**

Human capital and productivity

Literature review

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Table of Contents

Abstract	3
Executive summary	4
Formal learning and non-certified learning	4
Foundation skills	5
Management and leadership skills	5
Other benefits of learning.....	5
Conclusion	5
1. Introduction	6
Objectives	6
Scope	6
Methodology	7
Structure	7
2. Learning and productivity	8
Learning and individual outcomes	8
Effect on firm performance	16
Benefits to economy	21
Relative importance of different levels of education and types of learning.....	24
Marginal versus average return.....	27
Signalling theory	27
3. Foundation skills	29
4. Learning and innovation	32
5. Leadership and management	36
6. Other benefits of learning	41
7. Conclusion	42
Formal learning and non-certified learning	42
Foundation skills	43
Management and leadership skills	43
Other benefits of learning	43
General conclusions and recommendations for further research.....	43
References	44

Abstract

The Australian Workforce and Productivity Agency (the agency) was established to provide the Australian Government with independent advice on a range of matters including improving workforce productivity.

The primary means by which policy can improve workforce productivity is by enhancing human capital and by ensuring human capital is allocated efficiently and meets the dynamic needs of the economy. This literature review examines published evidence of links between human capital and productivity.

The literature establishes a strong positive association between human capital and productivity for individuals, firms and the economy as a whole. It also suggests: that both flows and stocks of human capital are important to productivity; that higher-level skills become increasingly important as countries develop, requiring firms and labour to adopt increasingly complex technologies or to innovate to further enhance welfare; that foundation skills play a key role in productivity and are more easily developed during an individual's formative years than in adulthood; and that good management and leaderships skills promote the efficient use of human capital within workplaces, including by ensuring skills are matched to jobs and are complemented by technology.

This review also identifies possible areas for further research. These include: research to identify where Australia sits on its learning-growth curve; research addressing how the marginal benefits of additional learning compare to the marginal costs; identifying Australia's skill needs in the complexity and rapid change of the Asian century; additional research at the firm level, including further examination of the importance of workforce development strategies; and an examination of the unique human capital challenges of particular groups including those of low social economic background, Indigenous Australians, women and older Australians (especially given the ageing population).

Industry level studies (directed at industries of strategic importance and in which Australia could develop a comparative advantage) addressing productivity challenges would also provide a useful contribution to the literature and the welfare of Australians.

Executive summary

It has long been recognised that productivity is the key to long-run economic growth. Increases in productivity allow firms (and by extension the economy) to produce more output with the same quantity of inputs. Traditionally productivity is measured by statistical agencies at the economy level by dividing output by labour inputs (in the case of labour productivity) or labour and capital inputs (in the case of multifactor productivity). There are many potential drivers of productivity including technological change, increases in human capital, microeconomic reforms, trade related reforms, and competition. From this list it is apparent that governments can enhance productivity by promoting efficient markets as well as through fiscal policies. In the case of human capital, governments have a role to play in both respects.

The OECD (2001) defines human capital as the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being. The aspects of human capital that are of most relevance to the Australian Workforce and Productivity are: formal learning (learning leading to a qualification); non-certified learning (on job training, work experience, or other learning not leading to a formal qualification); foundation skills; and management and leadership skills. This paper examines the existing literature on the productivity effects of human capital in the context of each of these relevant subject areas.

Formal learning and non-certified learning

Numerous studies have examined the association between learning (including formal learning and non-certified learning) and productivity. On balance, the literature tends to find that learning has a significant and positive effect on productivity both at the micro (individual or firm) and macro (economy) level. While the studies considered by this review are not directly comparable due to the different methodologies that have been applied, including different models, parameters, variables, data and samples, the following general observations may be made.

In the context of individuals, changes in wages appear to be the best indicator of the productivity effects of learning. The literature suggests that, on average, an additional year of learning increases an individual's wage by between 5 and 16 per cent.

For firms, various indicators have been considered including profits, value added per worker, and probability of survival. However, conclusions on the extent to which learning affects productivity at the firm level are difficult to draw from the literature due to the differences in methodology applied, particularly differences in the samples used which tended to be small. While the association between learning and productivity is therefore not as well established at the firm level, the studies reviewed generally indicated a positive correlation between learning and productivity.

At the country level, associations between learning and GDP per capita or average labour productivity have been examined. The literature reviewed indicates a strong and significant association between learning and productivity in cross-country studies. The studies suggest that an increase in the average level of education by one year would, on average, result in a 3 to 15 per cent growth in GDP per capita in the long-run.

There is also literature that suggests, however, that there are diminishing returns with additional learning seen at both the micro and macro levels. This indicates that additional learning would have a lesser impact on productivity than suggested by studies that estimate the average return from learning. It also indicates that there would be a point where additional investment in learning becomes wasteful—where the marginal social costs exceed the marginal social benefits. Interestingly, studies suggest that at the individual level, those that would expect the highest returns from learning (i.e. generally the least skilled and most disadvantaged) may be the least likely to undertake it.

Studies also suggest that the productivity gains from different levels of education (primary, secondary, tertiary) vary with a country's level of development. In particular, the literature suggests that tertiary education is likely to be more important for advanced economies such as Australia. Advanced economies are closer to the technological frontier, requiring firms and labour to engage and absorb

more complex technology and to engage in innovation to further enhance welfare. A more highly skilled workforce is therefore essential and skills are likely to be rewarded accordingly.

There is a growing body of literature that suggests that the stock (in addition to flows) of human capital can affect productivity and growth by facilitating innovation. As these models allow both stocks and flows of human capital to affect growth, these studies tend to estimate a higher return from learning than studies that focus on productivity effects based solely on flows of learning.

Foundation skills

The literature suggests that foundation skills are likely to have the largest impact on productivity. This is not surprising given that foundation skills provide the basis for further learning and productive activity in workplaces. However, studies examining interventions designed to develop foundation skills highlight that they are also some of the most difficult skills for adults to develop. In contrast, the literature suggests that intervention early in life (including in primary school) is likely to provide large payoffs.

Management and leadership skills

Management and leadership skills contribute to productivity by improving resource allocation within firms. In particular, research suggests that management and leadership skills are associated with improved firm performance and rates of innovation. For example, one way that good management contributes to productivity is by ensuring that skills are properly utilised within workplaces and are complemented by technology.

Other benefits of learning

In addition to the traditional avenues by which learning has been thought to contribute to productivity, there is also evidence of benefits through less obvious routes. Studies, for example, have found associations between learning and improved health, societal and environmental outcomes. In addition, it is also likely that investment in learning by one worker increases the productivity of his or her co-workers (these benefits would be external to the individual but internal to firms and the economy as a whole).

Conclusion

Overall, the benefits of investing in learning and sound management practices are compelling. Learning and effective management are good for individuals, firms and the economy. They enhance material welfare in terms of wages and profits and promote a more innovative, adaptive and inclusive economy.

1. Introduction

Objectives

This literature review aims to:

- i. elucidate the link between human capital and productivity as identified by the current literature on this topic; and
- ii. thereby assist the agency in directing its future work agenda in this area.

Scope

It has long been recognised that productivity is the key to long-run economic growth. Increases in productivity allow firms (and by extension the economy) to produce more output with the same quantity of inputs. Traditionally productivity is measured by statistical agencies at the economy level by dividing output by labour inputs (in the case of labour productivity) or labour and capital inputs (in the case of multi-factor productivity). There are many potential drivers of productivity including technological change, increases in human capital, microeconomic reforms, trade related reforms, and competition. From this list it is apparent that governments can enhance productivity by promoting efficient markets as well as through fiscal policies. In the case of human capital, governments have a role to play in both respects.

The OECD (2001) defines human capital as the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being. These elements of human capital can be innate or they can be acquired or enhanced through learning.

This review focuses on human capital as acquired or enhanced through learning. This focus reflects the mission of the agency—to ensure that the Australian Government’s investment in education, training and workforce development promotes the development of a highly skilled workforce, increases workforce participation, meets the needs of industry and individuals, and increases Australia’s productivity and quality of the education system.¹

The extent to which human capital contributes to productivity also depends on how effectively it is utilised. Perhaps the most obvious example of this is the need to match the knowledge, skills and competencies acquired through learning to an appropriate job. In this respect, the role of managers and leaders is likely to be critical.² Equally, managers and leaders are likely to be important in fostering learning within the workforce and in developing an organisation that is adaptive to changing economic circumstances. This review therefore also considers literature examining the effect of management and leadership on productivity.

1 ..This review, therefore, does not consider literature relating to links between other elements of human capital (such as health or innate ability) and productivity. However, such elements may be relevant to studies considered by this review. In particular, they may be factors that need to be controlled for in examining the impact of learning on productivity (e.g. innate ability) or the association between them and learning may be the subject of study (e.g. a study into whether education outcomes are associated with health outcomes).

2 ..Leaders and managers are part of the ‘organisation capital’ of a firm that link resources together to produce value. For a discussion of ‘organisation capital’ and the broader concept of ‘intellectual capital’ see Stiles and Kulvisaeschana (2003).

Methodology

Both Australian and international literature have been analysed in conducting this literature review.³

The majority of this paper examines the link between learning and productivity. To assist with analysis, the literature on this issue has been reviewed in accordance with the three main areas in which the impact of learning on productivity can be measured:⁴

- i. the impact on individuals (e.g. examining impacts on wages or employment outcomes);
- ii. the impact on firms (e.g. by examining impacts on profitability, value added or survival); and,
- iii. the impact on the economy (e.g. by examining impacts on average labour productivity or the level or rate of growth in GDP per capita).⁵

Although foundation skills such as literacy and numeracy may be classified as learning, this review considers the link between foundation skills and productivity separately. This is in recognition of the special nature of those skills and their likely role as an enabler of further learning.

Likewise, studies on the productivity gains of learning through effects on innovation are considered separately because of the different model of human capital used in comparison to studies that adopt a neoclassical approach.

Finally, literature on the productivity gains associated with leadership and management is examined.

Structure

The main sections of this report are divided as follows:

- Section 2 reviews literature on learning and productivity
- Section 3 reviews literature on foundation skills and productivity
- Section 4 reviews literature on learning and productivity growth via innovation
- Section 5 reviews literature on the productivity gains associated with leadership and management
- Section 6 sets out the conclusions that can be drawn from this literature review

3 The review examines different types of literature including econometric studies (that provide, for example, evidence of correlations) and policy reviews (that largely summaries existing evidence and highlight policy implications). While the emphasis of this paper is on econometric studies, policy reviews provide context and informed analysis of relevant matters.

4 The way studies approach the measurement of productivity, for example by using proxies such as wages or profits, partly results from difficulties in directly and accurately measuring productivity. Statistical agencies, such as the Australian Bureau of Statistics, measure productivity by measuring outputs and inputs. Generally, however, this is only reliably done for the market sector and only for limited factors of production, namely labour or capital or a combination of the two in the case of multi-factor productivity.

5 The three methods are interconnected. For example, the productivity impacts on firms and individuals should flow through to results for the aggregate economy given the economy is made up of individuals and firms.

2. Learning and productivity

This section reviews the existing literature on the association between learning and productivity.

Learning is a broad concept. It is therefore helpful to define ‘learning’ before proceeding to a review of the relevant literature.

There are two main categories of learning that are referred to in this paper—formal learning and non-certified learning. Formal learning is learning that leads to a qualification. This qualification could be at any level, for example, at the certificate level, diploma level, degree level or post-graduate level. Formal learning therefore includes learning within schools, TAFE and university as well as vocational education and training (VET) courses leading to a qualification.

