Forecasting Future Labour Demand in the Australian Rail Transport Industry (ARTI)

Prepared for the PATREC Research Forum

Murdoch University, Western Australia, 4 September, 2007.

by

Anusha Mahendran and Dr Alfred Michael Dockery

Centre for Labour Market Research

Curtin Business School, Curtin University of Technology

and

Professor Fred Affleck

Planning and Transport Research Centre, Curtin University of Technology

Address for correspondence:

Anusha Mahendran

(Research Associate)

Centre for Labour Market Research

Curtin Business School

Curtin University of Technology,

GPO Box U1987, Perth WA 6845

Email: Anusha.Mahendran@cbs.curtin.edu.au

Abstract:

The significant contribution that the Australian rail industry makes both to the national economy and Australia's transport network has long been established. However, in recent times, emerging labour shortages within the industry have threatened to curtail its output capacity. Increased strains on labour supply due to years of sustained economic growth and an aging population, combined with low industry recruitment levels in recent decades, has left many rail operators increasingly vulnerable to skill shortages. As one part of a major evaluation of the extent and nature of the skills shortages within the Australian Rail Transport Industry (ARTI), this paper presents projections of future labour demand and supply within the sector, disaggregated by occupation through to 2020. Demand projections are derived through a simple 'top down' model linking aggregate output to aggregate employment and then to employment by occupation, with output based upon existing projections of passenger and freight task. Supply projections are generated by applying best-estimates of future recruitment and retention rates to the existing profile of the rail workforce by occupation, age and gender. The modelling assumptions are based on primary research conducted with rail operators and industry representatives, existing literature and historical ABS statistics. Implications for workforce policy and for human resource management within the ATRI are also discussed.

1. Introduction

Research has identified that employee attraction and retention as well as workforce capability and skills are all prominent drivers of business success within many industries (Department of Education, Science & Training [DEST], 2006)**.** The availability of workers possessing appropriate skills and training, is thus of key importance to enterprises in all industry sectors. The ability of firms to recruit appropriately qualified workers is therefore widely considered as essential to ensuring the success of any business enterprise, in a similar way to the need to secure sufficient demand for the firm's services and also secure appropriate capital (Richardson, 2007). Thus, firms that are able to retain an adequately skilled workforce are able to expand

and grow at much faster rates than firms that experience difficulty in recruiting workers.

In the current economic climate within Australia which has been preceded by several consistently strong periods of economic growth, one of the most pressing issues facing many industries relates to finding sufficient numbers of skilled personnel to meet their output needs. As a consequence, many firms throughout a diverse range of industry sectors are presently facing capacity constraints as a direct result of skills shortages. One such industry which is currently facing somewhat of a skills crisis is the Australian rail transport industry (ARTI).

In order to effectively analyse skills shortages, it is necessary to firstly define the scope of the labour market that is being examined (Boswell, Stiller & Straubhaar, 2004). When evaluating and characterising labour markets, three main dimensions are generally considered. These include the geographical area (i.e. national, regional, etc.), the sector and the occupation and/or skills (Boswell, Stiller & Straubhaar, 2004). Most definitions of skills shortages appear to concentrate on specifying that they occur when the demand for a specific type of worker exceeds the supply of that type of labour, at prevailing wages and conditions (Richardson, 2007). A skills shortage has thus been defined in terms of supply and demand as being "a market disequilibrium between supply and demand in which the quantity of workers demanded exceeds the supply available and willing to work at a particular wage and working conditions at a particular place and point in time." (Barnow, Trutko & Lerman, 1998). Put more simply, skills shortages result when the supply of suitably qualified workers is insufficient to meet the demand that exists for these type of workers under the current market conditions. Skill and labour shortages often occur in skilled positions and amongst highly experienced and qualified workers and may occur in specific geographical regions (Yates, 1999). The size and magnitude of such shortages also often varies depending on a number of factors.

The following classification scheme for skills shortages has been suggested by (Richardson, 2007):

Level 1 shortage: Occurs when there is a limited number of workers who have the essential technical skills that are required but are not already using them and the time required for training to develop the skills is quite long.

Level 2 shortage: Refers to the situation when there is a limited number of workers who possess the essential technical skills that are required but are not already using them and the time required for training to develop the skills is relatively short.

Within the theme of skills shortages there are also various related concepts that should be understood. These include the following (listed below):

Aggregate labour shortage: Results at conditions of near full employment when there is a general difficulty in sourcing workers to fill job vacancies (Boswell, Stiller & Straubhaar, 2004).

Labour Market Mismatches – Shortages induced by labour market mismatches which can be coincident with high unemployment levels (Boswell, Stiller & Straubhaar, 2004). Some types of labour market mismatches include:

i) Skills mismatch: Results when there are sufficient workers with the essential technical skills required who are not already using them, but they are still unprepared to apply for vacancies under current conditions (Richardson, 2007).

Skill gaps result when existing workers lack the necessary experience, specialised skills and or qualifications to satisfactorily meet the needs of the specific occupation as required by the employer (Richardson, 2007). This situation often eventuates when employees are inadequately qualified or trained to perform set tasks or may not have upgraded their skills to meet the emerging skill requirements associated with the particular occupation. Skill gaps may occur in instances when employers are unable to find suitable candidates for a specific position and thus recruit workers who require additional training or experience in order to meet the firm's skill needs for the occupation (Shah & Burke, 2005). Some skill gaps eventuate as a result of employers being unable to identify that there is a problem due to being unaware of the optimal

skills that are required for the specific occupation. Normative skill gaps refer to those in which there is a vast difference between what the skill level is and what it should be (Roy, Henson and Lavoie, 1996).

ii) Qualitative Mismatch: Describes the situation when the skills/qualifications of workers are not appropriately matched to the skills/qualification profiles necessary to fill the existing vacancies (Boswell, Stiller & Straubhaar, 2004). Generally occurs when there are insufficient workers with the skills, qualification or experience required to effectively carry out the jobs in question.

