CHAPTER FOUR

A Detailed Consideration of the Data Used in the TFP Model (HF1)

4.1 INTRODUCTION TO HFI

The purpose of this Chapter is to consider the issues and review the literature surrounding the standard measures of output and input used in the TFP Model (HF1).

The Chapter is organised as follows:

- Each individual measure used, whether output, input or contextual, is identified and defined.
- Key philosophical and definitional issues relating to the data used in the study are canvassed. The practical issues relating to data compilation and the creation of RAILDATA (the comprehensive database) are reserved for Appendix 2.
- Each measure is compared and contrasted with similar measures used in other railway productivity studies.
- Conclusions are drawn as to the usefulness of each measure in helping towards the robustness of Model HF1.

4.2 THE MEASURES AND MEANINGS OF OUTPUT

Three measures of output are considered in this study: seat capacity kilometres, passenger kilometres and passenger journeys. After identification and discussion they are compared and contrasted with their use in other studies. This is undertaken at two levels; firstly where they are used in the development of partial productivity indicators for corporate annual reports and inter-railway comparisons, and secondly where they are used in other TFP studies. Discussion of their first use is very important because this is their commonly accepted use by railway corporate managements, and those who judge the performance of these managements whether they be Governments, their bureaucracies or their shareholders and customers. We also need to understand their use as performance indicators of services. In the New South Wales context, rail passenger services are "intermediate" services, that is they are services which are used in the

production of other goods and services rather than in final consumption. They provide journeys to work, school and other education, shopping, other business and recreation.

The railway passenger service offers space (usually seat space) in reasonable comfort and safety at a timetabled departure and arrival time and at a reasonable price. The quality of this service is usually judged by customers in terms of: on-time running, comfort, safety, cleanliness, frequency of service and journey time. The railway passenger service is also a "collective good", that is its chief characteristic is its non-excludability. Provided a person is in possession of a valid ticket or pass, they are entitled to travel on that service. It is not the extreme case of non-excludability (Samuelson 1952) where the service or good is obtained without payment.

Analysts and users of the information need to be clear about the meanings which may be attached to the term "output". In the case of a private sector firm which is manufacturing items for profit, output is relatively straightforward to understand. In a publicly owned firm which offers services, this is not the case. There are problems of concept and measurement, both on the score of being a service industry.

In the examination of these problems, it is first useful to consider the nature of instances of free and concessional travel for some groups in the community. Free and concessional travel creates some theoretical difficulties for the measurement of the output of such services.

The first problem is to find a unit of output that can be measured independently of changes in the units of input (Reder 1969). This has been done with: seat capacity kilometres, passenger kilometres and passenger journeys. Nevertheless, there are some linkages with inputs which are discussed later. Thus some compromises have been made.

The second problem derives from the fact that the rail services are collective goods. The general and well-known difficulties in measuring collective goods are present, to a greater or lesser degree, in NSW rail passenger services (Olson 1973) and are listed below.

Obtaining preferences from both users and non-users of rail services

Various attempts have been made over the years to develop "demand responsive" timetables after conducting surveys of existing customers. These have had limited success and have sometimes disadvantaged other travellers who may have been under-represented in the surveys. For example, this occurred when fast commuter services from the outer west of Sydney were increased in morning peak times. The increased

track usage of these services meant the cancellation of some inner west services. However, the greatest deficiency of the surveys was their inability to measure the travel preferences of non rail users. Studies such as those based upon the model used by the State Transport Study Group (STSG 1983) use travel time and distance as a proxy for mode choice. Thus, if a commuter is a certain distance away from a railway station or bus stop, his/her preference for travel mode is automatically determined. This too is a very blunt instrument for measuring preferences of non-users.

Where preferences are not well known, service providers over-supply or under-supply levels of service

This will be readily apparent when a close examination is made of NSW suburban and interurban capacity seat kilometres. For example, technical efficiency dictated that the old single deck 1929 "red rattlers" needed to be replaced. Restrictions of track space and very heavy peak loadings in the 1960s led to the decision to introduce the double-decked concept to rolling stock, and eventually, to link those carriages in sets of eight. In most cases, it is not technically efficient to break up too many car sets during the day time off-peak and then re-couple them for the homeward journey. The consequence of this is that, at times, there is a very large excess seat capacity on suburban and interurban services. This has its own problems of passenger safety and vandalism, when near-empty trains become a hazard for train crews and the few passengers who do use the service. When services are cut back, to reduce costs, some group in the community is inevitably disadvantaged.

Output is not in the form of divisible units

In the general case, it is argued (Olson 1973), that the characteristics of a collective good (which prevents non purchasers from exclusion) make it of a kind where output is not in the form of divisible units that can be readily counted.

In the case of NSW, this certainly applies to the so-called unremunerative journeys. Whilst the details of this problem must be reserved for Appendix 2, an overview of the problem is given here. "Unremunerative" passengers are those who are granted free or concessional travel. They comprise students, pensioners of various categories, public servants in some categories and other groups who have managed to obtain a concession after political representations. During the study period, the number of journeys undertaken by "Unremunerative" passengers was decided en bloc by a Ministerial Committee. A so-called formula was applied to determine an estimate of journeys made by each category of free or concession traveller. No survey data of any consequence backed the estimates. No one really knew how many "unremunerative" journeys were made and how many eligible persons took advantage of the free and concession travel on offer.

Dearth of satisfactory marketing information

The dearth of satisfactory marketing information for suppliers of collective goods, such as NSW rail passenger services, means that they have much less information than a private firm, to enable them to act efficiently. They know only their costs and, in NSW, only in a rudimentary way. Consequently, they have little idea what volumes of output these costs should bring about. And, even if they do know (which is only in a rudimentary way, in NSW, from counting heads in carriages, or "on-off" counts), they still have a major problem finding out what the service was worth to consumers.

Summary

For the four reasons mentioned above, any provider of a collective good (whether owned by the government or private capital) is inherently more inefficient than a firm providing non-collective goods or services.

This also spills over into the management of the collective goods firms. It is simply too difficult to assess the performance of managers. Any system is flawed, and these flaws tend to get worse over time, as entrenched managements determine the cultures within which they will best survive. For strong evidence of this, the reader should refer to Chapter 6 of this thesis. In the Sayers rail era at NSW, the contract system was expected to resolve this. However, the implementation of the Contract System for the hiring of senior executives is also seriously flawed because of deficiencies in measures of performance emanating from available information: should a marketing manager from Countrylink be rewarded if patronage is increased because the percentage of pensioners comprising total patronage increases from 50% to 80%? And could that person accurately monitor the number of pensioners using the service, anyway?

There are statistically robust solutions to the problems of obtaining market information for providers of collective goods and services. It is not the purpose of the thesis to canvass these. Instead, we are dealing with the situation in NSW between 1951/52 and 1991/92, where no such solutions were tried. How the analyst should overcome these deficiencies is the real subject of discussion below.

The third problem derives from the fact that output changes need to be adjusted for quality changes. Economists are in general agreement that failure to adjust for changes in quality of outputs leads to bias in conventional measures of productivity trends (Treadway 1969). Some economists contend that the more closely the units of measurement represent the service characteristics that the buyer is really seeking (i.e. the customer's stated preferences), the greater the chance the analyst has of measuring the output-increasing, effects of quality changes, and the more accurate will be the

measures of output. This viewpoint is considered in detail in the discussion on the measurement of passenger kilometres.

The viewpoint put forward in this thesis is that quality of service should be considered at two levels.

Level 1, where the service provider interfaces with the customer
It is considered unrealistic to expect standard measures of output of a collective good to reflect all the subtleties by which customers measure service. In the case of rail passenger services, this is considered impossible. Because of the importance of service quality in the measurement of a service provision, it is better to establish a separate set of measures. This thesis goes further by suggesting that customer response to service quality be monitored separately but be linked to measures of output. Hence, the creation of Model HF2 described above.

By way of illustration of the points made above, the complexities of measuring service quality in the railway context are considered below. The quality of a passenger train service in NSW is usually judged in terms of:

1. on time running
2. comfort
3. safety
4. cleanliness
5. frequency of service
6. journey time
7. other criteria (usually unspecified).

The State Rail list of seven is deliberately ordered to reflect those criteria which have most exercised management minds in the study period. For example, *on-time running* has been almost a fetish with rail management. However, it has two major measurement problems.

First, in the complexity of a commuter rail system that is Sydney, where should on time running be measured? It has always been measured at Central Station. But this takes no account of time lost in other parts of the system. Thus, a service may lose a half hour to Strathfield (which would be sufficient to severely disrupt the Strathfield worker in the morning), but pick up, say, ten minutes of that delay between Strathfield and Central, and be recorded as only twenty minutes late. Another issue relates to what constitutes on time running. For many years, if a train arrived at Central within three minutes to timetable, it was recorded as being on time. This was changed to six minutes in the

early 1980s at the Chief Executive's direction. Since then, debate has occurred whether one should stay with a three minute tolerance (which is technically preferable) or move to a six minute tolerance which some psychologists and others have suggested is the perception tolerance of the average commuter towards the late running of her/his train. Another issue arises with long distance trains. This has to do with padding a timetable with extra time to allow for the risk of contingencies during the journey. Thus a long distance passenger train can have one hundred percent on time running, but also have a timetabled journey time which is a half an hour too long.

Passenger *comfort* has always been an important criterion of service quality but has proved almost impossible to measure with any precision. It has also been one in which a great deal of engineering effort has been directed from the design of the first double deck carriage to the Tangara and the XPT. Once overcrowding was reduced on commuter trains by the use of double deck carriages, a substantial effort went into finding a suitable seat design. Eventually, full seat comfort had to be traded off against finding a seat design which would deter vandals. And, it was discovered early in the vandalism epidemic that no seat was totally vandal proof. Air conditioning of suburban trains was a heavily debated issue among engineers in the 1970s, and ultimately required a Ministerial decision to resolve it. The issue was the trade off between operating and capital cost, efficiency of operation and a perception that an air conditioned carriage on a suburban train would enhance the comfort of commuters. The Tangara carriage seems to have resolved the issue, although there are still complaints from some travellers who sit in window seats below the air conditioning ducts. Another issue occurs in the way some commuters are willing to trade off comfort (as measured by the probability of getting a seat) with faster journey times. Thus many express commuter services experience overcrowding (number of passengers standing) because commuters have traded off comfort for faster journey times.