In contrast, non-certified learning is learning that does not lead to a qualification. Non-certified learning is comprised of two components and generally occurs within workplaces:

- i. Non-formal learning, which is structured learning that does not lead to a qualification. An example is uncertified on-the-job training conducted by an employer; and
- ii. Informal learning, which is unstructured learning. It includes, for example, work experience and skills obtained by working which are not certified.⁶

The literature examining the relationship between learning and productivity generally involves either micro or macro level studies. Micro level studies tend to examine the impact of learning on individuals (e.g. wage, earnings or probability of employment) or firms (e.g. profit, value added or probability of survival). Macro level studies, on the other hand, focus on the regional or country level effects of learning (e.g. cross-country differences in average labour productivity, or in the level or growth rate of GDP per capita).

This section reviews the literature on learning and productivity by grouping the analysis according to the focus of the study, that is, the productivity effects of learning at the individual, firm or country level. This section also reviews literature on related matters such as signalling theory and whether or not there are diminishing marginal returns to learning as economic theory suggests.

Learning and individual outcomes

The association between learning and outcomes for individuals has been the subject of numerous academic studies across jurisdictions. Due to difficulties associated with directly measuring the productivity of individuals, the studies usually rely upon labour market outcomes as proxies for productivity. Whether or not these proxies accurately reflect productivity is not beyond question. They are, however, generally chosen on the basis of, and underpinned by, sound economic theory.

By way of example, one of the most common proxies chosen is hourly wages. Neoclassical theory suggests that in a perfectly competitive labour market, an individual’s return for working an additional hour (their hourly wage) will equal the value of the output they would produce if they worked that additional hour (the marginal value of their labour). The theory therefore suggests that if an individual’s wage increases it is (all things equal) because they are more productive.

⁶ It has long been recognised that there is a strong positive relationship between experience and productivity (see, for example, Arrow (1962)).

Of course, in the real world this relationship may not necessarily hold, especially at the industry level for the reasons set out below.

- i. An increase in productivity may occur at the same time as other changes that reduce the marginal value of labour. For example, if an increase in productivity is not matched by an increase in the demand for a commodity then any increase in productivity for that commodity is more likely to be reflected in a reduction in its unit cost of production and its relative price, rather than in an increase in relative wages for the workers engaged in its production.⁷
- ii. In the long-run, an increase in wages resulting from enhanced productivity would attract additional labour to the affected market placing downward pressure on wages. This redistribution of labour within the economy may also affect the supply of labour and thus wages in other industries, independently of any change in productivity;
- iii. In some circumstances, wages may be unable to freely adjust in response to changes in productivity. For example, some occupations and industries may be more likely to determine wages by factors unrelated to productivity (e.g. via pay scales or years of tenure) than others.⁸

However, notwithstanding these factors, it would appear reasonable to assume that on aggregate (at the country level) the association between wages and productivity would hold, albeit not perfectly.⁹ The imperfect nature of such proxies for productivity is one reason why studies also examine the productivity effects of learning at the firm and country levels.

The key indicators of productivity used by the studies are wages, earnings, and participation, each of which is outlined in further detail below. Each indicator embodies separate concepts that provide different measurements for productivity.

- i. 'Wages' refer to the hourly rate of pay that an individual receives. As noted above, in a perfectly competitive market wages will equal the marginal value of labour. As such, differences in individuals' wage rates may be viewed as an indication of differences in their productivity.
- ii. 'Earnings' refer to the total money received by the individual from the labour market over a defined period, usually a year. Earnings therefore depend both on the rate of pay (the wage) and the amount of hours worked. As such, it may be viewed as capturing both productivity and participation effects.
- iii. 'Participation' refers to an individual's involvement in the labour market. While economic theory does not suggest an association between participation and productivity in the short term, increased participation is likely to have long-term benefits. For example, increased participation would promote social inclusion and would enable the individual to develop skills via work experience, should they gain employment. Further, while increased participation would not necessarily increase GDP per worker (and may actually lower it) it would likely increase GDP per capita and therefore increase material wellbeing.

Tables 1 and 2 below provide a summary of the main results of recent studies on the effect of learning on the productivity of individuals. To assist with the analysis each table focuses on a different category of learning—formal learning (table 1) and non-certified learning (table 2). The studies are set out in chronological order according to the year of publication.

7 In fact the evidence suggests that different rates of productivity increase among industries are for the most part reflected in difference in their rate of change in relative prices rather than in differences in the rate of change in relative wages. See generally Salter (1960) and Keating (1983).

8 This may be more common in the government sector than in the private sector.

9 The link between productivity increases and wage increases is likely to be stronger at the country level than at the industry level. This is principally because, if the average real wage level for the economy does not increase in line with the increase in national productivity then it is likely that the wage share and the rate of return on capital will alter, and in most circumstances there is no reason (or market pressure) for this to occur—the most important exception would be if the terms of trade were changing.

Table 1—Formal learning and individual productivity

Study	Country ¹⁰	Key results
Bartel (1995)	US	Formal training has a positive and significant effect on wage growth of at least 13 per cent.
Ashenfelter and Krueger (1994)	US	An additional year of schooling was associated with a 12 to 16 per cent increase in wages.
Blundell, Deardon and Meghir (1996)	UK	<ul style="list-style-type: none"> • Employer-provided formal training has significant returns to individuals—adding 5 per cent to their real earnings over 10 years; • Obtaining a middle or higher vocational qualification from work-related training is associated with a higher (5 to 10 per cent) increase in earnings. • Returns to employer-provided training are transferable across employers. • Men and those who are highly qualified are more likely than women or those with intermediate-level school qualifications to obtain work related training.
Green, Hoskins and Montgomery (1996)	UK	<ul style="list-style-type: none"> • Participation in company training in long spells substantially raises wages but short spells do not. • Participation in the UK Youth Training Scheme (YTS) fails to raise, and possibly substantially lowers, wages even three years after graduation compared to those who left school at 16 and went to work and received no training; there is weak evidence that, even for those that do not enter higher education, it is better to stay on at school after 16 than go into YTS.
Ashenfelter and Rouse (1998)	US	An additional year of schooling is associated with a 9 per cent increase in wages for identical twins, but estimated returns appear to be slightly higher for less able individuals. The result implies that more able individuals attain more schooling because they face lower marginal costs of schooling, not because of higher marginal benefits.
<i>Preston (1997)</i>	<i>Australia</i>	<i>Certificate, diploma and degree level qualification are associated with a 27, 56 and 90 per cent increase in earnings relative to school non-completers, respectively.</i>
Card 1999	Literature review	<ul style="list-style-type: none"> • Over the preceding 15 years the return to education had risen by 35–50 per cent. • The 'best available' evidence from studies of identical twins suggests a small upwards bias in the order of 10 per cent (from unobserved ability) in simple OLS estimates.
<i>Lee (2000)</i>	<i>Australia</i>	<i>Applies the model used in Ashenfelter and Rouse (1998) to an Australian twin sample. Estimates that the return to schooling for genetically identical twins is 8.9 per cent. However, individuals from higher ability families receive a lower marginal benefit from their investment.</i>

¹⁰ In this and subsequent tables, studies relating to Australia are italicised for emphasis.

Study	Country ¹⁰	Key results
Norton et al., (2000)	New Zealand	An additional year of education is associated with an average increase in earnings of between 6 to 8 per cent.
Long et al., (2000)	Literature review	<ul style="list-style-type: none"> Workers with higher educational qualifications, in professional occupations, and in permanent full-time jobs usually receive more training than other workers. It is very difficult to find out what effect training by itself has on wages because it is bound up in a package (e.g. a promotion course)—and almost every bit of that package is leaning towards higher wages. This may lead to the effects of training being overstated. Little research has been conducted into informal training despite most training being informal. There are few studies that link the benefits of the training with the costs of that training i.e. to determine the value add of training.
Long (2001)	Australia	<ul style="list-style-type: none"> A basic vocational qualification is associated with an average increase in male earnings of 7.6 per cent. A skilled vocational qualification is associated with an average increase in male earnings of 9.2 per cent.
Kruger and Lindahl (2001)	US	An additional year of education is associated with an average increase in earnings of about 10 per cent.
Ryan (2002)	Australia	<i>Individuals who complete VET qualifications generally receive higher wages (around 10 per cent higher) than similar individuals who do not complete VET qualifications. However, the returns are lower for basic qualifications and for women than they are for higher level qualifications and for men.</i>
Walker and Zhu (2003)	UK	An additional year of education is associated with an average increase in wages of around 9 per cent for men and 10 per cent for women.
Booth et al., (2003)	UK	Relative to non-union workers, union-covered workers are more likely to receive training, and receive more days of training, than their uncovered counterparts, and also experience greater returns to training and higher wage growth than do trained-uncovered men.
NZIER (2004)	Literature review	On average, a trainee after industry training is likely to be 5–20 per cent more productive than they would otherwise be.

Study	Country ¹⁰	Key results
Cully (2005)	Australia	<ul style="list-style-type: none"> • There are clear differences in the way employers value the importance of qualifications for different categories of worker (e.g. managers versus clerical staff). • Those with non-school qualifications are more likely to be employed on a full-time basis. Those with degrees or higher have the best employment outcomes. • While employers may use qualifications in the selection process as a signal of competence, direct industry experience and evidence of personal qualities are often rated higher and more valuable. • In terms of earnings, there are considerable gains for degree and diploma holders (e.g. those with a degree earned around 40 per cent more than an identical person who had not completed year 12) as well as those who have completed a certificate level III/IV qualification. Year 12 completion appears to matter more than lower-level (certificate I and II) vocational qualifications.
Ingram and Neumann (2006)	US	Found that increasing variation in wages within formal qualifications groups is likely due to unobserved skill heterogeneity within those education categories. For example, the study found evidence that other measures of skills such as mathematics ability or hand-eye coordination contribute substantially to increases in wage dispersion among workers in formal qualification groups.
Cheung (2006)	Australia	Found that credentials are important in explaining the returns to education for young Australians. There is a sizeable and significant return to completion of a bachelor's degree for both genders. However, no such relationship exists for high school graduation and the results for undergraduate diplomas are mixed.
Leigh (2008)	Australia	A one-year increase in formal learning is associated with an 8–11 per cent increase in wages.
Forbes, Barker and Turner (2010)	Australia	Higher levels of education are associated with significantly higher wages. Compared to a person with a Year 11 education or less, on average: <ul style="list-style-type: none"> • a man with a Year 12 education earned around 13 per cent more, and a woman earned around 10 per cent more; • a man with a diploma or certificate earned around 14 per cent more, and a woman earned around 11 per cent more; and • a university education added around 40 per cent to men's and women's earnings
OECD (2009)	OECD	The wage premium on completed tertiary education was 55 per cent in 2001 (country-gender average), translating into a premium of almost 11 per cent per annum of tertiary education. Wage premia display little variation over time but huge cross-country variation, ranging from 27 per cent for men in Spain to 90 per cent for Hungary and the United States (42.1 per cent for Australia). At 6 per cent, the premium per annum of tertiary education is lowest in Greece and Spain while reaching 14–18 per cent in most Anglo-Saxon countries as well as in Portugal and Hungary.