Quality Gaps eventuate when there are sufficient workers with the essential technical skills who are not already using them, but they do not have some other qualities which employers require and consider important (Richardson, 2007).

iii) Preference Mismatch: This occurs when there is a mismatch in the existing vacancies in a specific region and the types of jobs that unemployed people living in that region are willing to accept (Boswell, Stiller & Straubhaar, 2004). In such cases, although there may be jobs available that match the skills and qualification profiles of unemployed workers, these workers are unwilling to take up certain types of work due to one or more reasons such as dissatisfaction with the location of work, rate of pay, working conditions or status.

iv) Regional Mismatch: This results when firms offering suitable jobs and unemployed workers who could fill these vacancies are located in different regions and the unemployed workers and/or jobs are immobile (Boswell, Stiller & Straubhaar, 2004).

v) Mismatch due to information deficits: Occurs when there is no aggregate labour or skills shortage but rather a lack of information prevents labour demand from being met by labour supply (Boswell, Stiller & Straubhaar, 2004). More specifically this results when employers lack the necessary information to find adequately qualified and experienced workers to fill their vacancies. It can also eventuate when labour market inefficiencies cause unemployed workers not to acquire relevant information on existing vacancies.

In contrast, recruitment difficulties are generally due to specific factors associated with the particular occupation, employer and or industry. This may include such things as an unfavourable industry image, poor working conditions and unsatisfactory working hours (Richardson, 2007). Other issues may include remoteness of the work locality, difficulty or inconvenience in commuting and the need for highly specialised skills.

When employers are unable to produce enough to the meet demand that exists for their product(s) and/or service(s) due to an inability to recruit enough skilled workers, they tend to view this as being due to inadequacies in the skills development system (Green, Machin & Wilson, 1998). Skills shortages are therefore often related to a lack of investment and deficiencies in capability development and training. The causes of skills shortages are however often complex and often compounded by multiple factors so their incidence can not always be simply attributed to the inability of employers and training organisations in an industry to train and develop sufficient number of workers to fill vacancies. Rather the imbalance between the demand and supply of specifically skilled workers may be put down to a range of complicated macroeconomic and microeconomic level factors which are often difficult to manage, such as some of the following (Richardson, 2007):

-cyclical fluctuations in labour demand and economic activity

-low levels of overall unemployment combined with rapid structural change

-economic and demographic changes which specifically affect certain industries and results in them experiencing skills shortages

-certain types of industries being comparatively less attractive to workers and recruits due to for example uncompetitive rates of pay and poor working conditions

One indicator which often signifies the existence of skills shortages is hard to fill vacancies. Hard to fill vacancies result when employers are unable or experience

significant difficulty in recruiting workers to fill specific vacancies associated with certain occupations at current remuneration levels, employment conditions and work locations (Shah and Burke, 2005). Hard to fill vacancies are defined by the fact that it takes a considerable period of time (longer than would normally be expected or a reasonable period of time) to fill such positions. Consequently the key principle underlying the use of hard to fill vacancies as a measure of skills shortages is the duration of time that the vacancy remains unfilled (Richardson, 2007).

The total number of vacancies for a specific occupation or vocation in isolation generally reveals very little about whether skills shortages actually exist. A high proportion of vacancies for a particular occupation is instead more likely to reflect a high rate of turnover associated with that vocation or profession (Richardson, 2007). Theoretically therefore hard to fill vacancies can act as an excellent indicator of where firms are experiencing recruitment difficulties. However in a practical sense, hard to fill vacancies are quite difficult to measure and gauge. There is also ambiguity as to whether hard to fill vacancies are actually hard to fill or if they are more a reflection lack of the attractiveness of certain occupations. In addition there is also the question of whether there will be any serious economic consequences if such vacancies remain unfilled.

Other common signs of labour shortages include improved employment terms and working conditions such as rising wages and the existence of low levels of unemployment and persistent vacancies (Richardson, 2007). In addition the increased use of both unpaid and paid overtime as well as the employment of more temporary workers are also indicators of labour shortages. One regular method of assessing current skills and labour shortages is through data collected from surveys. The benefits of using surveys lies in the fact that the information sourced through them contributes to the understanding of current shortages and builds on knowledge relating to the causes and implications of shortages (Boswell, Stiller & Straubhaar, 2004). In this respect employer surveys are especially informative for the following reasons (Boswell, Stiller & Straubhaar, 2004):

-they assist in improving the understanding of the impact that skills and labour shortages have on growth and/or productivity

-they can be used to determine vacancy rates which can subsequently be compared to unemployment rates to detect and evaluate labour mismatches

-they allow for better comprehension of the impact that government measures and technological change have on the demand for skills and/or labour

-they enable a more comprehensive profile of the qualifications and occupational composition of employment in different sectors to be developed

Although the use of surveys is viewed by most as being a useful component which could be used in forecasting models to project shortages, surveys have been criticised in some circles for having limited predictive potential. This is largely because surveys generally only reveal a limited scope of information about the determinants of labour shortages (Boswell, Stiller & Straubhaar, 2004).

One common means by which skills shortages are often addressed is through the use of workforce planning measures. Systematic workforce planning measures are often undertaken by most organisations regularly on a consistent basis, most often annually. Although it is accepted that the skills and labour needs for a specific industry workforce are dynamic and thus ever changing, it is still common practice to attempt to predict future skills needs using a singular or combination of various models (Australian National Training Authority [ANTA], 2003). Most workforce planning models are thus used to forecast the future workforce needs and capabilities at both the functional and corporate level.

Employment and occupational trends within specific industries can be influenced by numerous factors including overall economic structural changes, changing qualification requirements, developments in technology and varying socio-economic conditions (such as with regard to the organisation of firms, norms of product quality and demand structures). Generally, forecasting economic growth by sector is necessary to determine future labour demand. For more detailed and advanced analysis of labour markets, a sectoral breakdown of labour demand is often required (Boswell, Stiller & Straubhaar, 2004). The projections generated by these forecasting

models often assist to ensure effective policies can be developed to address impending workforce issues and accommodate future skill needs.