Perhaps the most contentious quality factor is *safety*. There are essentially two types of safety: safety of the system (technical safety), and safety of the customer from other persons. Safety of the system has always been an overriding issue with railway managements and, with a few exceptions, has been very good. Failure of the system in the few cases it occurred in NSW since 1952 has been traceable to management and maintenance crises. Technical safety has been constantly the subject of scrutiny and upgrading, as it is amenable to engineering solutions. It is, however, the safety of customers from other persons that is proving very difficult to insure against. Railway carriages and stations are places where groups of people are to be found, at most times of the day. The locations are public property and, in the case of moving carriages, may confine people for periods of time. They are "softer" targets for vandalism and crimes

against the person than most other public places, and therefore attract a disproportionate attention from graffiti gangs, street gangs and other anti-social groups in the community. Most sociologists agree that the prevalence of these groups is increasing in cities like Sydney. Extra policing and surveillance cannot eliminate the problem and, at best, can only contain it. Coupled with greater media coverage there is a heightened community perception that, at certain times, catching a train can increase the risk of assault or other crimes against the person.

Cleanliness is another quality factor influenced by perceptions. The banning of smoking on trains and in enclosed and waiting areas of stations has gone a long way towards cleaning up railway premises. However, running counter to this is the prevalence of graffiti. This gives the impression of non-cleanliness and neglect. As a consequence, rail managements throughout the world endeavour to clean up graffiti as quickly as it occurs, at significant cost.

Level 2 considers service quality within the production processes themselves

This requires a general Total Quality Management (TQM) approach to the production process. Each process and sub-process used in the production of a rail service thus has a "producer" and a "customer" who is usually the next person in the production line. The TQM method calls for the analysis of performance standards of each process and sub-process by those carrying out the functions, who then look for improvement opportunities, propose solutions, test the solutions and then agree with management on a new, improved set of performance standards. TQM then requires that this method be repeated to achieve a yet higher set of performance standards. The advantage of the TQM method for productivity analysis is that it requires that all processes and sub-processes be subjected to statistical quality control so that improvements can be quantified. Process "mapping" in the beginning establishes a base line from which the general level of improvement can be monitored. It is theoretically possible, then, to combine these improvements into a set of weighted index numbers and refer to this as an "innovation index". This has been done for Model HF1, where "innovation" is treated as a factor of production and discussed in Chapter 5. For a more complete definition and exposition, the reader is referred to the discussion of input indicators later in this chapter. The important considerations to bear in mind are:

- "innovation" is not simply technological improvement of the production process but also (and, importantly) improvements in the myriad of processes and sub-processes which go to make up the production system. Many of the latter are more important than improvements in the hardware, and
- provided the innovation events can be readily identified in the years 1951/52 to 1991/92 they can be indexed and weighted in accordance with their impact on

output. This remains a relatively subjective exercise until a TQM program is fully implemented.

In conclusion, the railway passenger service, whether in NSW or elsewhere, presents major conceptual problems in output measurement. The "collective good" difficulty arises in NSW with the measurement of "unremunerative" passengers. A detailed dissertation on the resolution of this problem is given below. In the longer run, however, only comprehensive demand analyses will resolve the broader issues completely. The difficulty of adjusting for changes in the quality of output may be considered at two levels, or interfaces. The first concerns itself with the interface between service provider and customer. The quality issues are so complex that, it is contended, they should be modelled separately. The second concerns itself with improvements within the production system itself. Total Quality Management (TQM) suggests a solution which has the added advantage that it is amenable to statistical control. It is contended that in the study period, the technological improvements and process improvements ("hardware" and "software") can be indexed and presented as a separate factor of production termed "innovation". However, most analysts agree that selection and measurement of service outputs is ultimately a matter of compromise.

4.3 SEAT KILOMETRES

Seat kilometres is a supply side measure of output which is estimated by linking an operating statistic, loaded carriage kilometres travelled, with nominal capacity, seats per carriage. Seat kilometres is considered to be a refinement of the more commonly used train kilometres: although this latter statistic has been used in deriving some estimates of loaded carriage kilometres. Seat kilometres and train kilometres are perfect substitutes where each train set has identical seating capacity. This is not the case in practice.

Loaded carriage kilometres were collected from drivers' daily report sheets and (for suburban and interurban electric trains) train guards' daily reports on running. These are the same sources of information for train kilometres, locomotive kilometres and vehicle kilometres.

Seat kilometres were estimated as follows:

1. From archival sources (operating statistics) annual total loaded carriage kilometres were obtained for the years 1970/71 to 1989/90. For the years 1951/52 to 1969/70 annual total loaded carriage kilometres were estimated by applying the ratio of 6.0 loaded carriage kilometres to every train kilometre. This estimator was based on a

study of operating statistics for the years 1970/71 to 1978/79. This showed that the mean ratio of train kilometres to loaded carriage kilometres was 5.885 carriage kilometres per train kilometres with an increasing trend in the earlier years of the study period. That is, the average passenger train in service was 6 carriages in length. The statistic was not collected after 1989/90. The trend in the ratio of train kilometres to loaded carriage kilometres between 1980/81 to 1988/89 was studied and it was found that the ratio was decreasing slightly, reflecting a growing incidence in the use of four-car train sets in suburban off-peaks. An estimate of 5.549 loaded carriage kilometres per train kilometre was obtained for 1989/90 and 1990/91.

2. The relative robustness of the ratios established in (1.) enabled the confident use of annual train kilometres to allocate total carriage kilometres into the four market segments.
3. The next step was to derive a weighted average of seats per carriage. All Annual Reports contain a listing of the numbers and types of carriages in use in the passenger fleet. Technical specifications are also readily available for nominal seating capacity by carriage type. However, whilst suburban and interurban carriages are readily identifiable, the dissection cannot be made for the forty years between the country and interstate segments. Consequently they were combined to obtain the same weighted average.
4. Finally, annual seat kilometres were obtained by multiplying average seats per carriage and annual loaded carriage kilometres.

It is useful to compare and contrast the use of this output indicator with its use in other performance measurement systems. One of the most intellectually advanced of these is the partial performance indicator (PPI) system that is used by British Rail. British Rail's Performance Measurement System is locked into an accounting identity which consists of five ratios (British Railways Board 1980):

$$\frac{\text{Receipts}}{\text{Traffic units}} \times \frac{\text{Traffic units}}{\text{Train kms}} \times \frac{\text{Train kms}}{\text{Staff nos.}} \times \frac{\text{Staff nos.}}{\text{Staff costs}} \times \frac{\text{Staff costs}}{\text{Total costs}} = \frac{\text{Receipts}}{\text{Total costs}}$$

A whole range of subsidiary PPIs are then hung off each ratio. The "traffic unit" is variously identified as passenger numbers, passenger kilometres, tonnes of freight, or net tonne kilometres.

The advantage of this system is its ultimate focus on cost recovery and the role of staff costs, staff productivity (as interpreted above) and average train loading in this cost recovery. It is also readily quotable and understandable in communication between management. Also, it readily permits inter-railway comparisons.

However, it has serious deficiencies when compared with TFP analysis. Its only means of establishing loadings of trains is when the following ratio is used

$$\frac{\text{Traffic units (Passenger number)}}{\text{Train kms}}$$

This is a very blunt measure when compared with seat kilometres. Nevertheless, it is understandable when the PPI system is locked into a set of accounting identities aimed at expressing performance in terms of the financial "bottom line", that is the financial deficit.

A similar approach was adopted by the Australian Railway Research and Development Organisation (ARRDO) but with additional identities included (ARRDO 1986). Again, this heuristic approach had, as its end point, the deficit which in turn was dependent upon measures of working expenses and revenue—working expenses on labour, materials and energy and revenue from passenger and freight traffics that were then linked to the traffic task, whose basic unit of measure was Freight Equivalent Traffic Units (FETU). This is an artificial unit of measure aimed at obtaining equivalence between the passenger and freight transport tasks. It depended very much upon the conversion factors used for each railway system in Australia. The conversion factor was obtained from one year's data, 1979/80.

A more ambitious exercise was proposed for the State Rail Authority of NSW (1987) as a prelude to corporate planning. Some 83 identities were set up. Passenger output indicators used were revenue, journeys, train kilometres, passenger kilometres and average passengers per train. The proposal was not implemented, because of the expected difficulties in establishing the information system. But, as with the British Rail and ARRDO approaches, it locked the analyst into a rigid structure of basically accounting identities focused on the "bottom line" of deficit control.

The use of seat capacity kilometres as a measure of output, in the case of NSW, is particularly relevant since it has captured the Railways' response to early problems of insufficient capacity in the suburban weekday peaks of the 1960s, i.e. the creation of the double decked carriage. In the process of developing this response, the Railways created major problems of over-capitalisation in rollingstock, excess capacity costs during the off-peak and similar matters.

4.4 PASSENGER JOURNEYS

Passenger journeys is a demand side measure of output. In the case of NSW, it is estimated from statistics of tickets sold. With single and return tickets, there is no problem with obtaining estimates. The problems have occurred in the application of average journey multipliers to weekly and periodical tickets sold, which account for the major share of total journeys in the suburban and interurban markets. For this and other reasons to do with methodology, a major study was mounted to obtain useful estimates for passenger journeys by the four market segments (suburban, interurban, country and interstate). As noted in the introduction to this Chapter, the practical issues involved in their compilation are contained in Appendix 2. The broader philosophical issues are discussed below.

First, passenger journey statistics have tended to take on an importance which is beyond their intrinsic worth. In the past, more than one Chief Executive of the NSW Railways has suffered at the hands of politicians as a result of minor downturns in passenger journey statistics. There has consequently always been a temptation (sometimes succumbed to) to change the procedures for estimation of passenger journeys. This problem is exacerbated by the fact that, although passenger demand is a very complex matter, simplistic explanations are usually sought for changes in demand. For the reasons mentioned above, a strong caveat needs to be placed on any passenger journey estimates used in performance measurement studies and verification always sought.

Second, the caveat which should be placed on NSW rail passenger journeys is that they are estimates based on ticket sales. Because of changing conventions, errors and other changes made to the statistics, they have proved to be a very discontinuous series since 1951/52. The purpose of the detailed analysis of the statistics, now contained in Appendix 2, is to identify as many of the causes of the discontinuities and adjust the series where possible. The data is therefore not "official" in the sense that it has been audited and presented before Parliament.