Study	Country¹⁰	Key results
<i>Intergenerational Report (2010)</i>	<i>Australia</i>	<i>A certificate III level qualifications or above is associated with an average increase in earnings of at least 10 per cent above, and up to double, those without these qualifications.</i>
<i>Watson (2011)</i>	<i>Australia</i>	<i>The earnings premium for a formal qualification under neoclassical conditions could be as high as 71 per cent (the case for males with a university degree). However, returns drop markedly once biases are accounted for (e.g. to around 59 per cent for males with a university degree).</i>

Table 2 —Non-certified learning and individual productivity

Study	Country	Key results
Medoff and Abraham (1980) ¹¹	US	In the two major corporations considered, there was a strong positive association between experience and relative earnings of managers and professionals. However, there was either no association or a negative association between experience and relative rated performance.
Moore, Newman and Turnball (1998)	US	A positive relationship between earnings and experience existed for lecturers and senior lecturers that were on a national pay scale. However, the relationship did not hold at the professor level where salaries were not considered to be determined by pay scales but by variations in individual research productivity.
Kruger and Rouse (1998)	US	A workplace education program at two companies was associated with a small, positive impact on earnings at the manufacturing company but an insignificant impact at the service company.
Dearden et al (2000)	UK	A 5 percentage point increase in the proportion of workers training in an industry is associated, on average, with a 1.6 per cent increase in wages.
Long (2001)	Australia	<ul style="list-style-type: none"> • <i>The number of years spent working in an occupation has a strong effect on earnings, but the size of the effect declines with experience.</i> • <i>Structured training has a positive effect on earnings (4.7 per cent) but the effect of the various forms of unstructured training is mixed.</i>
Smith (2001)	Literature review (Australia)	<i>Participation in enterprise-based training is associated, on average, with an 8 to 9 per cent increase in wages.</i>
Ryan (2002)	Australia	<i>Uncertified VET study appeared to have little effect on wages. Also, although the wage of VET graduates is larger it grows at a lesser rate than non-graduates (indicating a lesser return to work experience).</i>
Vignoles et al. (2004)	UK	Male workers who undertook work related training in mid-career (aged 33–42) experienced 4–5 per cent higher wage growth over the period 1991–2000. However, firms tend only to train those workers who will gain from training. When this was taken into account workers who received training experienced a 12 per cent higher wage growth over the period.
Richardson (2004)	Australia	<ul style="list-style-type: none"> • <i>Those with the least education (less than Year 12) systematically report receiving less of the main forms of employment-based training.</i>

¹¹ The authors also undertook a related study in 1981 that found that performance played a substantially smaller role in explaining experience-earning differential and earnings growth than would be expected by the human capital explanation of the experience-earnings profile.

Study	Country	Key results
		<ul style="list-style-type: none"> • <i>The more formal the training, the more it is focused on those with more education.</i> • <i>Analyses the amount of general and specific training received in different industries.</i> • <i>Estimates the employer contribution to training as being equivalent to around 5 per cent of the wage bill.</i>
Dearden et al. (2005)	UK	A 1 percentage point increase in the proportion of employees trained (say from 10 to 11 per cent) is associated with a 0.3 per cent increase in wages.
Green and McIntosh (2006)	UK	<ul style="list-style-type: none"> • Participation in non-certified learning is, on average, associated with a 5 to 6 per cent increase in wages. • A strong correlation was found between formal qualifications obtained and the incidence of non-certified learning. • The co-efficient on duration of training was insignificant implying that it is participation in non-certified learning (rather than its duration) that is associated with wage outcomes.

The studies show a strong positive correlation between learning and the productivity of individual workers for both categories of learning. However, it has long been recognised that a correlation between two variables does not necessarily imply a causal relationship between them. The question therefore arises as to whether or not the results of the studies are likely to have been influenced by unobserved factors not taken into account. Such unobserved factors could include social class, innate ability and the possible endogeneity of learning (that is, the idea that more productive individuals may be more likely to undertake learning).

To address the issue of potential influencing factors, the studies have sought to provide for controls in a variety of ways. For example, some studies incorporate such variables directly into the model utilised¹² while others have used natural experiments.¹³ The correlation between learning and the productivity of individuals generally withstands the inclusion of these controls. In fact, Oosterbeek and Walker (2003) note that controlling for such factors does not generally reduce the return and may actually increase it.¹⁴ However, as Ingram and Neumann (2006) suggest, it is likely that unobserved characteristics are important in explaining wage variations within qualification groups.

Increased wages or earnings may not be the only benefits that an individual derives from learning. As noted above, learning may also affect the probability of participation in the labour force or employment.

In the case of Australia, there appears to be a strong correlation between holding qualifications and labour force participation. For example, Keating, Riemens and Smith (forthcoming) note that the decline in male participation between 1981 and 2001 was almost entirely driven by those without a

12 See, for example, Walker and Ahu (2003) (which controlled for factors including age, region, union membership and marital status) and Green and McIntosh (2006) (which controlled for a wide range of individual and labour market characteristics, including occupation and industry worked in).

13 Natural experiments have tended to use twins (for example, Ashenfelter and Krueger (1994) and Lee (2000) or exploit policy differences (for example, studies have exploited school admission cut-off dates to estimate the private return of an additional year of schooling for those leaving at the minimum age i.e. the study exploited the fact that those born one day after the 'cut-off' would receive almost one year less schooling if they left at the minimum age than a student born on the 'cut-off': see generally, Card (2001).

14 The study finds that there is an unambiguously positive effect on the earnings of an individual from participation in education and that the size of the effect seems large relative to the returns on other investments.

post-school qualification. In particular, the analysis showed that nearly nine out of ten people of working age with a non-school qualification (86.2 per cent) were in the labour force in 2011, compared to 68.9 per cent of those without such a qualification. Outcomes are even worse for the almost 2.9 million Australians who had not completed Year 10 with almost 38 per cent not being in the labour market.

The importance of qualifications to participation and employment does not appear to be unique to Australia. Studies in other countries have shown similar results. For example, Hendy et al. (2003) found that around one third of the variation in employment growth across the New Zealand industries and occupations considered was related to differences in qualifications¹⁵

Studies have also examined which individuals, on average, obtain the most benefit from learning. The most pertinent studies in this respect relate to learning and disadvantage. In particular, several studies have found that it is individuals with low socioeconomic status, with lower levels of education attainment, and who are the least skilled that stand to gain the most from additional learning (see, for example, Kruger and Lindahl, 1998, Blundell et al., 1999, and Denny and O'Sullivan, 2005). This finding is not surprising as it is consistent with economic theory that suggests that there are diminishing marginal returns for additional learning.¹⁶

What is surprising, however, is that the literature also suggests that those who stand to benefit the most from learning are less likely to participate in it. For example, Blundell (1999) found that individuals with no or intermediate-level qualifications, individuals with low social economic status, women, part-time workers and older workers have relatively low participation rates in training.¹⁷ In contrast, that study found that people with higher ability and higher educational attainment had relatively high participation rates in training.¹⁸ Such an outcome is clearly sub-optimal from a social and economic perspective. Skills will likely become increasingly important to the labour market outcomes of advanced economies given that skills would need to complement technological developments.¹⁹

The literature also suggests, however, that the benefits derived from additional learning depend on each individual's attributes and the nature of the economy in which they seek employment. For example, Dockery (2005) suggests that the wage and employment outcomes for less able individuals may be worse if they remain in school rather than undertake a traineeship.²⁰ In relation to the importance of the nature of the economy, Krueger and Lindahl (1999) note that in developing countries higher education may be positively associated with unemployment. These studies suggest the need for Governments to appropriately target their education policies to individuals and the needs of their economy.

Effect on firm performance

Studies on the relationship between learning and productivity at the firm level offer two key advantages in comparison to studies that focus on the outcomes of individuals. First, firm level studies provide the potential for a direct measure of productivity at the micro level, without resorting to the use of proxies such as wages. Second, it is unlikely for all productivity gains to accrue to individuals or be reflected through observed wages. For example, labour markets may not be competitive, meaning that wages would not equal the marginal value of labour. Alternatively, individuals may receive non-

15 Studies have also found links between foundation skills and labour force outcomes, such as participation. These are discussed separately below in Section 3.

16 There are papers, however, that suggest that more able individuals (who are likely to also be the most qualified) get better returns from training. See, for example, Booth (1991) and Acemoglu and Pischke (1998).

17 See also Denny and O'Sullivan (2005).

18 Possible reasons for this include more educated individuals being better able to invest in training and the possibility that training may form part of an individual's remuneration package, particularly where the monetary wage is not flexible. See, for example, Booth and Zoega (2004). Further, as noted by Dockery (2005), the risk of additional learning (for example, a negative return or failure) may be higher for the less skilled.

19 See for example, literature on skilled bias technological change such as Violante (2012) of Card and DiNardo (2002).

20 In relation to probability of employment, the study found that if less able individuals stay on at school rather than leave in Year 10, their probability of unemployment increases from 6.6 per cent to 9 per cent.

wage benefits such as training or conversely may subsidise such benefits through accepting lower wages.

Notwithstanding these advantages, firm level studies present their own challenges. Chief among these is the difficulty of obtaining reliable data. This may partly explain why there appears to be less literature on the relationship between learning and productivity at the firm level in many countries including Australia.²¹ Also, it appears that much of the literature at the firm level focuses on the link between non-certified learning (as opposed to formal learning) and productivity. The results of the main firm level studies identified by this review are summarised in table 3 below.

Table 3—Learning and productivity at the firm level

Study	Country	Key results
Prais, Jarvis and Wagner (1989)	UK, Germany	Better vocationally training in German hotels was associated with around a one third reduction in labour requirements compared to hotels in the UK.
Holzer, Block, Cheatham, and Knott (1993)	US	Receipt by manufacturers of state training grants is associated with a large and significant, though one-time, increase in training hours, and with a more lasting reduction in output scrap rates (as an indicator of worker performance and productivity).
Bishop (1994)	US	The productivity gains from training are more likely to flow to firms than individuals when the training develops skills that are specific to a firm or specific to an industry or occupation (i.e. to a small number of firms in a locality).
Bartel (1994)	US	Formal training in firms with relatively low productivity (compared to competitors) was associated with a 6 per cent increase in productivity per year and enabled the firm to catch-up to competitors.
Lynch and Black (1995)	US	There are significant and positive effects on productivity associated with investments in human capital. Those establishments that hire better educated workers have appreciably higher productivity. The impact of employer provided training differs according to the nature, timing and location of the employer investments. The number of workers in the firm in receipt of training did not have an effect on productivity for either the manufacturing or non-manufacturing sample of firms. However, the percentage of formal training that occurred off-the-job had a significant effect on labour productivity in the manufacturing sector.
Bartel (1995)	US	Formal training within a manufacturer was associated with a positive and significant effect on rate of return, job performance and productivity. For example the return to the company was at least 13 per cent.
Lynch and Black (1996)	US	A 10 per cent increase in average education was associated with an increase of 8.5 per cent and 12.7 per cent in manufacturing and non-manufacturing, respectively.
Black and Lynch (1997)	US	No significant association found between training and productivity. ²²

21 It also affects the reliability of studies with many relying on relatively small samples. For example, Blandy et al., (2000) involved a sample of only 95 firms (including three in depth case studies). However, there are some studies that use larger samples. For example, Black and Lynch (2001) used a sample of more than 3,000 private establishments.

22 Note, the authors suggested that the survey information used may have been too weak to capture the effects of training in the estimation framework.