Employment forecasting models have been developed and used since the 1960's (Boswell, Stiller & Straubhaar, 2004). In the case of most employment forecasting models, historical trends are generally extrapolated into the future. This usually involves having to factor in several assumptions regarding future development trends in the determinants of labour demand (Boswell, Stiller & Straubhaar, 2004). These factors may act to weaken or bolster general employment trends in certain sectors.

The forecasts generated by the workforce planning models are often based on possible scenarios and analysis of the characteristics of the existing workforce within the specific industry examined (ANTA, 2003). The occupational profile of a particular industry influences the skills sets required and thus must also be considered when forecasting industry specific skills needs. When evaluating different forecasting models, it is also essential to consider that the determinants of sectoral labour demand can develop in distinct ways in the course of structural change (Boswell, Stiller & Straubhaar, 2004).

2. Rail Industry Reforms

In recent decades, Australia's railway sectors have undergone significant changes. Initiatives by the Commonwealth and State/Territory Governments to promote more competition and efficiency within the rail industry have resulted in an increase in private rail activity and a decline in government ownership and management of railways (Transport and Logistics Industry Skills Council, 2005). These deregulation policies were part of a wider microeconomic policy framework and were designed to open the rail industry to more private sector competitive forces and remove the existence of state based government monopolies (Everett, 2006).

The reforms involved significant deregulation of the industry based on the recommendations of the 1991 Industry Commission inquiry into rail transport, the 1993 Hilmer Report as well as the National Competition Policy (Productivity Commission, 2000a). Many of the policies that were implemented were based on a fairly broad microeconomic reform framework and involved enforcing a more commercial focus on rail operators to improve cost recovery (Everett, 2006). The structure of railways in most Australian jurisdictions consequently changed with many of the previously integrated State rail authorities being vertically and horizontally separated (Hensher et al., 1994).

Outcomes identified from the rail reforms introduced in the 1990's have included reduced freight rates, improvements in service quality and increased productivity (Productivity Commission 2000a, 2000c). In turn, this has been credited with enabling productivity improvements estimated to be worth more than $2 billion (Rail, Tram & Bus Union, 2004). The development and implementation of new technologies has also strongly contributed to productivity growth within the Australian rail industry and it is likely that this trend will continue and accelerate in the future (Rail CRC, 2006). The improvements in the levels of productivity and competition experienced within the Australian rail industry have contributed to an 18% decrease in freight rates over the period spanning from 1990 to 1997 and a 30% reduction in real national freight rates from 1989 to 1998 (Everett 2006, Productivity Commission 2000b).

Another consequence of the reform process and resulting labour productivity growth has been a large scale reduction in employment in the rail industry. Employment fell by around *one half* between 1991 and 2001. The Productivity Commission estimated that the number of full time employees in the rail industry decreased from 88500 in 1986 to 36500 in 1998 (2000c). Analysis of ABS Census data also shows a halving of employment in the rail transport industry between 1991 and 2001. Other factors believed to be responsible for the decline in demand for rail labour include increased competition from alternative transport modes; increased contracting/outsourcing of rail operations and redefining labour arrangements through multitasking or multiskilling.

3. Modelling future workforce needs

3.1 A model of labour demand in the rail industry

To illustrate the approach taken to forecasting labour demand, assume initially that there is just one homogenous output from the rail industry, which is denoted Y, produced by homogenous units of labour, X. In any one period, t, output per worker (or labour productivity) is defined by;

$$(1) \qquad l_t = \frac{Y_t}{X_t}$$

Given data on both output and employment in a base year it is possible to determine labour productivity. Forecasts for future output, combined with assumptions regarding changes in labour productivity, are then used to generate a forecast of total employment in each period. The distribution of employment by occupation is also known for the base year. Forecasts for employment by occupation are then derived from the forecasts of aggregate employment based on assumptions relating to the change in occupational distribution.

The basic forecasting approach is therefore straightforward - it is deriving the most plausible assumptions regarding labour productivity and the occupation distribution of employment that is more involved. It is also necessary to take account of the fact that the rail industry produces more than one type of output. Our model differentiates between passenger and freight task. The data sources and the basis for each assumption are detailed below, with the resulting projections presented in Section 3.3.

Output forecasts

The model differentiates between freight and passenger outputs for the rail industry. Recent data and forecasts for each are taken from existing published sources.

Projections for the freight task are taken from BTRE (2006), and passenger task from Apelbaum Consulting Group (2007). However, data on employment is not disaggregated between the provision of freight and passenger services in each year. For relating trends in output to employment, it is therefore necessary to translate the projected changes in the freight and passenger tasks into changes in a 'composite' index of output.

In their 2006 report *Freight measurement and modelling in Australia*, the BTRE provides forecasts of the total Australian rail freight task by single year to 2020. The task is predicted to grow by around 2.2 per cent per annum between 2003 and 2020; increasing from 161 billion tonne-kilometres in 2003 to 234 billion tonne-kilometres in 2020 (2006**,** Table 1). Data and projections on the passenger task are provided by Apelbaum Consulting Group's publication "Australian Rail Transport Facts 2007". This contains estimates of total actual passenger kilometres (including light rail, urban and non-urban passenger) up to 2005, and forecasts to 2015 (2007: Table D1-2). To take the projected series out to 2020, we assume that the forecast trend growth rate between 2010 and 2015 continues to 2020. Under this assumption, passenger task is forecast to increase from 11.3 billion passenger-kilometres in 2005 to 13.8 billion passenger-kilometres in 2020, an average rate of growth over those 15 years of 1.4 per cent per annum.