By way of contrast, it is useful to examine British Rail's use of passenger journey data in its Performance Management System (British Railway Board 1980). In its internal System, British Rail does not use the passenger journey as a performance indicator. Instead, it has developed a relatively sophisticated system for periodical measurement of passenger kilometres based upon train kilometres, train loadings and trip length (Mimeo, 26 March 1986). It has also managed to educate Governments, Treasury and other analysts in the use of the passenger kilometre as a single, robust indicator of market response to rail passenger services offered. This is partly due to the fact that the

central measure of saleable output is the train kilometre in the British Rail system and the passenger kilometre is a derivative of the train kilometre. The difficulty with British Rail's approach is that only three other major European rail systems have accurate train loading information. Consequently, no definitive statements can be made about the remaining six railways included in the international comparisons (British Railways Board 1980).

4.5 PASSENGER KILOMETRES

Passenger kilometres is a demand side measure of output estimated by linking annual passenger journeys with average trip length per passenger journey. A detailed account of the calculation of passenger kilometres travelled on NSW rail passenger services is given in Appendix 2. There are no "official" or unofficial statistics of passenger kilometres in NSW. This has now been rectified for Countrylink which does provide passenger kilometres figure for the years 1981/82 to 1991/92 in the Annual Report. Trip length distributions are not readily available.

The passenger kilometre is generally regarded as a more powerful indicator of passenger demand than the passenger journey, as it incorporates the dimension of travel distance. In the United Kingdom (for British Rail and the London Transport Executive, at least), it has been developed as a key indicator of demand response to the supply of saleable train/bus kilometres.

In the United Kingdom, it has also been put forward as a measure of consumer surplus, generated by a public transport service (Glaister and Collings 1978). This fulfilled, to some extent, the idea that grew up in North America in the early 1970s (Treadway 1969) that the measures of quantity and price in the service industries in general (and, public services in particular) should focus more towards a welfare direction. This was argued on the philosophical basis that the most important use (in policy terms) of a measure of production is what it tells us about consumption and welfare.

In the United Kingdom public transport context, London Transport established in 1975 the corporate objective that its bus services should be run in such a way as to maximise the total number of passenger kilometres. This was a strongly market-oriented, commercially sound objective for a bus company to have, since it enabled management to focus on such issues as improvements to off peak ridership, route changes and other means of ensuring that ridership is maximised for every saleable bus kilometre on offer. The objective of maximising passenger kilometres on a train service is much more

complicated because of the heterogeneity of services offered, the diverse character of markets served and the operational and other constraints on making major service changes. Thus an objective of maximising passenger kilometres for suburban commuter services very quickly runs into the problem of capacity to service the objective: for example, in outer western Sydney, without disadvantaging the commuter in, say, inner western Sydney. If the objective was then amended to, say, maximising passenger kilometres for full-fare paying commuters, then concession-holders would be discriminated against. Nevertheless, in Sydney, where there is massive excess capacity in off-peak saleable seat kilometres, maximisation of passenger kilometres makes a great deal of commercial sense.

It is, however, in the welfare context of a public transport system that the passenger kilometre and its maximisation, offers some scope as a policy tool (Glaister and Collings 1978). In the first instance, it is argued that passenger kilometre maximisation without weighting may lead to non-welfare maximising behaviour, i.e. price discrimination and cross-subsidisation may be introduced. This is because operators have a tendency to push up fares on inelastic services to earn surplus revenue which can be used to finance a service with high price elasticity and achieve the objective of increased passenger kilometres. The solution to this problem may be found in the weighting of passenger kilometres. In the first case, demand relationships are approximated by constant elasticity functions (with respect to generalised cost). These functions then represent single weights, so that the weighted passenger kilometres, when maximised, yield the same result as net consumer surplus, when maximised. In the second case, it is argued that marginal cost pricing is not a socially optimising strategy because of externalities such as traffic congestion. Weighting for traffic congestion would resolve this problem but no satisfactory weighting system was suggested (Glaister and Collings 1978). Also maximising the number of passenger kilometres is a sensible strategy only if there is a budget constraint on the operator: otherwise the optimal policy would be to provide an infinite level of service at minus infinity fares.

We have seen in Section 4.4 above the central role of passenger kilometres as a measure of British Railways' commercial performance. Under the terms of the 1974 Railways Act, British Rail has a public service obligation (PSO) to run passenger services over the network as it stood at the beginning of 1975. The management task is then to improve performance through more efficient operations and better matching of output to demand. Performance is measured as the bottom line deficit between cost and revenue when demand (measured by passenger kilometres) falls, supply (measured by

passenger train kilometres) is adjusted to meet it. In no sense can such a formula determine welfare maximisation policies.

The conclusion suggested by the foregoing analysis is similar to the conclusion on the use of output indicators to measure quality of service viz: in practical terms, welfare is too complicated a concept to measure with the use of one output indicator such as passenger kilometres. This conclusion lends support to the view that welfare issues are best modelled separately as in the Quadrae Model.

4.6 PASSENGER REVENUE

The Australian Railways Classification of Earnings and Working Expenses Accounts (AR 1961) defines gross earnings from passengers as follows:

> Includes all earnings from transportation of passengers including sleeping car and excess fares and deposits in connection with periodical tickets, excursions and special trains.

It does not therefore include parcels or trading and catering revenues earned on trains.

However, in the New South Wales context, it includes an amount of money paid by the Government to the railways to cover so-called "unremunerative" passengers. These are a substantial group of passengers who travel free or at concessional rates. In the period under consideration, a special committee sat at the end of the financial year and agreed on a formula which was then applied to determine what payment the railways should receive. This formula was founded on estimates of journeys made by each category of free or concession traveller. The journey estimates were made on the most cursory of survey information. Anecdotal information and other documentation on the meetings also indicate that the final amount of money was basically determined by the bargaining strength of the railways and its chief executive officer. This becomes clear when one looks at the variability in these numbers. The purist analyst would probably suggest that "unremunerative" revenue be excluded so that we are left with fare box revenue only. "Unremunerative" revenue has essentially been an outcome of the political process, and has no bearing upon the true revenue earning capacity of the railways. However, it is precisely for this reason that it should be included:

1. It is not a subsidy within the economic definition and can in no sense be regarded historically as a "community service obligation".
2. It is an economic rent imposed on the taxpayer, through the government, for carrying an undetermined number of concession holders that (presumably) would vote in favour of the government in return for holding on to their concessions. In the past, populist governments have used the railway concession fare with considerable

abandon. And, taxpayers have paid handsomely to the railways for this largesse. On the other hand, reformist governments have cut back on "unremunerative" payments.

3. The "unremunerative" payment variations are a very good proxy for measuring changes in the relative strength of the railways as a political institution, capable of keeping governments in power or of changing governments. The payments are made on behalf of a very wide spectrum of society. The size of the payment is then inversely proportional to the level of efficiency. This has led to an economic distribution in the system where the greater the sum received, the lesser is the pressure to reduce costs, as would happen in a normal business enterprise.

Specific information on the unremunerative subsidy is only available from 1966/67 although it was almost certainly being paid before that, in accordance with some formula. The data is set out in Table 4.1.

Table 4.1 Estimated payment for unremunerative journeys, 1966/67–1990/91

Year ended 30 June	Payment $'000 current	% change on prev year
1967	7,551	
1968	7,346	-2.7%
1969	7,601	3.5%
1970	8,225	8.2%
1971	8,228	-
1972	8,833	7.4%
1973	8,741	-1.0%
1974	8,298	-5.1%
1975	6,114	-26.3%
1976	19,656 (1)	221.5%
1977	2,750	-86.0%
1978	13,248	381.7%
1979	13,248	-
1980	21,348	61.1%
1981	27,333	28.0%
1982	39,917	46.0%
1983	49,944	25.1%
1984	57,439	15.0%
1985	74,337	29.4%
1986	80,700	8.6%
1987	89,859	11.3%
1988	100,548	11.9%
1989	110,194 (2)	9.6%
1990	100,000 (2)	-9.2%
1991	100,000 (2)	-

Notes:

(1) The 1975/76 Annual Report recorded a payment of $7.3 million for unremunerative services: an agreement made under the outgoing Liberal/Country Party government. The 1976/77 Annual Report, the first under the Wran Labor Government, showed the 1975/76 unremunerative payment to be $19.7 million.

(2) These figures are estimates.

A number of observations may be made about the figures which lend support to the "political rent" argument.

1. In the years 1966/67 to 1974/75, the unremunerative payments were a modest call on government funds. In fact, they declined slightly in 1972/73 and 1973/74, in the years following the 30 per cent fare increase.
2. In the years of the Wran Labor Government when the railways became a centrepiece of policy (for both state economic development and state welfare reasons), the unremunerative payments escalated rapidly. They continued to increase until they hit a ceiling about $100 million.
3. The $100 million was maintained under the Greiner Coalition, probably because any reform of this financial monster, in parlous times, would have had severe electoral consequences. This would be especially true in country areas where the majority of passengers travel on concessions.
4. The gyrations in the year to year numbers of concession holders tend to make a mockery of earnest attempts at, for example, guessing the number of times judges and magistrates on free passes use the train each year.
5. It is very important that it be included in the revenue figures because it holds a mirror up to the railways in its role as a political institution. It is certainly not a subsidy in the economic sense of the word.

For the years 1950/51 to 1965/66, only a single figure was available in Annual Reports, to cover revenue earned from all passenger market segments, and unremunerative payments. An extrapolation was made from later years of the percentage share of metropolitan and non-metropolitan passenger revenue. These extrapolated percentages were then used to split total revenue into metropolitan and non-metropolitan for the years 1950/51 to 1965/66. Average revenues per journey were then calculated to test for any inconsistencies in this procedure.

Interurban revenue was extrapolated from 1965/66 to its very small base in 1958/59 and deducted from metropolitan passenger revenue. This procedure then gave relatively robust estimates of suburban and interurban revenue for the years 1950/51 to 1965/66. Examination of the years 1966/67 to 1975/76 indicates that interstate revenue was a very stable one-third of the combined country and interstate revenue. This arose partly because of the interstate revenue sharing agreements with other systems at that time. This ratio was adopted to separate Country and Interstate revenues for the period 1950/51 to 1965/66.