Study	Country	Key results
Krueger and Rouse (1998)	US	A workplace education program at two companies was positively associated with the incidence of job bids, upgrades, performance awards, and job attendance. However, trainees were equally likely to exit the company as non-trainees.
Dearden, Reed and Van Reenen (2000)	UK	Raising the proportion of workers trained in an industry by 5 percentage points (say from an average of 10 per cent to 15 per cent) is associated with a 4 per cent increase in value added per worker and a 1.6 per cent increase in wages.
Blandy et al. (2000)	Australia	<i>Nearly all the productivity gains from incoming employees' training were captured by firms in Australia (compared with about half of the productivity gains in the US) and the profitability of firms is directly related to the quantity and quality of training offered.</i> ²³
Maglen, Hopkins and Burke (2001) ²⁴	Australia	<i>Results of the study were mixed depending largely on a firm's industry.</i> <ul style="list-style-type: none"> • <i>Footwear manufacturing—Each dollar invested in training was associated with a fifty-eight dollars increase in value added.</i> • <i>Wire products manufacture—Training of non-management personnel was associated with increased productivity in four out of five firms examined. For the four firms, each dollar spent on training was associated with a \$190 increase in value added.</i> • <i>Services industries—investment in training ineffective except in relation to hotels (rooms booked per hour).</i>²⁵ <i>The study also suggests that training appeared more effective when combined with other human resource management practices or as part of a business strategy.</i>
Michie and Sheehan-Quinn (2001)	UK	Found a positive correlation between company performance and human resource management systems that included training. Good HRM initiatives are more successful when introduced as a comprehensive package.
Black and Lynch (2001)	US	<ul style="list-style-type: none"> • Raising the average education level of nonproduction workers by 10 per cent (approximately one more year of schooling) is associated with a 4 per cent increase in productivity.²⁶ • No association found between productivity and whether or not workers were engaged in training.
Greenhalgh (2002)	France	Referred to French studies and concluded that the 'studies demonstrate that vocational training activity is associated with increased net output by firms, a higher rate of return on assets, payment of higher wages and a greater propensity to innovate.' ²⁷

23 The study, which focused on on-job training, also found that about half of an employee's time is taken up with training over the first three months of employment (compared with a third of the time in the US) and that Australian workers' pay for their training through accepting lower starting salaries.

24 The study involved case studies in four industries: footwear manufacture, wire products manufacture, four- and five-star hotels (accommodation) and supermarkets. Between five to eight firms in each industry were involved.

25 The authors considered that the result may have been due to unique characteristics of the industry.

26 However, note that the coefficient on education was positive but insignificant when Generalised Method of Moments (GMM) techniques were used. The authors conclude however that plant productivity is higher in businesses with more-educated workers.

27 Ananiadou et al. (2003) produced a summary table of five relevant French studies all of which reported a positive association between training and productivity. The table has not been reproduced here.

Study	Country	Key results
Collier et al. (2005)	UK	Positive correlation exists between training and firm survival in the medium term (after 7 years). For example, the study found: <ul style="list-style-type: none"> Nearly 19 per cent of the sample establishments which did not provide any continuing training closed down, compared with 13 per cent of establishments which did train; and raising the proportion of employees in receipt of training by 10 percentage points is associated with a reduction in the likelihood of closing down by 1.1 percentage points.
Dearden et al. (2005)	UK	A 1 percentage point increase in the proportion of employees trained in an industry (say from 10 per cent to 11 per cent) is associated with about a 0.6 per cent increase in value added per worker and a 0.3 per cent increase in wages.
Green and McIntosh (2006)	UK	No significant association found between non-certified learning and gross value added.
Zwick (2006)	Germany	A 1 per cent increase in the share of trained employees in the first half of 1997 was associated with a more than 0.7 per cent increase in average value added in the period 1998–2001.
Columbo and Stanca (2008)	Italy	A 1 per cent increase in training intensity (share of employees participating in training) was associated with a 0.07 per cent increase in value added per worker. The study also found that the effect of training on wages was about half the size of its total effect on productivity.
Bernier and Cousineau (2010)	Canada	A 10 per cent increase in expenditures for structured training per employee results in a 1.7 per cent increase in the firm's productivity for the following year. In addition, a 10 per cent increase in capital investment accompanied by formal training is associated with a 0.6 per cent increase in firm productivity the following year, compared to a company that had not integrated practices complementary to training, such as investments in physical capital.
Sala and Silva (2011)	Europe (multi-country)	An additional hour of vocational training per employee was associated with a 0.55 per cent increase in the rate of productivity growth.

There is literature to support the proposition that the effect of training on productivity is larger than its effect on wages. For example, Dearden, Reed and Van Reenen (2000) found that the overall effect of training on productivity was around twice as large as its effects on wages. However, it is also likely, as Blandy et al. (2000) found, that workers in high training firms get paid more on average than workers at low training firms. Together, such literature suggests that workers and firms share the productivity gains from training.

That firms would benefit from training workers is not surprising. A rational profit maximising firm would not undertake or invest in training unless they expected a return. Economic theory would suggest that the expected return would at least have to equal the opportunity cost of providing the training. However, it should be noted that even if all the increased productivity of a worker was absorbed by that worker's wage, it may still be rational for a firm to provide training if there were sufficient complementary benefits for the organisation as a whole. That is, sufficient benefits external to the individual but internal to the firm.²⁸

²⁸ As discussed below, such benefits may result from training enhancing the ability of the organisation to absorb new technology, techniques and expertise.

However, some firm level studies have found no significant relationship between training and productivity. This was the case, for example, in both Lynch and Black (1995) and Green and McIntosh (2006).

Overall, the literature tends to indicate a positive association between training and firm performance. However, there is also literature that suggests that the association may be stronger when combined with other policies within firms. For example, Smith (2001) notes that skills and training produce the best results when they form part of an overall businesses strategy. Likewise, several studies have found a positive impact on firm performance when training is part of a wider human resource management strategy (see, for example, Huselid, 1995, Huselid and Becker, 1996, Ichniowski et al., 1997; and Sheehan-Quinn, 2001). These results appear logical as it would be expected that better-managed firms or staff achieve more from training.

Benefits to economy

The preceding sections examined the literature on the effects of learning on individuals and firms, that is, at the micro level. Another approach in examining the productivity effects of learning is to focus on whether or not there are economy wide implications. Such studies are generally conducted on a cross-country basis although there are some studies at the regional level (see, for example, Draca, Foster and Green, 2003).

A potential limitation of cross-country studies is that underlying differences among countries may make it difficult to interpret results.²⁹ For this reason, the studies commonly limit their samples to countries that are otherwise similar, for example, a sample consisting of only advanced economies. However, even among advanced economies (such as members of the OECD) significant underlying differences exist. One alternative would be to restrict the sample even further, however, a sample size that is too small would risk diminishing the reliability of the results.

Notwithstanding these possible limitations, there is much to be learned from cross-country studies. For example, analysis at the country level has the potential to include benefits that are external to individuals and firms, but internal to the economy. Such benefits may possibly include benefits associated with health outcomes and technological transfers within the economy.

The table below summarises the findings in the literature that examines the impact of learning on productivity at the economy level.

29 These differences could either be unrelated to learning or result from difficulties with comparing learning across jurisdictions (e.g. the absence of a standardised education system making comparisons difficult). Also, a series of potential issues with macro level studies are noted in Sianesi and Van Reenen (2003), including: potential aggregation biases; the undue imposition of restrictions (e.g. linearity and homogenous impact of education); and reverse causality problems (e.g. it may be that income growth leads to increase demand for education via increased consumption possibilities and structural changes in the economy or that efficiency in the education system is associated with more general efficiencies in the economy).

Table 4—Learning and productivity at the economy level

Study	Country	Key results
Knight et al. (1993)	Cross-country	Finds a significant and positive association between human capital and economic growth.
Benhabib and Spiegel (1994)	Cross Country	Undertakes growth accounting regressions implied by a Cobb-Douglas aggregate production function. The results indicate that human capital is insignificant in explaining per capita growth rates (i.e. increases in educational attainments were not associated with economic growth).
Hamilton and Monteagudo (1998)	Cross-country	Investment in human capital has no ability to account for changes in growth rates in output per capita over time.
Krueger and Lindahl (1999)	Cross-country	Education is positively associated with economic growth once measurement error in education is accounted for. After adjusting for measurement error, the change in average years of schooling often has a greater effect in the cross-country regressions than in the within-country micro regressions.
<i>Barnes and Kennard (2002)</i>	<i>Australia</i>	<i>Factors other than increased skills (measured in terms of educational attainment plus work experience) mainly contributed to Australia's productivity surge from the mid-1990s. The study found that growth in skills contributed only around 0.05 of a percentage point to the 1.7 per cent a year growth in multifactor productivity from 1993–94 to 1997–98.³⁰</i>
<i>Dorwick (2002)</i>	<i>Australia</i>	<i>A one-year increase in the average educational attainment of the working-age population is associated with an 8 per cent increase in real GDP.</i>
<i>Dean Parham (2003)</i>	<i>Australia</i>	<i>Whilst the level and type of available human capital likely played a part in Australia's productivity surge in the 1990s, the timing of accumulation in human capital does not fit the timing of the 1990s productivity acceleration. The weight of evidence suggests there was a slower rate of accumulation of human capital in the Australian workforce in the 1990s, which all else equal would have detracted from the productivity surge in the 1990s.</i>
Sianesi and Van Reenan (2003)	Literature review	A one-year increase in average education is associated with a 3 to 6 per cent increase in the level of output per capita.
<i>Draca, Foster and Green (2003)</i>	<i>Australian states</i>	<i>The three states possessing the highest per capita incomes (NSW, VIC and WA) have the highest education completion rates. Much of the differences in output per capita between the states can be explained by differences in human capital, particularly differences in secondary level qualifications.</i>

30 The study also found that growth in skill contributed 0.2 of a percentage point to the 0.7 per cent a year growth in multifactor productivity between 1988–89 and 1993–94 and that skills may have contributed indirectly to growth by enabling innovation, particularly the take-up of ICT.

OECD (2004)	Cross-country	A one-year increasing in average education is associated with a 5 per cent increase in aggregate productivity with the possibility of a larger effect in the long term.
OECD (2006)	N/A	A large body of empirical research has confirmed a positive link between education and productivity.
Leitch Review (2006)	UK	Argued that 'skills were a key lever within our control to improve productivity in the workplace—one fifth or more of the UK's productivity gap with countries such as France and Germany results from the UK's relatively poor skills'. Moreover, the report stated that productivity was increasingly driven by skills and the ability of firms to succeed in the face of growing international competition depended increasingly on the skilled labour force they could draw.
Canton (2008)	Cross-country	A one year increase in the average education level of the labour force would increase labour productivity by 7–10 per cent in the short run and by 11–15 per cent in the long run. Canton also found evidence for the presence of spillover effects whereby the human capital stock increased prospective economic growth.
PC (2008)	Australia	<i>Raising educational qualifications tends to improve the productivity of labour, especially when education improves technical or problem-solving skills, or improves understanding and dialogue in the workplace.</i>
Mason, O'Leary and Vecchi (2012)	Cross-country	A 1 per cent increase in skills (certified and uncertified) is associated with a 0.291 per cent increase in average labour productivity (ALP). A 1 per cent increase in high level skills is associated with a 0.13 per cent increase in ALP

An interesting observation from the above table is that the majority of cross-country studies examine the link between formal education and productivity. There appears to be few cross-country studies that consider the impact of non-certified learning.³¹ One possible explanation is that access to reliable country level data is easier for formal learning than it is for uncertified learning. By its nature, it is less likely that data on non-certified learning would be consistently captured or centralised. In addition, non-certified learning may be less standardised and more difficult to accurately and consistently define across countries than formal learning.

Overall, the above-mentioned studies appear to demonstrate a positive relationship between learning and productivity. This relationship is consistent with economic theory that suggests that increasing a factor of production (in this case human capital) will expand the productive capacity of an economy.