Total freight task is therefore projected to grow significantly faster than passenger task. In fact, the projected growth rate for freight is 50 per cent higher than for passenger. Estimates for employment by freight and passenger available for 2003 and 2005 (ARA 2003a, ARA 2005a) show that, 157 persons were employed per 1 billion tonne-kilometres of freight carried, compared to 1,422 persons per 1 billion passenger-kilometres. To generate a composite measure of output consistent with employment requirement, freight and passenger kilometres are weighted accordingly. We standardised this composite measure to equal 1 million in 1991. The projections in freight and passenger output imply a rate of growth of 1.8 per cent per annum in weighted output from 2006 to 2020.

Labour productivity and aggregate employment

Although composite output *increased* by one-third between 1991 and 2001, as noted previously total employment in the rail industry *decreased* by 47 per cent as a result of extensive restructuring. Using the composite index of output and ABS Census employment figures, labour productivity is found to have increased by 13 per cent per annum between 1991 and 1996, and by a further 6.5 per cent per annum between 1996 and 2001. In all, output per worker increased by a factor of just over $2^1/_2$ in those 10 years. The assumption regarding future developments in labour productivity are critical to the projected estimates for labour demand. Clearly, the restructuring process can not continue indefinitely and, given that the rate of growth in labour productivity halved from 1991-96 to 1996-2001, we believe that the reform process had largely run it's course by 2001. We assume a further halving of the rate of growth in labour productivity to 3.25 per cent per annum between 2001 and 2006, followed by a trend rate of growth in labour productivity of 2 per cent per annum from 2007 onwards. Considering that this 'trend' will embody further industry restructuring, reforms to work practices and job redesign, technological change and economies of scale as the level of output increases, the assumption of a 2 per cent per annum growth in labour productivity seems reasonably conservative. Even though, the resulting projection is for total employment to fall from 28,875 in 2001 to 27,915 in 2020. This slight decline in aggregate employment contrasts to an increase in output over the same period of 50 per cent.

Employment by Occupation

Having generated estimates for aggregate employment, estimates of employment by occupation then requires an assumption regarding the occupational composition of employment. This is available on a consistent basis by ASCO categories from the 1996 and 2001 Censuses. Analysis of Census data on the rail transport industry indicates there was significant change in occupational composition between those years, including growth in the share of managers, professionals, and associate professionals, a decline in the share of employment for tradespersons and a significant decline in the share of labourers and related workers. To arrive at a distribution for 2006, consistent with the approach for labour productivity, we first assume that the

reform process continued but at half the rate of change that occurred between 1996 and 2001. This resulting profile is then compared to the aggregate occupational employment profile of the firms who responded to questionnaires sent out in the second half of 2006 as part of this project. Although the coverage of the survey and the ABS defined 'rail industry' will not directly correspond, the survey data suggests two adjustments to our projected distribution for 2006 are warranted: first there appears to have been more rapid continued growth in the employment of professionals, and second the decline in tradespersons may have been reversed. In each case the difference between our projections based on census data and the survey data is 5-6 percentage points. Given the likely inconsistencies between definitions used and coverage of the industry, we conservatively adjust the shares of both these groups up by two percentage points, and then re-scale all shares so they sum to 100.

The projected trends in occupational distribution between 2006 and 2011 are based on information collected in in-depth interviews conducted in 2006 and 2007on what changes the operators expected in their workforce in the coming five years. Based on a general consensus of the views expressed across operators, occupational groups are assigned changes in their share of either +1, +0.5, 0, -0.5 or -1 percentage points by 2011, with the compositional change occurring linearly for the years in between. From 2011 onwards, changes in occupational shares are based on estimates of the effect of scale on employment demand. In the in-depth interviews, respondents were asked to indicate how employment within each occupational category would change if there was a 50% increase in output. The average responses were then used to provide an estimate of the elasticity of employment with respect to output (remember that this impacts upon shares only – aggregate employment is already determined through projected output and labour productivity). We believe these economies of scale effects will be important and can be justified because increases in output in the rail industry are likely to lead to a higher scale of operation for existing operators rather than new operators entering the market, due to low marginal costs and falling average costs with output levels. These estimated elasticities range from a low of between a 6 to 8 percent increase in employment for professionals, clerical and sales workers and managers resulting from a 50 per cent increase in output, to a high of a 36 per cent increase in employment for intermediate transport and production workers (which includes drivers, controllers and signallers, other plant and machine operators).

3.2 A model of labour supply and population aging

Projections of labour supply by occupation are calculated separately by occupation, age and gender starting from the base year of 2001, the most recent year that such detailed data is available through the Census. The projections require assumptions to be made regarding the number of persons recruited to the rail industry at entry-level, and net retention rates. Unfortunately historical trends in employment in the rail industry cannot be used as a realistic guide for these assumptions because of the significant restructuring and labour shedding that occurred between 1991 and 2001. In contrast to a continuation of these trends, our output and employment projections show rail employment having stabilised and starting to expand slightly from 2006. Therefore recent trends for the economy as a whole will provide a better yardstick for future retention rates in the rail industry, rather than rail specific ones.

The approach can be illustrated as follows. Census data on employment by occupation has been collated by 5-year age groups — 15-19 years olds, 20-24 years olds, and so on to 60-64 year olds. Persons 65 and over make up the final category. Note also that the census is taken every five years. Thus all persons who were in the 25-29 year age group, for example, in the 1996 census, must have been in the 30-34 year age group for the 2001 census. It is possible to calculate the net retention rate from one census to the next. This is a 'net' rate in that it represents the balance between wastage rates (leaving the labour force through retirement, disability, temporary non-participation in the labour force or workers changing to a different occupation, out-migration) and entry rates (new entrants, people returning from outside the labour force, people entering the occupation from a different occupation, inward migration).

These net retention rates from 1996 to 2001 are calculated separately by occupation (at the major group level), age and gender for all Australian workers. As would be expected, the net retention rates vary significantly by gender and age. For men, they range from +11.3 per cent for 20-24 year olds to -31.8 per cent for 55-59 year olds. For women, the rates are much lower around age 20-29, but increase markedly from age 50 onwards. The proportion of people employed in lower skilled and manual occupations also falls with age. Using the profile of employment by occupation, age

and gender for the rail industry in the 2001 base year, it is then a simple mechanical matter to generate the projected workforce profile every fifth year from 2006 onwards, with the intervening years estimated through linear interpolation. The strength of this approach is that it explicitly takes into account the older average age of the rail workforce, as well as its specific gender and occupational distributions.