Revenue for each market segment, for the period 1966/67 to 1975/76, was obtained from the December 1976 Planning Division study (Planning Division, Public Transport Commission 1976). An added advantage of these data was that the revenue was fare-box revenue enabling the ready identification of unremunerative payments. Country and Interstate revenues are separately identified in the Annual Reports from 1976/77 to 1979/80. For this period an extrapolation was made to obtain the interurban proportion

of metropolitan revenue and cross checked by developing an average revenue per journey.

For the period 1988/89 to 1990/91, the 1990/91 Annual Report provides a time series of Countrylink (Country and Interstate) and Cityrail (Suburban and Interstate) revenue. Extrapolated ratios were used to split revenues into the four segments which were then cross-checked against average revenue per journey and other archival data. A similar method was used to obtain revenues for 1989/90 and 1990/91.

As seen in Section 4.3 above, Receipts (or, revenue) is the key function in the accounting identity established by British Rail (British Railways Board 1980):

$$\frac{\text{Receipts}}{\text{Traffic units}} \times \frac{\text{Traffic units}}{\text{Train kms}} \times \frac{\text{Train kms}}{\text{Staff nos.}} \times \frac{\text{Staff nos.}}{\text{Staff costs}} \times \frac{\text{Staff costs}}{\text{Total costs}} = \frac{\text{Receipts}}{\text{Total costs}}$$

Also, in all railway systems using the accounting (heuristic) approach, revenue appears as a key output indicator. The same applies to many TFP studies. The major difficulties with using revenue as an output indicator in the NSW rail passenger study are:

1. Fares were not set in accordance with any market rationale. Indeed, as is made abundantly clear in the following Chapter 5 and 6, fares were an outcome of the political process between 1951/52 and 1991/92.
2. This conclusion is reinforced by the analysis of "unremunerative" journeys, above.

Neither (1) nor (2) are unique to NSW. Knowledge of the situation in other railway systems in Australia suggests that a similar situation has applied in these systems. Such conclusions provide grave concerns for any other productivity studies of government railways (TFP based, or not) which have used revenue as an output indicator.

Two hypotheses are established here. They are reconsidered in Chapter 7 where they are relabelled "Overarching Hypothesis III" and "Overarching Hypothesis IV", i.e. contextual hypotheses which are descriptive of the institutional setting for which there is ample evidence in the preceding chapters, but which are not formally tested with TFP hypotheses in Chapter 8.

Hypothesis 1

There is a negligible functional relationship between the output of passenger train services and average revenue per passenger. The latter has been almost entirely determined by the political process.

Hypothesis 2

There is a negligible functional relationship between the output of passenger train services and revenue earned from "unremunerative" passenger journeys. This revenue is more clearly understood as an economic rent payable to passenger railways in NSW to operate services at a politically acceptable level. In the study period, the revenue amount has been highly negotiable.

The development of these hypotheses lends further weight to the argument that care needs to be exercised where revenue shares are used as output weights in the construction of Index numbers of productivity (Hensher 1987). The argument states that it is only valid to use revenue shares as output weights if the firm conforms to the theoretical competitive model of price equalling marginal cost. Where this is not the case, then revenue shares are not an accurate representation of the impact on a firm of expanding one output as opposed to another.

In the case of NSW rail passenger services, the Unremunerative Journeys payment is paid as a lump sum without regard to individual outputs in the different market segments. This is a problem with all PSO payments in transport. They can realistically only be paid as lump sums since it is very difficult to differentiate recipients by market segment.

4.7 THE MEASURES AND MEANINGS OF INPUT

Four traditional measures of input are used in this study: labour, energy, materials and capital. A fifth, non-traditional measure is added, termed "innovation". Managerial change is also modelled and builds upon the approach used in the recent study of Australian Railways Productivity 1971/72 to 1990/91 (Hensher et al. 1992).

As with the output indicators, it is useful to compare and contrast their use with similar indicators in other studies. Also, as with output indicators, it is important to consider any problems of concept and measurement which arise from the intrinsic nature of government-owned railway services.

4.7.1 Labour

The first of these conceptual problems arises with Labour. In most studies of the productivity of firms or industries, an implicit assumption is made that labour units can, and indeed should be, bought and consumed in the production process in the same way

as materials or fuel. When that production process is no longer required or production reduced, then the labour is laid off. For many reasons, the reality of railway labour in NSW is that it has characteristics which are more closely akin to capital.

The characteristics of the labour force in NSW railways are fourfold:

1. Person not negotiable

Labour is hired to fill a position. It is the functions of the position, and numbers of positions which are negotiated when the railway workforce is adjusted to meet changing output requirements. The person is not negotiable in the sense that, if s/he has met all the criteria for initial hiring and carrying out his/her job, then the employment is regarded as permanent. Should the position be negotiated out of existence, then the person has the right of redeployment, retraining etc.

Redundancy is a voluntary act. The reason why it has been a great success in recent years of very rapid "downsizing" has been due to the relatively generous redundancy payment coupled with generous "social" overhead carried by the Railways for each employee such as superannuation, leave entitlements, industry allowances, etc. The size of most of these overheads increases with longevity of service. And, in general terms, it has been the long service employees who have taken advantage of voluntary redundancy.

2. Lifetime career

Service in the railways has been traditionally regarded as a lifetime career. It has this in common with many government-owned business enterprises and other government services. In the boom times of the 1950s to 1970s, railways had great difficulty in matching wages, salaries and working conditions with the private sector particularly in the areas of skilled trades. This problem was the catalyst for much of the industrial unrest in the 1970s and 1980s. However, the voluntary redundancy scheme together with "social" overhead payments has allowed downsizing to proceed at a relatively smooth and non-disruptive pace.

3. Unionisation

The widespread and active unionisation of the industry has preserved the culture described in (2). The fragmentation of union membership has ensured that smaller skill groups have been able to have their own voices heard but led over time to job demarcation lines between functions. In the study period, this had been a major cause of inefficiencies and has led to the "Balkanisation" of some production processes, i.e. a cleaning section is black banned by electricians in a depot, because the cleaners insist on changing light bulbs when they fail. Since 1992, this problem has been largely

resolved. But the unionisation of railways has a special place not found in many other industries in Australia, let alone elsewhere in the world. Some of the major railway unions such as the Australian Railways Union, were foundation members of the Labor Movement in Australian politics and thereby founded the Australian Labor Party. Thus embedded in labour productivity has been a very potent socio-political amalgam of politics, union politics, and industrial activity influencing labour productivity.

Under the David Hill–Pat Johnson (1980 to 1988) regimes what was really at stake, in the final analysis, was changing the rules whereby individual unions, strongly welded to sectors of Labor politics, could become surrogate managers of the railways and promote their own members' needs above those of everybody else including the Australian community. Under Neal McCusker, an unwritten accord had been established between management and unions, which started to become unravelled in the late 1960s because boom conditions were leaving railway workers behind in the job market. This accord totally fractured in the 1970s despite very significant wage and salary increases. Its redefinition was begun in Pat Johnson's time of leadership, after Hill had quelled the Australian Federated Union of Locomotive Enginemen (AFULE) and the Australian Railways Union (ARU). A new accord is still taking shape. Since union power is a function of numbers of members, railway unions' powers will decline as the railway workforce declines to about half its previous size. Amalgamations with other unions, and the decline in union membership generally, will further reduce this power. However, unions are included in the decision making process of re-defining jobs, working conditions etc. to bring about a restructured railway. Along with this is a management commitment to improve education, training and motivation of employees so that the quality of the remaining workforce is of a higher standard than previously available.

4. Human capital

The nature of the railways workforce in the past, and that which is emerging for the future, suggest that the labour factor of production needs to be regarded as "human capital" rather than as a unit of input which can be bought, consumed and dispensed with as output rises and falls. A theory of human capital does exist in Western economics but it has some way to go before development to the levels which explain some labour markets such as NSW Railways. On the other hand, the labour practices (there is no discernible economic theory, but a strong cultural one) of Japan most closely approximate the notions of human capital theory. The theories (yet to be codified) of KAIZEN are a further development of the ideas of labour as human capital.

Human capital theory essentially grew out of a disquiet amongst North American economists with the exclusion of the activities of households and human capital in national accounts measurements. Also measures of the "standard of living" of individuals in the economy which essentially indicate a level of welfare of the community (Christensen and Jorgensen 1973).

Human capital theory asserts that income earned by the individual during her/his working lifetime is a function of formal education and learning and training episodes during that working lifetime (Juster 1973). In more formal terms, incomes received by any two individuals are dependent upon the amount of human capital investment (formal education and training) and the rate of return received on the human capital investment (Miller 1984).

Some commentators were concerned about the rather narrow focus upon education and training as the sole investment function and suggested inclusion of such factors as home activities with an investment focus—such as child rearing, job oriented activities carried out in leisure time, informal on-the-job acquisition of work skills and allowances for depreciation of human capital—where a workforce simply becomes older, as an industry declines, or where skills slowly become redundant when no effort is made towards upgrading these skills and the treatment of non-market activity generally (Juster 1973).

Solow (1973) has taken objection to the human capital approach to education, even though he acknowledges that financial returns to education usually do exist in the form of higher future productivity and earnings. First, it is not clear that what education creates is a "stock" of persons who are educated. Second, that even if such a group can be rightly termed a "stock", whether it is analytically appropriate to add the "stocks" of educated people together in one homogeneous group. Third, that there is a significant consumption component in education which when completed leads to a significant portion being lost and not retained. Fourth, diplomas and degrees function in part as a kind of signalling or screening device or simply as a scale measuring the volume of a stock accumulated. So one would have to be convinced that the right thing to do is treat all education expenditures as gross investment (Solow 1973).

Another school of thought has put the view that the gaining of intellectual skills in an education is only part of the output of education (Rivlin 1973). Educated people are able to participate more fully in an advanced economy and are less likely to become dependent upon social security and other government support agencies. At the very least, a "human capital" approach to labour would suggest that labour inputs should be

corrected for quality change. That such a correction be based upon the entry-level educational qualifications received in the past, is debatable.