There are, however, some studies that find no significant connection between learning and productivity (see, for example, Hamilton and Monteagudo, 1998). However, these studies (like others considered in this section) focus on the effects of additional learning on economic growth (i.e. flow effects). They do not take into account that learning may also have a stock effect, as suggested by endogenous growth models. That is, the stock of human capital may effect productivity indirectly by, for example, impacting the adaptive capacity of an economy or its ability to otherwise innovate. Therefore, if endogenous growth models are correct, learning may not only impact labour productivity but also multi-factor productivity.³²

³¹ Mason, O'Leary and Vecchi (2012) is an example of a study that considers the impact of both certified and uncertified skills.

³² If endogenous growth models are correct it is a misspecification to confine ones analysis to the impact of learning on labour productivity. Literature relating to whether there is a link between learning and innovation is discussed below in Section 4.

Section 4 of this review considers in further detail the literature examining correlations between learning and innovation. For the purposes of this section, however, it is noted that Mason, O’Leary and Vecchi (2012) found tentative evidence to suggest that the use of high-skilled labour is positively associated with multi-factor productivity growth in industries that make intensive use of university graduates.³³ However, evidence of such effects was not found in other industries.

As noted above, differences in education systems between countries may make cross-country comparisons difficult. To address this difficulty, some studies have used student results in internationally comparable examinations³⁴ as an indicator of labour force quality, rather than years of schooling or qualifications (see, for example: Hanushek and Kim, 1995; Hanushek and Kimko, 2000; Barro, 2007 and Hanushek and Wosmann, 2010)³⁵. There appears to be two consistent results from these studies that are particularly pertinent, namely:

- (i) that labour quality as indicated by the test results is positively associated with growth in GDP per capita; and
- (ii) that labour quality as indicated by the test results is a better indicator of growth in GDP per capita than the quantity of education.

The studies therefore highlight the importance of the quality of education, suggesting that it is the knowledge attained that matters, rather than the quantity of education received. That is, the knowledge gained by education (as opposed to the years of learning undertaken) has a greater impact on productivity and economic growth.

There are also cross-country studies that suggest that educated women are not well utilised in the labour market of many countries. For example, Barro (2000) found that the participation of qualified women in the labour market was poor relative to the participation of men. In this respect, it is interesting to note that in Australia the participation of women with a bachelor degree or above is 79.5 per cent, compared with 86.2 per cent per cent for men.³⁶ Addressing this imbalance may assist Australia meet the challenges of the twenty-first century, including those posed by an aging population.

Relative importance of different levels of education and types of learning

The above analysis considers the impact of learning on individuals, firms and the economy as a whole. However, a question that cuts across these studies (particularly the studies focused at the individual and economy level) is the relative importance of different levels of learning—early childhood, primary, secondary and tertiary education. By its nature, the studies that sought to address this question generally focused on formal learning.

One view that emerges from the literature is that, in general, earlier learning provides greater returns than later learning, e.g. early childhood education provides greater returns than primary school education and so on.³⁷ Heckman and Lochner and Masterov (2006) lends support to this view. This study found that high returns from early childhood learning were likely to be due to more time being available to realise gains and because it improves an individual’s skill base for further learning. This

33 Defined as industries where the graduate share of employment is greater than 15 per cent.

34 Examinations are typically in science, mathematics and comprehension. Interesting, Barro (2000) found that science scores had a particularly strong positive association with economic growth. This would seem to support a connection between leaning and the innovative capacity of the economy as foreshadowed by endogenous growth theorists.

35 The results of some of these studies are outlined in table 7 below.

36 Source: Australian Bureau of Statistics, 2011 Census of Population and Housing.

37 The importance of early learning is likely to have a close relationship to the importance of foundation skills. See discussion below in Section 3.

reasoning is supported by Leuven, Lindahl, Oosterbeek and Webbink (2004) who present evidence that early learning makes subsequent learning easier due to improved foundation skills.³⁸

The importance of earlier education relative to later education is also supported by studies that examine learning subsequent to early childhood education. Psacharopoulos (1994), for example, found that primary education generally provided the highest return followed by secondary and tertiary. Likewise, Mason and van Ark (1994) considered that differences in the productivity of engineers between two countries were associated with the relative earlier availability of VET in schools.

Other studies have found, however, that the relative returns from educational levels depend on an economy's level of development. For example, Sianesi and Van Reenan (2003) and Matton (2006) suggest that tertiary education is most important for advanced economies.³⁹ The rationale for this view is the link between higher-level education and technology. The link between higher-level education and technology is discussed in further detail at Section 4. For present purposes, it is sufficient to note that such findings appear supported by a significant body of literature that finds that the benefits of technological change may be biased towards higher skilled individuals.

A summary of Sianesi and Van Reenan's (2003) key findings on the importance of each educational level are set out in table 5 below.

38 The study found that allowing disadvantaged children to start school one month earlier increases their LLN test scores in grade 2 on average by about 0.06 of a standard deviation. No effect was found for non-disadvantaged students.

39 Consistently, the study also suggests that primary and secondary skills appear related to growth in the poorest and in intermediate developing countries, respectively.

Table 5—Importance of different levels of education

Level of education	Key findings
Primary ⁴⁰	<p>A 1 percentage point increase in primary school enrolment rates is associated with a 2 percentage point increase in the growth rate of GDP per capita (was not able to be estimated for only OECD countries due to homogeneity within that sub-sample).</p> <p>A 1 percentage point increase in the stock of primary human capital is associate with a less than 1 percentage point increase in the growth rate of GDP per capita (again, not possible to estimate just for OECD countries).</p>
Secondary	<p>A 1 percentage point increase in secondary school enrolments is associated with a 2.5 to 3 percentage point increase in growth (the effect is between 0 and 1.5 percentage points when the sample is restricted to OECD countries).</p> <p>An additional year of education is associated with a 0.5 to 1.2 percentage point increase in the growth rate of GDP per capita (there is no association when the sample is restricted to OECD countries.)</p>
Tertiary	<p>A 1 percentage point increase in the annual growth of human capital is associated with a 5.9 percentage point increase in GDP per capita for OECD countries.</p> <p>A one per cent increase in the initial human capital stock is associated with a 1.1 percentage point increase in GDP per capita growth.</p>

There is also evidence emerging from the literature that suggests that higher levels of education may be relatively more important for Australia. For example, Leigh (2008) found that the productivity gains associated with formal learning appeared to be greatest for grade 12 and Bachelor degree completion. Significant productivity gains were also found in association with post-graduate degrees.⁴¹ Leigh (2008) also examined the impact that each level of education had on earnings. The study found that qualifications tended to yield greater participation benefits for individuals with relatively low earnings and greater productivity gains for those with higher earnings.

Other interesting findings from the literature regarding the relative importance of learning include:

- (i) Employer provided training versus other training. Studies have suggested that employer provided training has larger and longer lasting impacts on earnings than other training. For example, Wolf (2002) found that a vocational qualification obtained on an employer provided course provided around twice the benefit of such a qualification obtained off-the-job. Blundell et al (1999) reached a similar conclusion and noted that employer provided training was portable to later jobs.
- (ii) Formal qualifications versus non-certified learning. Blundell et al (1999) suggested that the former was worth more than the later. This may result from formal qualifications being more portable or recognisable.
- (iii) Generic training versus specific training. There are studies indicating that generic skills increase productivity more than specific skills. For example, Barret and O'Connel (2001) found a significant positive effect on productivity for general training but not for specific training.⁴² The result appears to be supported by Blundell et al (1999) who found that managerial training had the largest impact on wages followed by professional and technical training and semi-skilled

40 Note, Barro (2000) found no association between primary education and growth, but suggested that it may affect growth indirectly by being an enabler of further study.

41 Leigh (2008) adjusted for ability bias by using ability bias estimates published in the literate, which he considered to be around 10 per cent.

42 The positive effects of general training remained after controlling for factors such as changes in work organisation, corporate re-structuring, firm size, and the initial level of human capital in the enterprise.

training. Again, these results may be due to generic skills being more transferable (both between and within firms) than specific skills.

Marginal versus average return

An interesting observation emerging from the literature considered above is that, overall, the average productivity returns to education has remained significant and positive over an extended period despite increases in the average level of education attained. This raises a question as to whether or not learning suffers from diminishing marginal returns (as economic theory suggests) and if so where Australia sits in terms of the most efficient level of educational investment.⁴³

The studies considered by this review generally focus on the average productivity returns to learning rather than the marginal returns. While a consideration of the average rate of return is useful, it cannot be assumed that this would provide an accurate indication of the returns derived from additional investment in learning. To the contrary, economic theory suggests that investments usually suffer from diminishing marginal returns. If this is the case with education, additional learning will provide less than the average return. In addition, it is possible for the average return to be positive despite a negative marginal return (meaning that a positive average return does not necessarily warrant additional investment).

The literature also examines the question of whether or not educational investment is subject to diminishing marginal returns. The studies considered generally find that it is (see, for example, Blundell et al., 1999;⁴⁴ and Kruger and Lindahl, 1998).⁴⁵ As noted above, this result is expected and consistent with economic theory. It is logical to assume that on average individuals would undertake the most beneficial learning first and that firms would utilise and train the most productive individuals first.

Signalling theory

Before concluding this section of the review, it is worth noting that there is a body of literature suggesting that education may be more a 'signal' to employers of a worker's underlying attributes as opposed to being a means of enhancing human capital. That is, education acts primarily as a screen that assists employers in identifying the most productive workers, rather than as a means of enhancing skills and thereby human capital.⁴⁶

If signalling theory holds true for education, then investments in education may be of limited efficiency. This is, of course, unless education reduces transaction costs for firms (in selecting staff) to an extent that would justify society's costs of educational investment. However, even then the benefits of education could be undermined as individuals may undertake study simply to game the system (regardless of the qualifications true social value), reducing its effectiveness as a signal. The economy would also have to suffer the 'opportunity cost' (e.g. lost production) of such individuals undertaking the study.

One way to ascertain the existence of signalling effects is to draw a comparison between the value of qualifications to salaried workers and the value of qualifications to self-employed workers. In theory, the existence of a signalling effect would result in a higher return for salaried workers (as self-

43 It would be difficult to estimate the efficient level of educational investment itself. The level would be constantly changing due to factors such as technological change.

44 As noted above, Blundell et al., (1999) also suggests that more qualified and able individuals are relatively more likely to obtain a qualification than those that would benefit the most from training.

45 Kruger and Lindahl (1998) is a particularly interesting example as they suggest that education has a peak growth return at around 7.5 years. This would suggest that Australia is at least on the downward sloping portion of the education return line.

46 In this respect, note that some jobs require a qualification regardless of the underlying attributes of individuals e.g. court admission requirements for legal practitioners require an individual to hold certain qualifications.

employed workers do not need to signal to prospective employers). This may, however, be too simplistic as:

- (i) the choice to be self-employed or a salaried employee may not be random but depend upon unobserved factors;
- (ii) self-employed workers may derive a 'signalling' benefit by signalling to third parties such as their customers;
- (iii) self-employed workers may not take the benefits of education through wages (or other easily measured source) but reinvest them in their business for longer-term benefits;⁴⁷ and
- (iv) self-employed workers may perform different functions to salaried workers, for example, they may be more likely to undertake a variety of tasks (both managerial and clerical) and therefore less likely to gain benefits from specialised qualifications.