The remaining assumption needed to complete the forecasting exercise relates to the number of new recruits at entry level. Given that employment levels in the rail industry are estimated to be very similar for 2006 as for 2001, it seems reasonable to assume that the training and recruitment levels will also have remained roughly constant. In each occupational group in the rail industry, the number of 20-24 year olds in 2001 is much higher than the number of 15-19 year olds. Therefore it is assumed that the number of employees in the age group 15-24 is constant at the 2001 level as an estimate of the training rate in each year. This is in contrast to the alternative of holding the 15-19 year old intake constant and applying the net retention rate estimates to generate the figure for 20-24 years olds in subsequent years. This latter approach is unlikely to reflect actual training and recruitment practices, particularly for more skilled occupations in which people will not complete their qualifications until after they have turned 20.

3.3 Modelling results

The final results are shown in Table 1. Total employment in the rail transport industry is forecast to rise initially to 2010 due to robust forecasts for output growth, but then to contract steadily to be around 27,915 (1,000 persons lower) by 2020 as a slower rate of output growth is more than offset by the trend increase in labour productivity. In contrast, applying the retention rates observed for all industries by occupation, gender and age to the rail workforce's current profile and recruitment levels suggests the supply of workers will fall to 24,353 persons by 2020. The projected shortfall in supply relative to demand is predicted to grow steadily starting from 2006 to reach 3,562 persons in 2020.

Given total employment demand is forecast to moderate slightly we believe the output and employment demand projections are quite conservative. This suggests that the factors most likely to lead to labour shortages in the rail industry lie on the supply side. The declining supply projections result from both the assumptions used and the current profile of the rail workforce. With respect to the assumptions, addressing the shortfall will require the industry to significantly increase their entry level recruitment over 2001 levels, or else achieve much higher retention rates of older workers relative to other industries. The model indicates that entry rates to the rail industry in the 15-24 year old age groups would have to approximately double over 2001 levels to balance the demand and supply projections.

Admittedly recruitment levels in 2001 may have been suppressed due to the prior periods of labour shedding, however in the current climate of very tight labour markets and the resources boom, it seems unlikely that the rail industry could expand recruitment levels by this degree. The option of doing so by substantially increasing the wages and conditions on offer at entry level seems unrealistic given that the degree of price competition the industry faces from other transport modes. Increases in wages at entry level will also inevitably eventually flow on to some degree to incumbent workers.

Table 1: Rail workforce projections

	1996[a]	2001[a]	2006[p]	2011[p]	2016[p]	2020[p]
Rail output forecasts						
Freight (billion tonne-kms)	110.25	136.91	174.95	195.96	217.03	234.06
Passenger (billion passenger-kms)	10.12	11.40	11.58	12.77	13.32	13.84
Index of weighted output (millions)	1.12	1.34	1.56	1.73	1.88	2.00
Output per worker	33.7	46.3	54.3	59.9	66.2	71.6
Total employment (persons)	33295	28875	28679	28922	28387	27915
Occupational share						
Managerial	2.9%	4.9%	5.7%	6.9%	6.8%	6.7%
Professionals	4.9%	7.4%	10.3%	9.3%	9.1%	9.0%
Associate Professionals	6.4%	8.7%	9.5%	9.8%	9.7%	9.6%
Tradespersons	14.2%	11.0%	10.9%	10.1%	10.0%	9.9%
Adv Clerical & Service	1.5%	1.8%	1.9%	2.0%	2.0%	2.0%
Int Clerical & Service	10.6%	11.4%	11.3%	11.9%	11.7%	11.5%
Int Production+Transport	31.7%	31.5%	30.2%	31.3%	32.3%	33.1%
Elem Clerk,Sales & Service	12.9%	13.6%	13.4%	14.2%	14.0%	13.8%
Labourers & Related Workers	15.0%	9.8%	6.9%	4.5%	4.5%	4.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Demand by occupation (persons)						
Managerial	971	1418	1629	1987	1922	1868
Professionals	1618	2136	2942	2676	2579	2500
Associate Professionals	2123	2520	2730	2848	2759	2685
Tradespersons	4721	3164	3128	2920	2834	2763
Adv Clerical & Service	498	519	538	583	562	545
Int Clerical & Service	3516	3279	3242	3439	3319	3219
Int Production+Transport	10558	9097	8660	9063	9171	9234
Elem Clerk,Sales & Service	4293	3925	3846	4112	3969	3850
Labourers & Related Workers	4998	2817	1965	1294	1272	1252
Total	33295	28875	28679	28922	28387	27915
Supply by occupation (persons)						
Managerial	971	1418	1423	1360	1230	1084
Professionals	1618	2136	2311	2502	2694	2839
Associate Professionals	2123	2520	2531	2523	2500	2417
Tradespersons	4721	3164	2989	2786	2542	2339
Adv Clerical & Service	498	519	507	516	532	500
Int Clerical & Service	3516	3279	3334	3488	3635	3662
Int Production+Transport	10558	9097	8516	7702	6542	5419
Elem Clerk,Sales & Service	4293	3925	4181	4495	4714	4780
Labourers & Related Workers	4998	2817	2563	2029	1591	1313
Total	33295	28875	28357	27402	25982	24353

Table 1: Rail workforce projections (Cont'd)