In the context of the NSW Railways such an approach raises a number of issues, as follows:

1. For most of the study period 1951/52 to 1991/92, the Railways have recruited staff at a number of levels. Rail operations staff were recruited from the School Certificate level, and given on-the-job training and internal courses to improve their skills as they advanced "through the ranks", tradesmen were recruited on the open market or as apprentices, clerical staff from the School Certificate, but more recently, from the Higher School Certificate or tertiary levels and engineers from universities and other tertiary institutions providing degrees or diplomas in engineering. Other professionals were recruited by advertisement on the open market. However, since the 1970s, it was not uncommon for holders of degrees or diplomas to gain entry as low paid operations staff and later develop their careers in areas more appropriate to their qualifications.
2. In the technical areas there has certainly been an overall improvement in the quality of labour. This is directly related to the level of technology in new equipment and the necessity to upgrade the skills needed to operate and maintain the new equipment. For example, in the change from steam to diesel, drivers needed to be re-trained in handling diesel locomotives. A great deal of attention is now paid to the acquisition, recognition and maintenance of skills related to specific functions. Much of this is internalised in the Railways which has established a substantial training and development capability.
3. In the non-technical areas labour skills have largely been hostage to systems and processes which have been in use for a very long time. The possible exceptions to this are main-frame computers, personal computers, word processors and other office hardware. But even here there has been a tendency to graft modern hardware onto old systems and processes which are ill-equipped to cope with new processes.
4. In general terms, the Railways have reflected community trends (albeit, somewhat laggardly) towards the upgrading of quality of labour defined by level of education and training, skills acquired, etc. The real difficulty is to come up with a satisfactory definition of labour quality, and then to find an accurate way of measuring changes in quality. Perhaps the best way forward is offered by the methodology of Total Quality Management and KAIZEN.

In a conscious effort to lay to rest some of the ghosts of pre-1945 Japan, its companies have devised numerous programs to hold down barriers of class and status between its employees: plant tours for family members, family-directed publicity on company activities, company badges for workers, citations for outstanding performance, long service, safety records, etc., intra departmental contests, welcome parties for new employees, visits to other company plants, company bulletins and plant newspapers, radio broadcasts of the latest news, President's message enclosed in pay envelopes, field-day events and regular meetings with top management. Whilst, some of these

activities may seem bizarre to Western management, they seem to work for Japanese employers and employees because of the strong pre-existing social cohesion. The fact that, by and large, this workplace cohesion has survived, in recent years, severe economic downturns, financial and political scandals is compelling evidence of its effectiveness.

The democratisation of the workplace has been pursued in other ways as well. For example, since 1950s, Japanese firms have encouraged the idea of small-group activities in the work place. Out of this has grown many innovations such as quality circles, zero defects schemes, worker suggestion systems, safety groups and recreation circles. The small-group idea tapped into a very ancient cultural tradition in Japan wherein the ancient craftsmen worked in small groups making some of the finest quality products in the world. Small groups at the shop floor level can often resolve conflicts by consensus, which might later lead to intransigent stands taken by union leadership and top management, as each tries to avoid losing face. Hand in hand with the policy of lifetime employment in many firms is the concept of *jishu kanri* (JK), which means self-management or voluntary participation aimed at developing in the average Japanese worker a mind set which enables him to tackle many different job assignments. Thus, as some industries decline, their workforces can be readily transferred to other, growing industries (Masaaki 1986):

> KAIZEN is a further manifestation of this underlying belief in the individual (at whatever level in the corporate hierarchy) as having feelings, intelligence and a motivation to improve himself, his job, and the fortunes of his employer.

In such a setting, a concept of "human capital" sits comfortably. The difficulty is to find a useful measure of labour quality. Since TQM, KAIZEN etc. are essentially aimed at improving labour quality (regardless of level of formal education), then labour quality may be measured by the incidence of TQM programs in a firm, e.g. programs per 1,000 employees.

In the present study, labour costs include salaries, wages, expenses, uniforms and other supplies provided to employees. Five categories of labour are identified and allocated to each market segment. These are train running labour (further dissected into train crew and on-train crew), variable track maintenance labour, terminals (including stations) labour, corridor fixed cost labour and business and corporate overheads labour. The full definitions and derivations of each category are included in Appendix 2. The quantity of labour in each category is provided as well as unit costs. Labour numbers are verified from an independent source. It is possible to independently verify unit costs. They are also consistent with aggregate figures or labour costs, derived from the annual accounts. Since labour numbers are categorised by function, all classifications of labour are

included in each functional category including management, professional staff, tradespersons and unskilled. This is a further reason for not attempting to correct labour input for quality. Nevertheless, experience from participation in TQM programs suggests that tradespersons and so called unskilled employees' intelligence and potential skill and quality has been heavily undervalued in the management culture of the NSW Railways. Baird (19xx) provides an account of an abortive attempt to introduce TQM into Freight Rail (it was never attempted comprehensively with passenger services). TQM was initially accepted at the "coal face". In many cases, it was the first time in their working lives that TQM Team participants were asked to formally present new ideas. Generally, these teams produced reports of very high quality and worked hours which were well beyond their rostered times. In some cases, individual members were subjected to low-level harassment by their supervisors. In a few cases, teams implemented their findings by by-passing those with hierarchical responsibility, simply to bring urgently needed improvements to the process. One team invented a new work tool.

The problem was that in a traditional hierarchical management structure (which was also in the process of downsizing), TQM was perceived as a threat to this hierarchy. Thus, whilst radical re-organisations had happened through the years the culture had remained intact, basically, since 1951/52. Except for the engineering professions, university education and degrees were neither coveted nor encouraged. Management progressed from recruitment at basic levels of education (the School Certificate, until well into the 1980s) through a long apprenticeship in layer upon layer of grades until middle management rank was achieved. Non-conformity to this norm was frowned upon and discouraged. A "generic" organisation persisted in one form or another, despite many changes since 1951/52. A "generic" organisation structure contains:

- A CEO, Chief Executive, Chief Commissioner or similar title at the head.
- The chief officer is supported by a secretariat which in the past handled all matters peripheral to train operations including accounts, planning, policing, legal matters etc. The secretariat activities are now confined to some legal and public relations activities and the rest of the activities outsourced or established as separate organisations.
- A chief of train operations. This has now been devolved into separate corporations and regions.
- A chief engineer covering all engineering functions, each with its own chief officer. Again these functions have been devolved into separate corporations and regions.

In comparing and contrasting the approach used in this study with that of other studies, we again look at British Rail (British Railways Board 1980). Labour ratios are key elements in the accounting identity used, thus:

$$\frac{\text{Receipts}}{\text{Traffic units}} \times \frac{\text{Traffic units}}{\text{Train kms}} \times \frac{\text{Train kms}}{\text{Staff nos.}} \times \frac{\text{Staff nos.}}{\text{Staff costs}} \times \frac{\text{Staff costs}}{\text{Total costs}} = \frac{\text{Receipts}}{\text{Total costs}}$$

In support of this accounting identity, an additional twelve PPIs are used: train miles per person and earnings per person for, operations, mechanical and electrical engineering, civil engineering, signals and telecommunications engineering, and general departments (British Railways Board 1986). Train crew productivity is also of particular concern and PPIs are present for passenger train miles per person, freight train miles per person, parcel train miles per person and total train miles per person. These are of special concern because 65 per cent of train operating costs are labour costs. The British Rail Board (British Railways Board 1982), however, heavily qualifies its labour PPIs, thus:

> General measures of labour productivity are often expressed in terms of the ratio of output to staff employed. They are not measures of how efficiently the staff are performing, but more of business productivity with respect to total labour input, heavily influenced by pricing, volume, investment and the current state of the economy.

What this amounts to is an almost total disclaimer that the labour PPIs measure anything, least of all labour productivity. This is a very clear demonstration of the limitations of PPIs in the explanation of productivity changes.

Early North American studies of railway labour productivity have developed some useful insights into the factors influencing change in productivity (US National Centre for Productivity and Quality of Working Life, November 1973). This study was the first to undertake a critique of a US Bureau of Labour Studies index which measured "net ton-miles and passenger miles per man-hour" for the years 1939 and 1947 to 1970; the latter being critical years of US railways restructuring in response to road and airline competition. On this basis, railway labour productivity was shown to grow at an average rate of 5.2 per cent from 1947 to 1970, and 6.0 per cent per year between 1957 and 1970. This was about double the rate of the US private sector as a whole, in the same period, and also double that of its principal competitor, the inter-city motor trucking industry. The study then explained some of the deficiencies in the labour productivity measure, thus:

1. Person-hours tend to understate the change of total factor inputs needed to produce rail services in three ways. First, rail labour inputs have declined much more rapidly than capital inputs. This has been due to a substitution of capital for labour as the unit price of capital declined relative to the unit price of labour. Second, there was a greater amount of contracting out of labour services formerly undertaken "in-house".

Third, recorded person-hours understate the growth of inputs needed to produce current output and to maintain rail plant at given standards of safety, etc. A traditional railway strategy is to defer maintenance when in times of financial stricture. However, this strategy has the effect of postponing expenses involved in producing present output. This causes present inputs to be understated and productivity improvements to be overstated.

2. Ton-miles tend to overstate output growth of railways, in a number of ways. The traffic mix has changed towards traffic that is less costly to produce and is inherently less valuable. This is particularly apparent in the decline of passenger services where the output of a passenger mile is several times more costly to produce than the freight ton mile. Furthermore, the average freight ton was carried over greater distances where the incremental cost increase is slight. In freight, the traffic mix has changed to low-value bulk commodities away from less-than-car-load traffic. All of this has resulted in a shift towards rail ton-miles which are inherently less costly to produce.

To overcome the problems mentioned above, the study recommends the measurement of output in rail freight revenue expressed in constant freight dollars where one revenue passenger mile is equal to five revenue ton-miles of freight, reflecting more nearly the relative cost levels of passenger and freight. There are serious problems with this measure. First, it does not resolve the initial deficiency on the input side of the ratio where person-hours are used. Second, there is no evidence that a ratio of five passenger units to one freight unit remains fixed from year to year nor indeed whether the ratio ever did apply. No detailed evidence is presented in support. Nevertheless, the study is important in the sense that it highlights the dangers in using single macro-level ratios as indicators of labour productivity.

Disaggregated labour inputs are now publicly available for US railways, from ICC statistics, but not from Canada (although Canadian Pacific and Canadian National are reported as being co-operative in providing limited access to information) (Tretheway et al. 1992). Thus, for US railways, it is possible to construct indexes of labour inputs based on a number of labour categories. Nevertheless, sufficient information on labour inputs was available for a major study to be undertaken on the growth and performance of Canadian transcontinental railways from 1956 to 1981 (Freeman et al. 1987).