Castagnetti et al., (2005) and Wolpin (1977) are two studies that explore the value of qualifications to salaried workers compared to the self-employed. Both studies found that education has a greater productivity effect for salaried workers than for the self-employed. However, the effects in the case of the former study (based on Italian data) are much larger than for the latter study which found that the self-employed obtain around 75 per cent of the benefits of salaried workers. The result, therefore, suggests that around 25 per cent of the gains attributable to qualifications are based on factors other than increased productivity.

While it is likely that qualifications do provide some form of 'signal' to potential employers, the literature reviewed does not suggest that this is a dominating factor.⁴⁸ Perhaps signalling theory is most useful in providing support for governments and educational institutions in ensuring that a high quality of education is achieved, so that signal effects cannot be exploited. As suggested by Wolf (2002), employers should also avoid practices that allow signalling to unduly distort the market for skills or which devalue core skills.

47 For example, Psacharopoulos (1994) suggests that the firm level returns to learning are greater in the self-employment (unregulated) sector of the economy than in the dependent employment sector.

48 In fact, Lange and Topel (2006) find insufficient empirical evidence of the existence of a signalling effect.

3. Foundation skills

Foundations skills include reading, writing, numeracy and oral communication along with employability and learning skills. It appears uncontroversial that foundation skills would be critical for enabling both learning and employment.

The importance of foundation skills is borne out in the literature. For example, the Moser report (1999) found that many Britons with limited basic skills had serious disadvantages at work and in finding work. This, the report argued, limited much of what a full life could offer to these individuals. Moreover, the report stated that limited skills restricted the economy, and was one factor underlying the UK’s relatively poor productivity compared with much of Europe.

In Australia, the Australian Workforce and Productivity Agency (AWPA) (2013) has emphasised the importance of foundation skills. The report notes the enabling characteristics of such skills and their importance to individuals, firms, the economy as well as society through indirect benefits such as enhanced social inclusion.

There is much evidence to support the positions put forward by the Moser Report and AWPA (2013). The table below outlines some of the relevant studies relating to foundation skills.

Table 6—Foundation skills and productivity

Study	Country	Key results
Romer (1990)	Cross-country	The initial level of literacy (but not the change in literacy) helps predict the subsequent rate of investment, and indirectly, the rate of growth.
Wolf (2002)	N/A	Suggests that it is literacy and numeracy training that most affects labour market outcomes.
<i>Chiswick, Lee and Miller (2002),</i>	<i>Australia</i>	<i>The estimation of models of labour market outcomes that include variables for both level of education and literacy and numeracy shows that perhaps as much as one-half of the total effect of education is in fact an indirect effect of education that arises due to the higher literacy and numeracy skills of the better educated.</i>
Coulombe, Tremblay and Marchand (2004)	OECD	A 1 per cent increase in adult literacy scores relative to the international average is associated with reaching a steady state with labour productivity and GDP per capita 2.5 per cent and 1.5 per cent higher than other countries, respectively. ⁴⁹ The study found that literacy scores, as a direct measure of human capital, perform better in growth regressions than indicators of schooling.
Ananiadou et al., (2004)	Literature review	The evidence suggests that better numeracy and literacy skills have a strong positive effect on individuals’ earnings and employment stability, even when other relevant factors, such as qualification levels are taken into account. Improvement of basic skills levels in adults has very small or even no positive effect on wages and employment probability.

49 The study estimated the relationship between human capital and economic growth using internationally comparable literacy scores. The literacy results of 17-to-25-year-olds in a given period were then used as proxies for investment in human capital during the previous period.

Earl (2010)	New Zealand	For males who have not completed school, higher levels of literacy are strongly associated with employment. For those that have completed school or have qualifications the separate effects of literacy on employment are not as marked.
Shomos (2010)	Australia	<i>An improvement in LLN from level 1 to level 3 is associated with about a 25 and 30 per cent increase in wages for women and men, respectively.</i> <i>An improvement in LLN from level 1 to level 3 is associated with a 5 and 15 percentage point increase in the likelihood of labour force participation for men and women, respectively.</i> <i>The effect of education on labour market outcomes was reduced but still positive for most levels of attainment after controlling for literacy and numeracy scores.</i>
Curtis (2010)	Australia	<i>Literacy has a strong association with employment outcomes even after taking account of qualifications.</i> <i>Those with higher levels of qualifications receive higher additions to their wages for a given level of literacy than those with lower or no qualifications.</i>
Heckman and Kautz (2012)	US	Cognitive ability measures do not adequately capture, soft skills—personality traits, goals, motivations, and preferences—that are valued in the labour market, in school, and in many other domains. The link between soft skills and labour market outcomes is causal and they have an important place in an effective portfolio of public policies.

The above studies provide strong evidence of a positive association between foundation skills and productivity.⁵⁰ However, achieving productivity gains through improved foundation skills can be challenging. Attempts to improve foundation skills in the adult population indicate that it may be difficult to design effective programs to enhance such skills. Wolf et al (2010)⁵¹ and Krueger and Rouse (1994, 1998)⁵² are examples of studies that considered the results of programs to improve foundation skills.

The literature indicates that foundations skills are more easily developed during an individual's formative years.⁵³ However, this is not to say that interventions later in life cannot be successful with careful design. Some of the design considerations that appear important include: ensuring employers support the program and are behind its implementation; ensuring that learners improve their literacy to a degree that will change their work performance or lead to additional job opportunities; recognising that there are likely to be benefits from foundation skills that are external to both firms and individuals; recognising that foundation skills may take some time to improve and communicating this to employers and those undertaking training; and, targeting those individuals and firms that stand to benefit the most from improved foundation skills (i.e. those firms and individuals that are being held back).

50 See also Burke 2010 which provides an overview of relevant Australian and New Zealand data and analysis.

51 Wolf et al (2010) conducted a longitudinal study that tracked 53 workplaces hosting subsidised basic skills courses, and examined the impact on the enterprises themselves as well as on learners. The study found that contrary to policy-makers' expectations, employers were not particularly concerned about employees' literacy levels, and supported the provision largely as a way of providing general development opportunities. Once subsidies ended, employers were generally unwilling to support further provision at full cost suggesting that the program did not have an immediate impact on performance. Overall, the authors found that the program had no lasting impact.

52 Krueger and Rouse (1994, 1998) examined the impact of a workplace literacy program on a variety of employment outcomes for individual employees, such as earnings, staff turnover, and absenteeism. The study analysed a basic skills tuition program that was delivered to 480 low-skilled, hourly-paid workers at two mid-sized New Jersey (US) companies (one service, one manufacturing). Overall, it was found that in the service company, there was no significant effect on wage growth for program participants compared to non-participants, while in the manufacturing company there was a larger growth in earnings for trainees compared to non-trainees.

53 See footnote 38 which discusses Leuven, Lindahl, Oosterbeek and Webbink (2004).

As noted above, it appears clear from the literature that foundation skills are valued in the labour market. In addition, the literature also suggests that foundation skills are an important enabler of further learning. For example, the results of Shomos (2010) suggest that later education provides additional skills that are of value, even after the effects of foundation skills have been taken into account. It is likely, however, that the ability to develop skills through subsequent education depends greatly on an individual's foundation skills.

4. Learning and innovation

The literature reviewed above focuses on increases in productivity through increased investment in learning. Such literature generally utilises an augmented neoclassical growth model that treats human capital (of which learning is a component) as an ordinary factor input. As an ordinary input, human capital can only affect productivity growth through flow effects over time, whereby increases in productivity arise from increased learning.

However, there is a growing body of literature that calls attention to the appropriateness of characterising human capital in such a way. This body of literature tends to apply augmented endogenous growth models that incorporate human capital. In these models, both stocks and flows of human capital are considered capable of affecting productivity growth.⁵⁴ In addition to taking into account the flow effects of learning as per the traditional neoclassical model discussed above, endogenous growth models allow a mechanism that takes into account how the level (or stock) of human capital can affect productivity. Under this mechanism, levels of human capital are generally seen to affect productivity growth by enabling innovation. The theory is that a higher level of skills would enable individuals and workplaces to adopt or develop new ideas and processes.

On this basis, one would expect a greater impact on productivity growth from learning to be seen in studies implementing an augmented endogenous growth model. If an augmented endogenous growth model is considered the correct approach to take, then the implications for studies utilising a neoclassical type model is that they would generally understate the effect of human capital on productivity growth. Furthermore, findings of no connection between learning and productivity in studies applying a neoclassical model may not be reliable due to a failure to take into account stock effects through a misspecification of the model.

The findings of studies on the possible impact of learning on productivity through innovation are outlined in the table below.

Table 7—Link between learning and innovation⁵⁵

Study	Country	Key results
Benhabib and Spiegel (1994)	Cross-country	Specifies a model in which the growth rate of total factor productivity depends on a nation's human capital stock level. Human capital is found to have a positive effect on growth through its influence on the rate of catch-up with more advanced economies (i.e. move towards the technology frontier) and as an 'engine of innovation'.
Eaton and Kortum (1996)	Cross-country	Suggests that inward technology diffusion increased with a county's level of human capital.
Gemmell (1996)	Cross-country	A 1 per cent increase in human capital is associated with a 1.1 percentage point increase in the growth rate of real GDP per capital. A 1 percentage point increase in tertiary level human capital is associated with a 5.9 percentage point increase in per capita GDP growth rate. Tertiary human capital effects are strongest in OECD countries.

⁵⁴ It should be noted that many endogenous growth models focus on the relationship between the initial stock of human capital and economic growth (rather than on both stocks and flows) and suggest that increasing the level of human capital can have long run effects on the rate of economic growth. However, in view of the literature examined above and other research including Kruger and Lindahl (1998) and Lucas (1988), it is considered likely that both flows and stocks of human capital affect economic growth.

⁵⁵ Some studies listed in table 7 are also listed in table 4 as they examine both the flow and stock effects of human capital (see, for example, Benhabib and Spiegel (1994)).

Hanusheck and Kimko (2000)	Cross-country	A one standard deviation increase in test performance (measured at the student level across all OECD countries in PISA) is associated with a 1 percentage point increase in the growth rate of GDP per capita The importance of years of schooling as an indicator of economic growth is considerably reduced once labour quality is taken into account.
Barro (2001)	Cross-country	Found that extra education helped countries to adapt and absorb new technology. An additional year of education was associational with a 0.44 of a percentage point increase in the growth rate per year.
<i>Dowrick and Rogers (2002)</i>	<i>Cross-country</i>	<i>The level of human capital facilitates technological catch-up, especially amongst the middle-income and richer countries.</i>
<i>Dowrick (2002)</i>	<i>Australia</i>	<i>An additional year of educational attainment in the working-age population is associated with a predicted 0.2– 0.5 per cent increase in the long-run growth rate (for Australia). However, other studies considered indicated that the effect could be as high as 0.8 per cent.</i>
Sianesi and Van Reenan (2003)	Literature review	According to estimates from new-growth theories, a one-year increase in average education leads to an over 1 percentage point faster growth. However, the neoclassical specification was preferred as the new growth models may overstate the effect due to methodological problems.
Griffith, Redding and Van Reenne (2004)	OECD	Workforce skills help to stimulate productivity growth by their effects on innovation (a direct effect) and by facilitating the adoption and diffusion of new technologies (an indirect effect) that assists countries catch up with world technological leaders. Human capital stocks are positively correlated with a country's ability to narrow the technological/productivity gap between themselves and world leaders.
OECD (2006)	N/A	Higher stocks of human capital affect productivity by facilitating investments in physical capital and enhancing the development and diffusion of new technologies.
Vandenbussche et al. (2006) and Inklaar et al. (2008)	OECD	High level skills contribute more to productivity the closer a country is to the technological frontier. As the country approaches the frontier they are more likely to innovate as opposed to imitate. However, Inklaar et al (2008) challenged this result arguing that any positive correlation between human capital and multifactor productivity growth disappears once inter-country differences in labour quality and number of hours worked are taken into account.
Hanushek and Wosmann (2007)	OECD	A one standard deviation increase in test performance (measured at the student level across all OECD countries in PISA) is associated with a 2 percentage point increase in the growth rate of GDP per capita.