	1996[a]	2001[a]	2006[p]	2011[p]	2016[p]	2020[p]
Projected shortage – persons (Demand minus Supply)						
Managerial		0	206	626	692	784
Professionals		0	630	174	-115	-339
Associate Professionals		0	199	325	259	267
Tradespersons		0	139	134	292	423
Adv Clerical & Service		0	31	66	31	45
Int Clerical & Service		0	-93	-49	-316	-443
Int Production+Transport		0	144	1361	2629	3814
Elem Clerk,Sales & Service		0	-336	-382	-746	-930
Labourers & Related Workers		0	-598	-735	-319	-61
Total		0	322	1520	2405	3562
Projected shortage - percent of projected demand						
Managerial			12.6%	31.5%	36.0%	42.0%
Professionals			21.4%	6.5%	-4.5%	-13.6%
Associate Professionals			7.3%	11.4%	9.4%	10.0%
Tradespersons			4.4%	4.6%	10.3%	15.3%
Adv Clerical & Service			5.7%	11.4%	5.5%	8.3%
Int Clerical & Service			-2.9%	-1.4%	-9.5%	-13.8%
Int Production+Transport			1.7%	15.0%	28.7%	41.3%
Elem Clerk,Sales & Service			-8.7%	-9.3%	-18.8%	-24.1%
Labourers & Related Workers			-30.4%	-56.8%	-25.1%	-4.8%
Total			1.1%	5.3%	8.5%	12.8%

Notes: a. actual, p. projected.

The more important supply-side factor lies in the simple reality of the aging, male-dominated rail workforce and hence the high expected wastage rates of exiting workers over the coming 15 years. Based on ABS Census data, the average age of all workers in the rail transport industry in 2001 was calculated to be 41.5 years. Under the supply projections, this increases to 49.1 by 2021. Even with a hypothetical doubling in the intake of 15-24 year olds, the average age of all workers in the rail transport industry still increases to 46.0 years (see Table 2).

Projections by occupation

The projected shortages are given in the final panels of Table 1 expressed in both the number of persons and as a percentage of projected demand (a positive figure indicates a shortage and a negative figure a surplus). The most significant shortage

arises with respect to intermediate production and transport workers, which include drivers and other transport operators. This arises because the occupation share is forecast to increase and because of low retention rates expected for these occupations, as they are dominated by older males. Significant shortages are also projected for managers, and tradespersons. Table 2 illustrates the importance of the age profile of the workforce in determining these projected shortages. In the case of managers the average age is projected to reach 55.9 years by 2021, and 52.2 years for intermediate production and transport workers.

Future Occupational Shortages

The projections appear to be consistent with many of the views expressed by the rail operators in the study who anticipated they would experience shortages amongst tradespeople, intermediate production and transport workers and managerial and professional staff in the future. Most of the respondents, including 17 of the total of 24 rail operators (over 70%) who were interviewed believed that they were likely to experience skill shortages in at least one occupational group in the future. Half of these operators were expecting to experience shortages amongst engineering staff including electrical, civil, mechanical and bridge engineers. Many operators were also of the opinion that they would face shortages in tradespeople (e.g. electrical) with approximately 38% of interviewees expressing this sentiment. One quarter of respondents identified train drivers as being an occupational group in which future shortages were likely. Managerial staff was another group of professionals singled out by several operators as an area where they also predicted experiencing future shortages with roughly 17% of respondents stating this would be the case. Shunters were also identified by 2 operators (8%) of those interviewed as being a profession in which future shortages were likely.

Table 2: Average age by occupation, rail workforce projections

	2001[a]	2006[p]	2011[p]	2016[p]	2021[p]
Managers	44.0	47.5	50.8	53.7	55.9
Professionals	40.3	42.2	44.1	45.8	47.2
Associate Professionals	42.0	44.7	46.9	48.6	49.3
Tradespersons	40.0	41.9	43.0	43.3	42.9
Adv Clerical & Service	38.6	42.3	45.5	48.4	49.0
Int Clerical & Service	41.2	44.4	47.6	50.2	51.8
Int Production+Transport	43.0	46.3	49.1	51.2	52.2
Elem Clerk,Sales & Service	39.3	42.2	44.7	46.7	47.8
Labourers & Related Wrkers	42.1	44.3	45.3	45.2	43.5
Total	41.6	44.4	46.6	48.4	49.1

Notes: a. actual, p. projected.

Relatively large surpluses of labourers and related workers and elementary clerk, sales and service workers are projected to emerge by 2011. For labourers and related workers, this largely results due to the assumption of continued decline in the occupational share of this group in line with recent trends, and the surplus has moderated by 2020. For elementary clerk, sales and service workers, however, the surplus arises due to the occupations being dominated by younger (relatively) females and thus have much higher expected net retention rates. In this case, the projected surplus increased out to 930 persons in 2020, around one quarter of projected demand. In the immediate term, one possible remedy to labour shortages (amongst drivers and operators) is the upskilling of labourers and related workers to drivers and operators, though the potential for this decreases over time. The same potential does not exist for the surplus of elementary clerk, sales and service workers because of the mismatch in gender profiles of the two occupations.

4. Recruitment and Training Implications

Given the current and projected long term shortages expected amongst intermediate production and transport workers, managerial, associate professional and trade staff within the rail industry over the next 15 years, there is an apparent need to increase the number of personnel that are recruited within these occupational groups. The largely unfavourable image of the rail industry and its lack of career appeal to many potential recruits means that it is likely to be quite a challenge to ensure sustainable

and adequate levels of staff recruitment will be achieved. In the case of Managers and Intermediate production and transport workers it also seems imperative that rail operators should place greater emphasis on recruiting younger workers due to the consistently higher average age of workers in these occupational groups as predicted by the modelling results.

One potential strategy to address the aging workforce problem and labour shortages within the rail industry, would be an aggressive campaign to attract women re-entering the labour force into those rail occupations currently dominated by men. However, gender biases in employment patterns are typically strongly rooted in social norms that are not easily overturned. A second strategy would be to achieve net retention rates of existing employees that are well above the average for all industries, given the workers' ages. Net retention rates can be increased either by reducing the rate at which existing workers leave the industry, or increasing the rate at which new workers enter. In either case, the success of any such strategy would depend upon increasing the attractiveness of the rail sector as an industry of employment relative to other industries.