For the years 1956 to 1963, the Canadian Transport Commission (CTC) provided information on 79 labour categories i.e. annual average number of employees, service hours paid for and total compensation and time on duty (in hours). From 1964, service hours actually worked (equivalent to the earlier time on duty designation) is reported but for four categories only namely general labour, road (permanent way) maintenance, equipment maintenance and transportation. Only an aggregate labour number is presented, although the two series of labour statistics are linked.

A second adjustment was necessary for labour hours and compensation used in the installation or construction of capital assets. The total labour index is presented with capitalised labour excluded. A further exclusion was made for Canadian National, where from 1962, increasing numbers of non-railway workers were included such as persons working in its highway and express businesses. The labour price series is developed by dividing the value of labour input by the quantity of labour input. Overheads (e.g. labour taxes) are included.

The basic methodology used in the thesis is very similar to the one employed for this study (with further details in Appendix 2) for all categories of labour, labour hours (paid), labour unit cost and labour numbers are estimated.

Train running labour

Two categories of labour are calculated separately for crews (train crew and on-train crew) and then combined within train running labour. Crew labour includes: drivers, firemen, observers, second persons, assistant drivers (designations used over the years to describe the second person in the driver's cab); trainee drivers; guards, conductors, hostesses, ticket collectors on trains, and other personnel who may be engaged part of their time on trains as guards.

Two categories of labour are calculated separately for maintenance namely, locomotives maintenance (used for Country and Interstate trains only) and passenger carriages maintenance. These are also combined with crew labour within train running labour. Locomotive maintenance labour includes costs incurred at two locations, the workshop and the depot/running shed. In the workshop, the maintenance consists of scheduled and unscheduled maintenance of a major nature. Locomotive depots and running sheds are locations where locomotives are stabled, cleaned and prepared for the next rostered runs. Carriage maintenance labour includes costs incurred at two locations, the workshop and the depot. In the workshop, the maintenance is of a major nature. Depots are locations where carriages are stabled, cleaned, examined, lubricated and prepared for their next rostered runs.

Corridor labour

Two categories of labour are calculated separately and then combined within corridor labour, i.e. variable track maintenance and fixed corridor costs. In the case of variable track maintenance, it is first necessary to distinguish between maintenance and capital expenditure. Track maintenance usually refers to work undertaken in order to maintain the track to a current, safe standard. However, any incremental expenditure above the

current standard level is usually regarded as capital expenditure. Corridor fixed labour costs include: fixed track and structure maintenance (maintenance which does not vary with traffic levels), which includes maintenance of bridges, culverts, tunnels and buildings, electrical overhead facilities maintenance, signalling and communications maintenance and other non-renewable capital items, including infrastructure, buildings and plant.

Terminal and station labour

These cover a conglomerate of labour costs incurred in freight handling, passenger duties, shunting, train examinations and bogie exchange/transfer. Passenger duties including shunting cover the salaries, wages, expenses, uniforms and supplies of staff employed at stations and yards including: station masters, assistant station masters, station assistants, caretakers, yard masters, station agents, clerks and any staff who may be attached to yards or stations in the grades mentioned. Also included are staff involved in signalling operations, safeworking and train control.

Business and corporate overheads labour

These cover a conglomerate of labour costs associated with management of a business sector and with employees engaged in support functions including administration, accounting, stores and supply, information services (computing), legal and security and personnel.

A study of TFP of Australian National Railways from 1979/80 to 1990/91 (AN 1992) concluded that the best measure for labour inputs is total hours worked, but that Australian National (AN) did not have an accurate series for total hours, going back to 1979/80. As a consequence, labour numbers were substituted for hours worked. It noted also that the Bureau of Transport and Communications Economics (BTCE) and the Industry Commission (IC) had to fall back on this procedure. Given that an hours statistic is critical for the development of an hourly cost of labour, the AN study may have been too conservative.

A study of the NSW situation shows that it is impossible to develop an annual time series of actual hours worked by each category of railway worker. The records are just not good enough. The study also showed that the only variation from standard, award hours paid for work done (or, more accurately, work attended) was overtime. A study of overtime payments suggests that it has had the following features:

1. It has occurred in bursts of a few periods during the year, associated with seasonal activity e.g. during the wheat harvest. These bursts usually are constant from year to year so that the overtime tends to become a traditional payment.
2. In times of cost cuts and rationalisation, overtime payment cuts are the first major labour cost to go. It is the first piece of "fat" in a labour cost budget. These cuts are well publicised.
3. When overtime payments reach a ceiling in a particular function, staff numbers are increased.
4. Overtime, by tradition, is paid to lower graded staff only.

The conclusion is that, for the purposes of TFP studies, it is vital to obtain an hours paid statistic in order to accurately calculate a unit cost of labour. A standard award hours paid statistic is a suitable figure to use as a multiplier for the quantity of labour.

4.7.2 Energy

Compared with labour, capital and materials, energy inputs create few conceptual problems. In this study, the energy consumed in the production of rail passenger services is dissected into electricity, solid fuel and liquid fuel. To reduce these different energy sources to a common measure, the "joule" is used. Joule is a unit of energy generated by a current of one ampere acting for one second against a resistance of one ohm.

Electricity consumption in the NSW Railways is measured in Kilowatt hours (kWh). The watt is a unit of electric power where one thousand watts are working one hour to produce one ampere of electric current. To convert kilowatt hours to megajoules, kWh are multiplied by 3600 (Energy Authority of NSW 1982).

Solid fuel is a collective item of fuels used in the production of steam to power steam locomotives. They include, coal, wood, "kindlers" and water. Coal was the main part of the fuel cycle in the creation of steam. It is measured quantitatively, converting from long tons, to metric tonnes and then to joules. To convert metric tonnes of coal to gigajoules (one thousand million joules), kilograms of coal are multiplied by 25 (Energy Authority of NSW 1982).

Liquid fuel is diesel distillate and is the source of traction fuel, although some locomotives used fuel oil in the 1950s. In the NSW Railways, it is measured in thousands of litres. It was calculated for each locomotive and self-propelled unit used in passenger services and then aggregated. To convert to megajoules, litres are multiplied by 38.4 (Energy Authority of NSW 1982). Data is collated on quantities of fuel in each category, expressed in gigajoules, and unit costs, expressed in cents per gigajoule. In

comparing and contrasting the approach used in this study, we look again at British Rail (British Railways Board 1986). Only two out of 83 indicators relate to fuel usage, namely liquid fuel expenditure per train mile and electric fuel expenditure per train mile. The Canadian Railways study (Freeman et al. 1987) also collates fuel used for motive power only, from CTC Annual Reports. Fuels used in the operation of terminals, stations and other related services are subsumed to be included in other purchased inputs: probably materials. British Thermal Units (BTU) are used as the standardisation unit, instead of joules. Joules are now the accepted international standard measure of energy.

4.7.3 Materials

Materials costs are the residual of working expenses after deduction of fuel and labour costs from each of the following cost components:

- Locomotive maintenance costs
- Carriage maintenance costs
- Variable track maintenance costs
- Corridor maintenance costs
- Terminal running costs
- Business and corporate overheads. (In this item, there is an element of balancing: to make the total of all costs, at the "fully distributed" level, balance to the total of working expenses, allocated to passenger services.)

A materials cost component is thus available for train running, corridor, terminal (incl. station) and business and corporate overheads. This is also classified by market segment.

In comparing and contrasting the approach used in this study, we look again at British Rail (British Railways Board 1986). Only 3 out of 83 indicators relate to materials cost:

- Expenditure per standard hour of traction and rolling stock maintenance.
- Cost of ballasting (which includes a labour component).
- Other civil engineering materials costs.

The Canadian Railways study (Freeman et al. 1987) collates an item termed "Materials or other purchased inputs". This item is also calculated as a residual for all purchased inputs which are not included in the other input categories. The category is measured by deflating aggregate materials expenditures by an appropriate price index to arrive at physical units. The same procedure is adopted in the thesis. The Canadian study notes that the alternative is an impossibly time consuming catalogue of all the individual

items of material purchased by the Railways. The same situation applies with the NSW Railways, where there are in fact over 5 000 items that might receive a separate listing which even then would not be exhaustive.

4.7.4 Capital

The capital factor of production has created even more conceptual difficulties than labour for the productivity analyst. Before becoming immersed in the conceptual issues, it is instructive to summarise some of the realities of capital formation in the NSW Railways:

- The Railways entered 1951/52 with infrastructure and rolling stock which was old and worn down by heavy use during World War II.
- Between 1951/52 and 1991/92, the Railways spent some $7 billion (current dollars) on capital formation.
- Much of this capital formation was undertaken on political criteria rather than economic criteria and would be difficult to justify on standard benefit/cost analysis criteria.
- To a significant extent, and then only when safety issues intervened, fundamental infrastructure such as permanent way, bridgework, signalling buildings etc., was the least endowed in terms of capital. When capital was spent, the upgradings were generally done within the constraints of existing alignments, gradients etc. These were established in the 19th Century.

In the first instance, it is useful to reconsider the accepted definitions of capital as a background to what will be revealed about the nature of railway capital, in this and following Chapters. In understanding the issues of capital (as shorthand for capital formation) productivity, a useful starting point is Alfred Marshall (1920, reprinted 1969). Capital for him included:

- "Trade" capital, or goods which a businessperson holds to convert into money: whether by direct sale or for use in producing other goods for sale. It also included the "goodwill" of the business.
- "Credit" capital or loans made and "... all the command over capital which he may hold under the complex forms of the modern "money market". From this are deducted the value of debts incurred by him". Marshall excludes "land" which covers all assets deemed to be "free gifts of nature".

Marshall has never been far from the controversies which have since developed in relation to the definition and measurement of capital. From one point of view the most significant of these has been the debate between the Cambridge England School (sometime known as the neo-Keynesians) and the Cambridge Massachusetts School (also, sometimes known as the "neo-neo-Classicals") (Harcourt and Laing 1973).