OECD (2010)	N/A	Considered that human capabilities and skills drive innovative activity, stating that 'human capital is the essence of innovation'.
OECD (2011)	N/A	A skilled workforce enables innovation through its capacity to: generate new knowledge; adopt and adapt existing ideas; develop a capacity to learn; complement other inputs to innovation; generate 'spillovers', and add to social capital.
Toner (2011)	Australia	<i>Notes that it is generally argued that increased innovation across economies requires the workforce to possess 'both technical competence and what are termed 'generic skills' – problem solving, creativity, team work and communication skills'.</i>
Mason, O'Leary and Vecchi (2012)	Cross-country	A 1 per cent increase in skills is associated with a 0.365 per cent increase in average labour productivity when their model is extended to take account of the potential role of skills in assisting productivity follower countries catch up with countries on or near the frontier. See table 3 for the basic result from their model.
Barro (2013) ⁵⁶	Cross-country	There is a positively association between GDP growth and the average years of school attainment for adult males at the secondary and higher levels, but not for females. The quality of education is more important than the quantity of education.

On balance, there appears to be evidence supporting the proposition that learning not only has a positive effect on labour productivity but also promotes innovation. The relationship between learning and innovation, however, is complex. In addition, as noted by Sianesi and Van Reenan (2003) the exact magnitude of the 'innovation' effect is difficult to ascertain.⁵⁷

Setting aside this complexity, however, the studies are clear about the various ways in which human capital can affect productivity growth through enhanced innovation. These include: by promoting the transfer of knowledge between firms, industries and countries (Lundvall, 1992); by developing absorptive capacity so that firms can better innovate or adopt best practices (Benhabib and Spiegel, 1994; Cameron, Proudman and Redding, 1998, Greffith, Redding and Van Reenen, 2000, and Griffith et al., 2004); and by promoting mobility of skilled workers that may assist, for example, in disseminating ideas and processes (Mason et al., 2004).

Findings in relation to learning and innovation also appear consistent with literature discussed above in Section 2 which suggests that tertiary qualifications might be most important for advanced economics. For example, Vandebussche et al. (2006) (see table 7) argues that as a country approaches the technological frontier, higher level skills become increasingly important relative to lower level skills. This result is not surprising. A country at or near the technological frontier would require highly skilled individuals to shift the frontier forward through enhanced innovation. Conversely, a nation situated further from the frontier would not be seeking to move the frontier forward but would simply be focused on absorbing existing technologies. However, it should be noted that some studies challenge this finding (see Inklaar et al. (2008) at table 6). Mason, O'Leary and Vecchi (2012) also

⁵⁶ Utilised a panel of around 100 countries with observations from 1960 to 1995

⁵⁷ However, it does appear clear from PC and ABS (2011) that there is a clear relationship between innovation and productivity.

failed to find evidence that the spillover effects from high-level skills were larger in countries closer to the technological frontier.⁵⁸

Having considered the evidence linking learning or skills to innovation, the question arises as to which skills are most important for promoting innovation. In this respect, ABS data shows that the skills most valued by innovation-active businesses in 2010–11 were business management, financial, marketing and trades skills. Further, innovative Australian businesses were more than twice as likely to value business management, project management and marketing skills than were non-innovators (ABS, 2012). The importance of management skills as a driver of productivity and innovation is examined further below.

58 As noted above, however, Mason, O’Leary and Vecchi (2012) did find evidence that spillover effects (or externalities) from high-level skills affect multifactor productivity.

5. Leadership and management

As noted above, leadership and management skills are important (and well rewarded) elements of human capital. Leadership and management skills contribute to productivity by improving resource allocation within firms. Accordingly, it is not surprising that the literature on the productivity effects of leadership and management tends to focus on a firm's performance as the relevant measure.

The relationship between leadership, management and firm performance is well established in the literature. In fact, literature from as early as the nineteenth century identifies the role of leadership and management in explaining firm performance (see, for example, Walker, 1887). Since then, many studies have further examined this issue. Some of the key literature on the subject is outlined in table 8 below.

Table 8—Link between leadership and management and productivity

Study	Country	Key results
<i>Karpin Report (1995)</i>	<i>Australia</i>	<i>Good management practices drive productivity growth and competitiveness at the enterprise level and economy-wide. Identified six critical areas where the development of Australian managers failed, namely: low levels of education and training undertaken; over-reliance on short courses; over-emphasis on current rather than future skills; failure to handle the transition from specialist to manager; failure to link management development to strategic business direction; failing to evaluate the effectiveness of management development activities.</i>
Huselid and Becker (1996)	US	Found a correlation between human resource management and labour productivity. A one standard deviation 'improvement' in a firm's HR strategy is associated with a present value gain in cash flow and market value of \$15,000 to \$17,000 per employee.
Hunter et al (2001); and Autor et al. (2003)	Cross-country	Retail banks that did not reorganise following the introduction of information and communication technologies received lesser benefits from their introduction.
Black and Lynch (2001)	US	It is not whether an establishment adopts a particular work practice but how that work practice is implemented that is associated with higher productivity.
Bloom and Van Reenen (2007)	Cross country	A large fraction of differences in performance between countries is related to whether they have a long or short tail of firms with relatively poor management performance. Better-managed manufacturing firms have a more highly educated workforce, among managers and non-managers alike and make better use of highly educated workers. ⁵⁹

59 The study found that: 84 per cent of managers in the highest scoring firms were educated to degree level or higher, as were a quarter of the non-management work force. Among the lowest scoring firms, by contrast, only 53 per cent of managers and only 5 per cent of the wider workforce had degrees.

<i>Green (2009)</i>	<i>Australia</i>	<i>Australia has a substantial ‘tail’ of firms that are ‘mediocre’, especially in their approach to people management and addressing this is ‘a cost-effective way of improving the productivity performance of Australian firms’ and closing the gap with better performing, more innovative countries. Large companies are generally much better managed than small ones. The level of education and skills of both managers and non-managers is positively correlated with management performance.</i>
<i>Bloom & Van Reenen (2010)</i>	<i>Cross-country</i>	<i>Differences in productivity at the firm and the national level largely reflect variations in management practices.</i>
<i>IBSA (2011)</i>	<i>IBSA</i>	<i>There are knowledge gaps in management education which, if addressed, could help enhance management performance.</i>
<i>Boedker et al. (2011)</i>	<i>Australia</i>	<i>Total factor productivity of high performing workplaces was 12 per cent higher than the total factor productivity for lower performing workplaces.</i>
<i>OECD (2011)</i>	<i>N/A</i>	<i>In a context of constant change, managers and entrepreneurs play a crucial role in building innovative capacity and improving performance as they put innovative ideas into practice, either by starting new businesses or managing innovative capacity within firms.</i>
<i>Bloom, Sadun, and Van Reenen (2012)</i>	<i>US, Europe</i>	<i>A one-point increment in a five-point management score card—the equivalent of going from the bottom third to the top third of the group—was associated with 23 per cent greater productivity. Variation in management accounts for nearly a quarter of the roughly 30 per cent productivity gap between the US and Europe. This was largely due to different people management practices interacted with falls in IT prices. Productivity was higher for firms with better management practices. ‘When manufacturers were systematically taught how to implement good management’s basic features—targets, incentives, and monitoring—performance improved measurably and dramatically.’</i>
<i>Green, et al. (2012)</i>	<i>Australia</i>	<i>Australian workplaces do not fully utilise the skills of their workforce, with up to half of employers regard their employees as over-qualified or over-skilled and that the most effective way to address this problem is through the promotion of innovative and participatory work practices. The McKell institute calls for government, industry and trade unions to look to innovate, improve management capability and focus on workforce development and up skilling in order to deliver long-term productivity growth.</i>
<i>Dolman and Gruen (2012) utilising Bloom, Genakos, Sadun, and Van Reenen (2012)</i>	<i>Australia</i>	<i>Lifting management practices in Australian manufacturing firms to the average level in the US would raise the level of productivity in Australian manufacturing by around 8 per cent.</i>

<i>Australian Institute of Management (2012)</i>	<i>Australia</i>	<i>The Australian Management Capability Index indicates that Australian organisations are using less than three-quarters of their management capability.⁶⁰</i>
Lazear et al. (2012)	US	The effects of bosses on the productivity of technology-based service workers 'are large and significant' with the value of the average boss estimated at 1.75 times that of a worker. In addition, the most important role of bosses is teaching, accounting for 67 per cent of the effect of bosses on workers' productivity.
McBain et al. (2012)	UK	Management and leadership development activities can lead to increases of up to 32 per cent in people performance and 23 per cent in overall organisational performance—but too few employers are doing the right thing and the types of training being offered by organisations are not necessarily those activities that managers rate as most effective.
Department of Business Innovation and Skills (2012)	UK	Ineffective management practices could be costing UK business over £19 billion per year in lost working hours.
<i>Skills Australia (2012)</i>	<i>Australia</i>	<i>Case study research identified leadership and management as being one of five critical success factors for skills utilisation to thrive.</i>
<i>Smith et al. (2012)</i>	<i>Australia</i>	<i>Found that the three elements of a firm most strongly correlated to the development of innovative capacity are people management, external linkages and learning and development. In particular, the study found that:</i> <ul style="list-style-type: none"> • <i>organisations that supported a learning culture, not simply provided training, showed a higher level of innovative capacity; and</i> • <i>bundling of human resource management practices into complementary sets that reinforce each other appeared important in building innovative capacity.</i> <i>External links to universities and training providers promote innovation.</i>
<i>Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) (2012)</i>	<i>Australia</i>	<i>Found that 'Australian business management capability and innovation culture is poor by international standards'.</i>
Bloom et al (2013)	India	Intervention to improve management practices was associated with a 17 per cent increase in productivity compared to the control group.

The above studies generally indicate that good leadership and management have a positive effect on productivity. More specifically, studies suggest a connection between good human resource management practices and increased productivity.

The literature reviewed also examines how effective leadership and management practices improve productivity. Studies suggest that firms with sound management are better able to: match skills to

⁶⁰ Management capability describes how effectively the management team puts into practice its combined competencies to deliver business results.

jobs; develop productive networks; make better decisions through engagement with employees (for example); and, are better able to respond to changes in the market place, including changes resulting from the introduction of new technologies. The studies also indicate that simply having good management policies is not sufficient. They must also be effectively implemented into the firm's culture.

Of particular note is the role of leadership and management in skills utilisation. Skills Australia (2012) highlights the link between effective management, skills utilisation and productivity. The study found that skills utilisation is underpinned by effective management practices and promotes (among other things) innovation, staff retention, and enhanced job satisfaction and performance. The study also demonstrated that enhanced skills utilisation benefits both employers and employees.⁶¹ Unfortunately, as noted by AWP (2013) there is little evidence about the extent to which skills utilisation strategies are adopted in Australian workplaces. However, research suggests that around 37 per cent of employers and 10 and 15 per cent of employees report that existing skills are underutilised.⁶²

The magnitude of the productivity gains associated with effective leadership and management is significant at both the micro and macro levels. At the micro level, studies have found that improved leadership and management can increase productivity by around 17 per cent (Bloom et al., 2013) with potentially larger gains in the longer term. Leadership and management may also help to explain the large dispersion in the productivity of firms observed by Syverson (2004).⁶³ At the macro level, the studies indicate a strong association between management practices and country level outcomes. In particular, those countries with a larger number of firms with better management practices and fewer firms with poor management practices (i.e. a short left hand tail in the distribution of management performance) perform significantly better in terms of productivity (with management practices potentially explaining up to half the differences).