According to the projections, there will be a need for rail employers to recruit increasing numbers of professional staff in the short to medium term due to the current shortages in these personnel which are predicted to continue until 2011. However according to the modelling results, this recruitment drive to attract professionals into the rail industry will not have to be sustained into the long term future since surpluses are predicted to eventuate by 2016. One potential strategy that could be implemented to help operators better adjust to their workforce needs over the next decade would be to train some additional professional staff into becoming managerial staff to minimise the extent of shortages predicted amongst the latter occupational group.

According to the modelling results, there will also be a need to increase recruitment amongst advanced clerical and service staff over the next 5 year period in order to accommodate an increase in vacancies that is predicted to occur within this occupational group. The extent of recruitment can then diminish as although shortages are still expected over the next 15 years amongst associate professionals in the rail

industry, the number of vacancies is likely to decline and plateau by 2016 onwards. One potential way of resolving some of the shortages expected amongst associate professional staff is to retrain and upskill intermediate clerical and service staff and/or elementary clerk, sales and service staff to assume working as advanced clerical and service personnel. This appears to be a relatively logical and easy measure to implement due to the similar skills set (and gender concentration) of the workers involved.

Several of the interviewees also anticipated that they were likely to invest more in capability development training going forward with an enhanced focus on personal, management and leadership development programs. Consequently many of these operators believed that demand for training organisations that offered such courses and programs would be likely to grow in the future. This would appear to be a fairly logical outcome given the predicted shortages forecast to occur amongst managerial and professional staff in the future. Such projections therefore signify the need to enhance training to develop the skills of these workers.

The results of the modelling indicate that a significant increase in training must be committed to by rail operators to develop and ensure there is an adequate supply of workers in the occupational groups predicted to experience significant shortages in the future including among intermediate production and transport workers, managerial, associate professional and trade staff. Therefore considerable resources are likely to be needed to be invested in developing training programs and courses designed for driving, trade, associate professional and managerial staff operating within the rail industry.

5. Conclusion

The microeconomic reform policies that were introduced into the industry in the 1990's and which contributed to the increased privatisation and fragmentation of the rail sector, were principally designed to achieve several short term operational goals such as improved industry productivity and cost minimisation. This has however

largely been at the expense of long term investment in the workforce, the adverse effects of which are presently being realised. The rail reforms have resulted in a significant decline and underinvestment in training and capability development by employers across the rail industry. Consequently there was a reluctance for operators to invest substantially in the training of rail workers due to the considerable costs involved and the increased prevalence of poaching within the industry. This approach has however proved unsustainable for rail employers and has contributed to and exacerbated many of the workforce issues the industry now faces including the problems relating to aging, skills shortages and the attraction and retention of workers.

In the next ten year period, the Australian rail industry faces several different challenges. One is the likely high rate of labour turnover, which is predicted to occur due to the aging profile of the rail workforce. This will largely be due to the high prevalence of "baby boomer" rail workers who were predominantly recruited in the period lasting from the 1960s -1980s. The problem is likely to be further exacerbated by the fact that the downsizing of firms in all rail sectors since the mid 1980's has resulted in low recruitment levels. Consequently a large proportion of the rail industry's existing workforce is likely to retire during the next decade (Rail CRC, 2006). Recently collected input from Australian rail operators also reveals that currently utilised recruitment practices and present turnover trends have compounded the aging workforce effects and thus further intensified problems relating to rail labour supply.

These factors combined are likely to result in a significant loss of experience and skills as a large group of older workers retire, which will overlap with there being an insufficient number of adequately qualified or suitably experienced workers to fill their positions. The retirement of experienced workers will also mean there will be a lack of mentors to effectively train and develop the younger workers. A lack of effective workforce planning and training of younger rail workers by Australian rail operators can thus be identified as having contributed to the skilled labour shortage currently being experienced by the industry nationally.

That the number of younger workers entering the rail transport industry is not sufficient to replace ongoing wastage and retirement rates has yet to greatly impact upon the sector because of the long run reduction in employment brought about by industry restructuring and technological change. However, given general expectations that output in the rail industry will grow, it seems unlikely that the rationalisation of employment can continue at the rate it has done in recent decades. Furthermore, the rail operators interviewed in the study also provided no clear indication that they were expecting further declines in employment either in aggregate or within specific occupations. The aging of the workforce is therefore likely to become a major issue in the near future and further dilemmas are likely to derive from the increasing dissatisfaction among workers regarding their work-life balance.

The industry's ability to meet its labour and skill needs in many areas will therefore certainly be challenged in the coming five to ten years, and this was confirmed by much of the information provided by participants through the questionnaires and in-depth interviews which were completed as part of this project. The significant amount of recruitment that is required of younger workers (especially in the under 25's age group) to accommodate the demand projections for the future would seem particularly hard to achieve given the current tight labour market conditions which look set to remain the same for some time to come. Thus, the industry may need to look to other solutions, including expecting to have to pay increasingly high wage premiums to secure skilled workers in engineering and the trades, at least for the duration of the booms currently occurring in the resource and building and construction industries. However there are already indications from what respondents have said that rail operators are often not able to effectively compete with the financial incentives offered to recruits by larger firms in competing sectors such as the mining, building and construction and infrastructure development industries.

As has been identified elsewhere, (see, for example DEST, 2006) the image of careers within the rail industry consequently needs to be improved in order to attract young workers. Factors identified as negatively impacting on the attraction and recruitment of workers into the rail transport sector included such things as the lack of clear career pathways, the industry image (i.e. as old, dirty and unsophisticated) and specific issues relating to the employment of younger workers. In addition, if rail operators

were able to increase the levels of recruitment and workforce representation amongst female workers, this would further assist them in alleviating many of the skills shortages they face. Therefore it would be productive for the ARTI to address the entrenched gender segregation that exists within the major semi-skilled occupations in the sector. Currently, half of the potential supply of young workers are effectively excluded from major rail occupations, such as driver and intermediate plant operator positions, due to the almost complete domination of males within these occupations. Policies to address this imbalance would likely involve incorporating greater flexibility in working hours and other family-friendly working arrangements and a visible antidiscrimination regime.