In what amounted to a general assault on the relevance of the production function, Joan Robinson (of Cambridge, England) (Harcourt and Laing 1973) argued that capital could only be measured in labour units because:

> Investment consists, in essence, in employing labour now in a way which will yield its fruits in the future while saving is making current products available for the workers to consume in the meantime: and the productiveness of capital consists in the fact that a unit of labour that was expended at a certain time in the past is more valuable today than a unit expended today, because its fruits are already ripe.

This is true of the Cobb-Douglas production function where the elasticity of substitution between factors (labour and capital) is automatically constrained to the value of one. Later empirical work suggested, however, that it is not an extreme constraint, namely that one is a central value around which the value for various industries are clustered. A model which avoids this problem is the constant elasticity of substitution (CES) production function which is equivalent to the constant returns to scale form of the Cobb-Douglas model (but, railway systems show some evidence of increasing returns to scale).

Another model which avoids the problem are Translog Functions (Transcendental Logarithmic). It is a form of flexible cost function in that it assumes no a priori restrictions such as separability, unitary elasticity of input substitution, etc. This model also enables us to move naturally to the Total Factor Productivity (TFP) Index—the empirically determined form of the production process.

The Cambridge Massachusetts School, as represented by Robert Solow (Harcourt and Laing 1973) argued that the central idea in capital theory was the rate of return on investment. The essential points of this idea were:

- There are many factors present in the production of a good,
- "... from natural resource deposits to labour of different quality and skill characteristics".
- The process of production makes use of physical capital goods, which are themselves produced, some of which will involve delays.
- The allocation of resources to be used in production is "efficient" i.e. there is neither an oversupply of some nor an undersupply of others.
- The current round of production will leave sufficient resources for the next rounds.
- The short (one round) rate on investment in the current period is defined as:

$$(k - L)/L = k/L - 1$$

where

k = units of consumption after the next round of production.
L = units of under-consumption in the current period.

An example would illustrate the point. If (an extra) $1 of consumption this year is saved, then society can enjoy at most $1.10 of consumption next year without endangering its later prospects. One would then certainly want to say that society has earned 10% on its investment. Complicating cases are then considered and a critique presented of the Cambridge, England position, which required gross over-simplifications such as that capital was a sort of amorphous mass that could be transformed perfectly and instantaneously from one mode of production to another.

From the point of view of an industry that has reached a watershed in its historical development, the concept of maximum "efficiency" in the utilisation of resources is the most useful. Solow has elaborated upon this idea in collaboration with Dorfman and Samuelson (Harcourt and Laing 1973). It leads to a notion of optimum economic growth. This is particularly significant for industries (such as railways) which have reached a watershed. The choices here are disintegration and demise or restructuring renewed innovation and renewed growth which seeks to find an optimum path.

Capital theory has hitherto been framed within the context of "goods" as distinct from "services". Since the greater part of the value of gross domestic product is now generated by non-goods (or services) such as railway transport, it is important to ensure the compatibility of capital theory with the production of services. For Alfred Marshall (1920):

> Services and other goods, which pass out of existence in the same instant that they come into it, are, of course, not part of the stock of wealth.

Also the debates between the two Cambridge Schools express output in terms of goods rather than services. The implicit assumption here is that production functions for the two types of output are the same. To some extent this is true, in the sense that, ultimately, goods are purchased for the services which they provide e.g., the motor car. In the policy sense, the real test is the ability of the National Accounting systems to accurately reflect the value of output of both goods and services. Related to this is Samuelson's definition of income, which is much wider than that of Marshall. For Samuelson, income should be defined as the discounted value of all future consumption (Moss 1973).

Apart from the debates about the nature of capital between the Cambridge Schools, there is a third strand of economic philosophy that needs consideration, namely that of the neo-Marxists. Their concepts are important because a bowdlerised version has ruled decision-making about Government investment in Australia from time to time. It is important, therefore, to seriously consider the essential neo-Marxian precepts. For the

neo-Marxist thinkers in post-War industrial societies, the idea of the welfare state was the focus of concern, the welfare state being defined as (Gough 1983):

> ... the use of state power to modify the reproduction of labour power to maintain the non-working population in capitalist societies.

The state accomplishes this by providing benefits and services, use of the tax system and regulation of the private activities of individuals and corporations. Also, the welfare state replenishes the capacity of persons to perform labour in the traditional Marxian sense. This is done by four basic, late 20th Century, interventions:

- Disposable income levels are altered by the taxation and social security systems.
- The utility derived from consumption may be regulated by the state through such things as consumer-protection legislation.
- Some goods and services are subsidised either for the whole community or for those identified as disadvantaged in some way.
- Some services are produced by the States either free of charge or at greatly reduced prices.

A central feature remains the "Laws of Motion of Capitalism" i.e. capital is accumulated out of the surplus value derived from the process of production, and this provides the wherewithal for the extra means of production. But there is no guarantee that this surplus value will continue to be produced. Wages can be bid up by labour to the point where surplus is eliminated. For neo-Marxists, this is still prevented by the existence of Marx's "industrial reserve army". In modern industrial societies, this "army" consists of: the unemployed, seasonally employed, redundant workers, immigrants, the disabled and working housewives. In the classic Marxian tradition, the existence of these groups prevent wage levels rising to a point where they eliminate the surplus value.

It is not possible to underestimate the influence (explicit or implicit) which the assumptions of the political economy of the welfare state have had upon the development of public transport in New South Wales. However, by the 1980s, most welfare state assumptions and institutions were under siege. As Graycar has put it (1983):

> The retreat from Welfare State principles is defended by decision-makers and opponents who point to the inability of the economic system to support expenditures. Influential commentators continually stress that "social progress" is possible only within the framework of economic capacity and is limited by economic means...
>
> He (Secretary-General of the OECD) went on to highlight the social welfare constraints of the 1980s in particular the task of finding a balance between present consumption and investment for the future; identifying the so-called "side effects" of social policies, particularly, higher income taxes and higher inflation; and the escalation of demands and the revolution of raising expectations.

It was thus that the Cambridge Massachusetts School's notion of optimum consumption levels seems to have survived the test of the 1980s. Also surviving was the notion that the public sector was contributing to most of the excess consumption. In policy terms, it amounts to a major restructuring of the welfare state in all industrialised countries which will probably include a dismantling of many of the publicly owned units set up after World War II.

The partners in Government decision-making regarding investment strategies for the railway in New South Wales have been the railway engineers. Organised as individual branches of the railway according to their particular area of expertise, they have competed for available funds with each other. Fundamentally, however, they have acted symbiotically, as by and large the investment function of one Branch has been dependent upon the investment function of every other Branch.

The railway system in NSW was in a long term growth cycle from 1855 until the beginning of World War II. The growth depended very much upon the creation of new railway lines (whether or not electrified), the maintenance of existing lines (built in previous boom periods) and the construction and maintenance of rolling stock to run on them. The expertise provided by engineers was, therefore, crucial to the capacity of the railway system to deliver its services on time and safely. Also the profession has produced the geniuses and the clowns that are part of the rich history of the New South Wales railway. It was a personal animosity between an Irish engineer and an English engineer that led to the different gauges in New South Wales and Victoria.

Others, like Dr J J C Bradfield drew up the suburban railway network for Sydney and thereby determined Sydney's urban design for evermore. Whilst the passage of time has diminished the railway engineers' power and sense of involvement in determining the destiny of New South Wales, they have retained much of their power. Emphasis of investment has shifted from new infrastructure to up-grading an obsolescent railway system. Almost always, the criteria for determination of investment priorities have been technological rather than economic or commercial. Since World War II, not all governments have been sympathetic to railways so that there have been lean years as well as fat years.

A recent variant of the argument previously put forward by political economists and supported by techno-bureaucrats such as railway engineers (although they are no different from their cousins who build roads, power stations etc) is the inviolability of Australia's "infrastructure". The argument advanced is that Australia needs an efficient "infrastructure network" for it to develop as an industrialised economy. Literally, "infrastructure" means understructure. In the context of economic development, it refers

to the facilities of social capital. The elements which make up Australia's physical infrastructure are said to have the following common characteristics (Senate Standing Committee on Transport 1988):

- they exist to support other economic or social activities, not as an end in themselves;
- incur relatively high initial capital costs;
- have relatively long lives; and
- therefore should be managed and paid for on a long term basis.

Apart from railways, the other elements are roads, aerodromes, ports, major dams and reservoirs, the telephone and telecommunication network, schools, occupied dwellings and hospitals. Solow quotes an interesting insight by John Bates Clark on the nature of capital, thus (Harcourt and Laing 1973):

> The kernel of useful truth in the John Bates Clark picture of capital as a kind of jelly that transforms itself over time is that indeed, over time, something like this does happen as capital goods wear out and are replaced by different capital goods.

Nowhere is this "jelly-like" property more in evidence than in the consideration of railway land for capital-like properties which these other factors of production possess at certain times in their life cycles.

The New South Wales railway owns big tracts of land. Some of these are so big in fact that it does not yet have a clear idea of how much. Land was valued at $38.18 million in the 1988 Annual Report but this was a gross undervaluation. Appendix 2 of this thesis estimates land for passenger services alone at $414 million in that year. Much of this land was acquired during the great railway expansions of the 19th Century and early 20th Century. Inadequate records and poor boundary fencing has meant the loss of information on much of this property. In the metropolitan areas of Sydney and Newcastle, two further developments have enhanced the value of railway property namely:

1. Major yards, terminals and sidings were built in close proximity to the Central Business District (such as Darling Harbour) or the Central Industrial Area. The westward expansion of industry has made some of these facilities redundant to the railway, but highly prized as commercial and retail development sites.
2. Suburban railway stations always occupied central locations which have tended to become densely utilised with the passage of time. As commercial and retail activities have moved into these suburbs, the central location of the railway stations has enhanced their value as prime development sites. This has led to the development of the airspace above the railway stations as commercial and office space. Some of these were aborted in the collapsed property boom of the late 1980s but will become a future reality.

In the sense that land market conditions in Sydney, Newcastle and elsewhere in New South Wales are allowing State Rail to convert underutilised land assets into cash flow which may be used for the repayment of debt, it has a relationship to capital. The potential cash flow is not insignificant.

For Alfred Marshall (1920) land was distinguishable from capital because:

> By Land is meant the material and the forces which Nature gives freely for man's aid, in land and water, in air and light and heat.