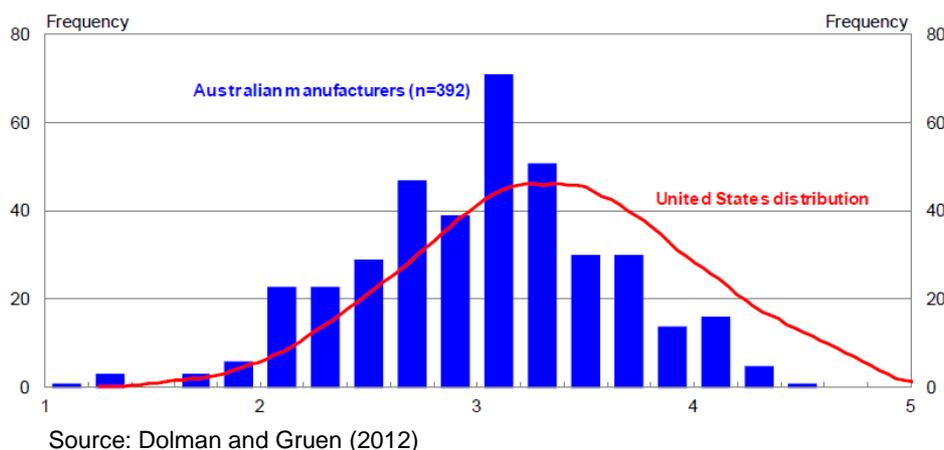
Interestingly, as highlighted by figure 1, Australia appears to have a 'long tail' of relatively poorly managed firms relative to the US (Dolman and Gruen, 2012). This may indicate that Australia could significantly improve its productivity by improving its management practices. This position is supported by DIISRTE (2012) which found that Australia's management capability is poor by international standards.

61 The study provides an overview of the management practices that promote the effective use of skills. These include: effective job design; facilitating employee participation in discussions on business strategy or direction; ensuring effective delegation to employees; providing job rotation and multi-skilling opportunities; undertaking skills audits to identify employee skills and skill needs; and implementing knowledge transfer systems, including mentoring regimes and relevant training opportunities.

62 See NCVET (2011) and Watson (2008).

63 Syverson (2004) found that a plant at the 90th percentile of the labour productivity distribution was over four times as productive (in the US) and over 5 times as productive in the (UK) as a firm at the 50th percentile.

**Figure 1—Distribution of management performance
(Scale: 1 = worst, 5 = best)**



The literature also provides guidance on the type of management and human resource practices that are associated with high performance workplaces. These include: appropriately constructed incentives to perform, including individual and group performance bonuses (Prentice et al., 2007); higher levels of responsiveness to changes in stakeholder and customer networks; higher levels of employee participation in decision making processes; higher levels of behavioural and skills flexibility in employees; effective use and quality of information, communication and technology; and, excellence in attracting and retaining high quality people (see generally Boedker et al. 2011).

However, the studies also note that the motivation for implementing such management practices may depend on the economic environment in which the firm operates. In particular, Van Reenen (2011) found that one of the main mechanisms by which competition improves productivity is by improving management practices. The theory behind such a finding is straightforward—a competitive environment drives efficient management by forcing poorly managed firms to leave the market and by providing an incentive for remaining firms to ‘pick up their game’ or face failure. In addition, competition may lead to larger firms through consolidation and research suggests that larger firms are better managed (Green, 2009). The above suggests that firms improve management by necessity rather than by choice.

The literature also establishes a close link between effective management and leadership, and the innovative capacity of firms. In addition, it has also been suggested that different leadership and management styles may be required at different stages of innovation activity (Munshi et al., 2005). For example, that study suggests a greater role for transformational leadership during the early stages of innovation compared to a more structuralist style for latter stages such as commercialisation.

There may also be gains from specialising in different forms of management depending on the type of firm or the market environment in which it operates. For example, Bloom and Van Reenen (2001) found that different countries have a comparative advantage in different types of management. In particular, they suggest that US, China and India have the largest relative advantage in people management while Japan, Sweden and Germany had the largest relative advantage in monitoring and target setting management. Equally, firms and industries may specialise in different types of management depending on the nature of their product or service and the market in which they compete.⁶⁴

⁶⁴ For example, Bloom and Van Reenen (2007) suggest that firms specialise more in “people management” when they operate in a skill-intensive industries. In addition, Green et al. (2009) found that Australian manufacturing firms tend to be stronger in operations management than people management.

6. Other benefits of learning

As demonstrated above, learning may affect productivity both directly (by increasing human capital) and indirectly (by promoting innovation). It should be noted, however, that there are numerous studies that also point to various other indirect benefits of learning that are not captured by the above discussion.

It is beyond the scope of this review to consider these additional benefits in detail. However, for completeness some of the other benefits of learning that may have an indirect impact on productivity are set out below:

- better health outcomes including higher life expectancy, lower infant mortality, better public health, and reduced incidence of chronic illness (Barro and Lee, 1994; OECD, 1998; Wolf and Haveman 2001; Johnston, 2004; OECD, 2006; PC, 2010)
- better societal outcomes including lower crime rates, better parenting, wider political and community participation, greater life satisfaction and greater social cohesion (OECD, 1998; Blundell 1999; Wolf and Haveman 2001; Burke et al., (2004); Johnston 2004; OECD, 2006)
- Intra-firm benefits including flow-on effects to co-workers (i.e. the productivity of workers depends not only on their own skill level but that of their co-workers) and greater investment in physical capital (Barro, 1991, Gemmell, 1996, Benhabib and Spiegel, 1994; Dowrick, 2002; OECD, 2006)⁶⁵
- Better environmental outcomes (OECD, 1998; McMahon, 2001)

Despite these additional benefits, it should also be noted that the social returns of education may be less than the private returns. For example, the OECD (2006) found that due mainly to public subsidisation of education the social returns of education were less than the private returns in all countries considered. However, this is not to imply that the costs of education would exceed its benefits.

⁶⁵ Regarding the latter point, the resulting accumulation of capital may be a source of endogenous growth. An increase in available skills would enable firms to utilise new capital equipment. In turn, the use of the new equipment would provide experience to workers leading to further increases in human capital (see Arrow, 2000). Conversely, economies with lower levels of skills would have less capital per worker and therefore an even greater development gap to a country with a higher level of human capital (see generally Layard, McIntosh and Vignoles, 2002).

7. Conclusion

The literature examining the association between human capital and productivity is extensive. This review focused on studies that relate to those aspects of human capital that are of most relevance to the agency. These aspects of human capital are: formal learning (education leading to a qualification); non-certified learning (on job training, work experience, or other learning not leading to a formal qualification); foundation skills and management and leadership skills. The conclusions reached in respect of each relevant aspect of human capital are set out below.

Formal learning and non-certified learning

Numerous studies have examined the association between learning (including formal learning and non-certified learning) and productivity. On balance, the literature tends to find that learning has a significant and positive effect on productivity both at the micro (individual or firm) and macro (economy) level. While the studies considered by this review are not directly comparable due to the different methodologies that have been applied, including different models, parameters, variables, data and samples, the following general observations may be made.

- (i) In the context of individuals, changes in wages appear to be the best indicator of the productivity effects of learning. The literature suggests that the wage effects from an additional year of learning range between 5 and 16 per cent.
- (ii) For firms, various indicators have been considered including profits, value added per worker, and probability of survival. However, conclusions on the extent to which learning affects productivity at the firm level are difficult to draw from the literature due to the differences in methodology applied, particularly differences in the samples used which tended to be small. While the association between learning and productivity is therefore not as well established at the firm level, the studies reviewed generally indicated a positive correlation between learning and productivity.
- (iii) At the country level, associations between learning and GDP per capita or average labour productivity have been examined. The literature reviewed indicates a strong and significant association between learning and productivity in cross-country studies. The studies suggest that an increase in the average level of education by one year would result in a three to fifteen per cent growth in GDP per capita.

There is also literature that suggests, however, that there are diminishing returns with additional learning seen at both the micro and macro levels. This indicates that additional learning would have a lesser impact on productivity than suggested by studies that estimate the average return from learning. It also indicates that there would be a point where additional investment in learning becomes wasteful—where the marginal social costs exceed the marginal social benefits. Interestingly, studies suggest that at the individual level, those that would expect the highest returns from learning may be the least likely to undertake it.

Studies also suggest that the productivity gains from different levels of education (primary, secondary, tertiary) vary with a country's level of development. In particular, the literature suggests that tertiary education is likely to be more important for advanced economies such as Australia. Advanced economies are closer to the technological frontier, requiring firms and labour to engage and absorb more complex technology and to engage in innovation to further enhance welfare. A more highly skilled workforce is therefore essential and skills are likely to be rewarded accordingly.

There is a growing body of literature that suggests that the stock (in addition to flows) of human capital can affect productivity and growth by facilitating innovation. As these models allow both stocks and flows of human capital to affect growth, these studies tend to estimate a higher return from learning than studies that focus on productivity effects based solely on flows of learning.

Foundation skills

The literature suggests that foundation skills are likely to have the largest impact on productivity. This is not surprising given that foundation skills provide the basis for further learning and productive activity in workplaces. However, studies examining interventions designed to develop foundation skills highlight that they are also some of the most difficult skills for adults to develop. In contrast, the literature suggests that intervention early in life (including in primary school) is likely to provide large payoffs.

Management and leadership skills

Management and leadership skills contribute to productivity by improving resource allocation within firms. In particular, research suggests that management and leadership skills are associated with improved firm performance and rates of innovation. For example, one way that good management contributes to productivity is by ensuring that skills are properly utilised within workplaces and are complemented by technology.

Other benefits of learning

In addition to the traditional avenues by which learning has been thought to contribute to productivity, there is also evidence of benefits through less obvious routes. Studies, for example, have found associations between learning and improved health, societal and environmental outcomes. In addition, it is also likely that investment in learning by one worker increases the productivity of his or her co-workers (these benefits would be external to the individual but internal to firms and the economy as a whole).

General conclusions and recommendations for further research

Overall, the benefits of learning and sound management practices are compelling. Learning and effective management are good for individuals, firms and the economy. They enhance material welfare in terms of wages and profits and promote a more innovative, adaptive and inclusive economy. However, this is not to say that all the questions regarding learning and management have been answered. To the contrary there is a range of questions that deserve further research by government, business groups, and academics. In this regard, additional research (focused on Australian data) on the following would also be useful:

- research to identify where Australia sits on its learning-growth curve;
- research addressing how the marginal benefits of additional learning compare to the marginal costs;
- identifying Australia's skill needs in the complexity and rapid change of the Asian century;
- additional research at the firm level, including further examination of the importance of workforce development strategies; and
- an examination of the unique human capital challenges of particular groups including those of low social economic background, Indigenous Australians, women and older Australians as the population ages.

Studies at the industry level (directed at those of strategic importance and in which Australia could have a comparative advantage e.g. the resource sector and food industry) addressing productivity challenges would also provide a useful contribution to the literature and the welfare of Australians.

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