A useful strategy for addressing the rail industry's many workforce issues would be to differentiate the workforce by specific occupational groups to identify and implement tailored policies based on the type of skills being sought. In this sense, it would be desirable for the industry to implement measures to promote the development of rail careers as well as develop policies designed to enhance the sustainability of industry workforce skills and experience to ensure the continued effective operation of the sector in the future. The future workforce model for the rail industry may even have to be based on increased outsourcing using external contractors, instigating employment tenures of shorter duration and substantially increasing pre-industry training for workers.

Without the development and implementation of effective strategies to address many of the workforce issues currently facing the rail industry, these are likely to get worse which will have implications for all sectors of the industry. In the event that no effective action is taken and appropriate policies are implemented in the medium to short term, many have predicted that the Australian rail industry is likely to experience a labour attraction and retention crisis. The main objective of the Australian rail industry should therefore be to develop and maintain a motivated, flexible and adequately skilled workforce through innovative employee recruitment, renewal, deployment, retention and training and development strategies. There is thus an onus for rail companies and industry organisations within Australia to work co operatively and take effective action to curtail the skills shortages and other workforce issues that currently exist in the Australian rail industry.

REFERENCES

Apelbaum Consulting Group (ACG), 2005. *Australian Rail- The 2004 Productivity Report,* Australasian Railways Association (ARA) Inc., Australia
Available from:
http://www.ara.net.au/dbdoc/ARA%20Productivity%20Report%202004.pdf

Australasian Railways Association (ARA). 2003a, Australian Rail - Industry Report 2003, ARA Inc., Australia.
Available from: **http://www.ara.net.au/dbdoc/Industry%20Report%202003.pdf**

Australasian Railways Association (ARA). 2005a, Australian Rail – Industry Report 2005, ARA Inc., Australia.
Available from: **http://www.ara.net.au/dbdoc/Industry%20Report%202005.pdf**

Australian National Training Authority (ANTA- Federal Government), 2003, Submission by the Australian National Training Authority; *Senate Inquiry into Current and Future Skills Needs*, p. 33

Barnow, B, Trutko, J & Lerman, R 1998, *Skill mismatches and worker shortages: The problem and appropriate responses,* Urban Institute Policy Memorandum prepared for the Department of Labor, Washington, DC., p.7

Bureau of Transport and Regional Economics (BTRE)(2006), *Freight measurement and modeling in Australia*, BTRE, Report 112, Department of Transport and Regional Services, Commonwealth of Australia, Canberra.

Boswell C., Stiller S., Straubhaar T., 2004 *Forecasting Labour and Skills Shortages: How Can Projections Better Inform Labour Migration Policies?,*
Hamburg Institute of International Economics (HWWA)

Department of Education, Science & Training (DEST- Federal Government), 2006, *National Industry Skills Report*, p.15
Available from: http://www.dest.gov.au/NR/rdonlyres/9364A212-6183-4A66-81459165CB98C9F7/10627/NationalIndustrySkillsReportMay2006.pdf

Everett, S. 2006, "Deregulation and reform in Australia: Some emerging constraints", *Transport Policy,* Volume 13, Issue 1, January 2006, p. 74-84

Green, F, Machin, S & Wilkinson, D 1998, ‹The meaning and determinants of skills shortages›, *Oxford Bulletin of Economics and Statistics*, vol.60, no.2.

Hensher, D.A, Daniels R., DeMellow I., 1994. *Revisions and Update: Productivity of Australian Railways 1971/71 to 1991/92*, Institute of Transport Studies, Graduate School of Business, The University of Sydney

Productivity Commission. 2000a, *Progress in Rail Reform*, Productivity Commission (Australian Government), Canberra
Available from: http://www.pc.gov.au/inquiry/rail/finalreport/index.html\

Productivity Commission. 2000b, *An Assessment of the Performance of Australian Railways 1990-1998*, Productivity Commission (Australian Government), Canberra
Available from:
http://www.pc.gov.au/inquiry/rail/finalreport/supplement/supplement.pdf

Productivity Commission. 2000c, *Draft Report- Progress in Rail Reform (Media Release)*, Productivity Commission (Australian Government), Canberra
Available from: http://www.pc.gov.au/inquiry/rail/draftreport/mediarelease.html

Rail Collaborative Research Centre (Rail CRC). 2006, *Research: Theme 6 Industry Skills Development (Education and Training)*, Rail CRC. Australia
Available from: http://www.railcrc.cqu.edu.au/uploads/theme%206.pdf

Rail, Tram & Bus Union. 2004, “Skills Crisis in Australia’s Railways”, *Rail, Tram & Bus Worker*, Vol. 12, # 3, pp 1
Available from: http://www.rtbu-nat.asn.au/journal/303/1098065251_21378.html

Richardson, S 2007, *What is a skill shortage?,* National Centre for Vocation Education Research (NCVER), Adelaide

Roy, R, Henson, H & Lavoie, C 1996, *A Primer on Skill Shortages in Canada*, R-96-8E, Human Resources Development Canada, Hull, Canada.

Shah, C. and Burke, G. (2005), “Skills shortages: concepts measurement and policy responses”, *Australian Bulletin of Labour*, 31, 1, pp. 44-71

Transport and Logistics Industry Skills Council (TDT), February 2005, *Industry Skills Report*, Australian National Training Authority, 2005, pp 9-28.
Available from:
http://www.tdtaustralia.com/files/documents/1111027027transportlogistics%20final.pdf

Yates, A. 1999, Engineering for rail sector growth: a report on engineering rail skills shortages in Australia, Institution of Engineers, Australia.
Available from:
http://66.102.7.104/search?q=cache:pgrhY4ur6mcJ:www.ieaust.org.au/library/publications/railreport.doc+rail+sector+growth-+athol+yates&hl=en&gl=au&ct=clnk&cd=2