Structures on land, in the airspace above it or the ground below it are regarded as capital. However, land's interdependency with capital, especially in the railway context, is so close that separate classification may at times be inappropriate. By and large, however, land has special characteristics which distinguish it including a fixity of supply, no cost of creation, a heterogeneous quality and a scarcity value.

In the context of TFP studies, the Canadian Railways study must rank as one of the most rigorous treatments of capital (Freeman et al. 1987). The methods used in this thesis in the measurement of capital input and capital service price follow the Canadian Railways Study approach very closely. The approach calls for a deep understanding of the nature of capital.

The Canadian study excludes land from the capital stock. This is in line with the viewpoint of Marshall and many others. However, for the reasons given above, it is important that land be included as part of capital, although it needs to be shown separately from infrastructure, as land does not depreciate and has experienced somewhat different price trends to infrastructure.

The main problem for the study was to derive a reasonable estimate of the market value of railway land in NSW.

Traditionally two conventions have existed in the accounting for railway land in NSW.

1. In the establishment of a new railway line, land was entered at cost amounting to about 5 per cent of the capital value of the new construction.
2. On average, the land take in the establishment of a new railway line was 40.2 metres along the route including ancillary facilities such as yards, depots, sidings etc. Thus, route kilometres multiplied by 40.2 metres provides a reasonable global estimate of the area of railway land in NSW. On this basis, only about 5 per cent of the total land is in the Sydney metropolitan area, but it is by far the most valuable.

An Index of Railway Land Prices in NSW from 1861 to 1991/92 was developed for the thesis based on prevailing price of land resumed for railway use. The Index was expressed in 1989/90 dollars and was developed as follows:

1. In 1861, the NSW Railways had 117 kilometres of line, and about 47 000 hectares of land, mostly in the area of NSW now classified as Greater Sydney. This land was valued at $86 000 (1861 prices, and at cost), giving an average price of 18 cents per hectare. It needs to be remembered that this was the year of the first of the Robertson Acts, aimed at returning to Crown ownership vast areas of land claimed by squatters who had paid nothing. The land was then to be sold to homestead "selectors" who could buy the land for a 25 per cent deposit of 5 shillings (50 cents) per acre. This provides a useful benchmark for the price of railway land relative to a government-controlled "market price". Also, between 1861 and 1930, railway land purchases remained below 18 cents per hectare (current dollars), and in most years were around 12 cents per hectare (Annual Report) even though most of these acquisitions were in country NSW. By 1930, most of the land acquisitions had been made and some attempt was undertaken to adjust land values upwards.
2. In 1951/52, the average value of land held by the railways in NSW was $3.08 per hectare with values in the Sydney Metropolitan area being higher (Annual Report).
3. In 1975/76, the average value was given as $6.01 per hectare (Annual Report).
4. In 1989/90, the average value is estimated to have been $10.00 per hectare, but with some Sydney Area sites well in excess of this (Annual Report).
5. The following trend is revealed when current prices are deflated by price indexes with the Base Year at 1989/90.

	Price per hectare	
	Current $	1989/90 $
1861	0.18	9.00
1951/52	3.08	6.70
1975/76	6.01	6.75
1989/90	10.00	10.00

This trend would suggest that apart from a handful of spectacular railway land developments in commercial centres of Sydney, Newcastle and Wollongong, most railway land does not have a high opportunity cost. This conclusion is supported in the cases where railway lines have been abandoned to be turned into pastures, low cost housing developments or public reserves.

This conclusion refutes a long-held myth that the NSW Railway's commercial salvation may be found in the commercial development of the vast tracts of land which it occupies.

Table 4.2 provides estimates of NSW rail passenger services stocks of railway land valued at market prices 1951/52 to 1991/92 ($ million). Appendix 2 provides explanatory notes on the calculation of the capital costs of railway land.

Table 4.2 NSW rail passenger services: stocks of railway land valued at market prices, 1951/52 to 1991/92

Year ended 30 June	Value of land ($ million 1989/90)
1952	1751
1953	1674
1954	1707
1955	1768
1956	1768
1957	1712
1958	1727
1959	1781
1960	1794
1961	1780
1962	1831
1963	1869
1964	1906
1965	1889
1966	1873
1967	1870
1968	1856
1969	1853
1970	1819
1971	1767
1972	1666
1973	1603
1974	1454
1975	1271
1976	1149
1977	1034
1978	957
1979	889
1980	811
1981	745
1982	682
1983	614
1984	585
1985	567
1986	527
1987	486
1988	455
1989	424
1990	396
1991	380
1992	377

In all other respects this thesis has followed the Canadian Study's methodology in the measurement of passenger capital inputs and the service price of capital. Here capital is defined as a stock of physical assets from which a flow of capital services is derived. The price of an asset is much more than the price of the flow of services (Freeman et al. 1987).

A two step procedure is used to estimate capital inputs and their annual costs, as follows:

1. The stock of the particular asset category is measured using the perpetual inventory method. Capital stock in this method is defined as the sum of real new investment

and the capital stock at the beginning of the period. In addition, this method requires that the estimation of real capital stocks needs information on a capital benchmark, nominal gross investment, a rate of depreciation and an asset price deflation. A brief description of the derivation of each of these is given below, whilst a more detailed dissertation is reserved for Appendix 2.

2. The annual service price of the particular category of capital is then calculated using information on the opportunity cost of capital and depreciated rates. The Canadian Study also includes capital gains rates and marginal tax rates. They are excluded from the NSW study because no taxes (other than payroll tax, a business overhead cost) are paid and no capital gains are made on any assets which are retired usually at a nominal scrap value. Even railway land, as was shown above, has been subject to little gain, on average.

The Canadian Study includes the marginal opportunity cost of capital, as it is most clearly reflected in the cost of debt (Freeman et al. 1987):

> ... debt retirement (being) the most obvious alternative use of funds available to any firm. Furthermore, since long term capital is usually cheaper and less likely to be withdrawn than short term capital, the yields on senior debt issues can be viewed as a good approximation to the firm's reckoning of its own marginal opportunity cost.

This approach is considered far more veracious in a study of NSW passenger capital, for two reasons. First, it bypasses an accounting fiction periodically used by governments in the 40 years of the study where portions of NSW railway debt are transferred from Railway Accounts to NSW Treasury Accounts. Second, it bypasses the methodological fiction posed by threshold discount rates regardless of whether they are expressed as real rates or current rates. The essential fiction of the threshold discount rate is that debt cost is not influenced by inflation. Even a cursory examination of the general levels of debt cost in Australia over the past 40 years indicates that this is clearly not true.

The NSW study uses the Ten Year Commonwealth Government Bond Rate to estimate the average yield on NSW passenger railway debt. An annual rate is applied which represents the theoretical yield on a non-brokerage basis, based on averages for the week centred on the last Wednesday of June of each year. This is a much more stringent test of capital spending since it relates the price of railway capital to monetary policy and the capacity of the community to pay. This runs counter to accepted philosophies in the past, and in some quarters in the present, which argue that infrastructure spending which has a high "community service obligation" content (such as public transport) may have a return on capital which is zero, and that this is acceptable as a social welfare trade-off. For example, this applied to much of the Whitlam government's spending in the Urban Public Transport Improvement Program in the early 1970s and to the XPT Program in the 1980s.

As early as the late 1980s, a Senate Standing Committee (1988) considered that:

1. Existing capital, which is the main input of most public business enterprises usually has a low opportunity cost outside the enterprise—it is generally a sunk cost—and its accounting value will often be higher than its opportunity cost.
2. Targeting of any particular accounting rate of return will result in prices which cover accounting costs, not marginal opportunity costs.

But, perhaps the most important aspect of the service price of capital is the inclusion of depreciation deductions. And, it is not sufficient to use a book value depreciation rate but rather economic depreciation, i.e. real declines in the usefulness of capital assets. This takes into account the obsolescence of the asset as well as the physical wearing out. In the context of NSW Railways, during the 40 years study period, assets were generally in service well beyond their period of obsolescence. There was a heavy price to pay for this policy by other factors of production. For example, as carriages and locomotives become older, their hours of service decline relative to new rollingstock, as more and more time is spent in maintenance. Also, performance in service is not as good as new rollingstock and reduces the quality of service.

Depreciation assumptions, based on the economic life of the assets, are as follows:

Infrastructure:	60 years
Locomotives:	23 years
Carriages:	25 years
Equipment:	10 years

These assumptions are broadly in line with the Canadian Study and current accounting practice in State Rail.

Finally, the Senate Standing Committee (1988) also noted that the annual capital input cost is calculated as the product of the constructed capital stock times the service price.

Capital stocks comprise a wide variety of goods which cannot be added together and measured quantitatively. Nor can they be added together and measured in current values, as they are purchased at different times and at different prices. Nevertheless, the accounting records of the NSW Railways, as with other firms, provide a "book value" of assets. This is not considered to be a true or accurate guide to the constant dollar investment of a firm.

In order to develop a more accurate measure of capital employed, annual investments are first converted to constant dollars. Then, the capital base is recalculated by

accumulating the constant dollar annual investments over the years. This provides an estimate of the economic value of the accumulated capital investment over the years.

Whilst accumulation of capital investment is recognised, so also is the wearing out of this capital investment. Thus, a depreciation rate is applied to account for this wearing out.

In the case of infrastructure capital, the data series which provides estimates based on capital accumulation and depreciation, is commenced in 1861, based on archival and Annual Report data. In the case of rollingstock, asset registers commencing 1 July 1951 provide the data base for calculating capital accumulation. Rollingstock purchased prior to 1 July 1951 is allocated an average age, and written off in the ensuing years. In the case of equipment, an average age prior to 1 July 1951 is approximated, and then written off in ensuing years.

Good information contained in Annual Reports provides the basis for a relatively accurate accounting for new acquisitions by type of rollingstock and equipment. Details of the calculations are contained in Appendix 2.

4.8 CONCLUSIONS

The purpose of this Chapter was to consider the issues and review the literature surrounding the standard measures of output and input used in the TFP Model (HF1), which forms the basis of the study. Consideration of the only non-standard measure, innovation, is reserved for Chapter 5. By and large it may be concluded that the measures are reasonably robust.

This Chapter considers the issues surrounding the measures of input and output used in the TFP Model (HF1). The cost allocation procedures and the reconstruction of time series from Annual Reports are reported in Appendix 2 for the reason that the procedures are complex and would create a disfunction in the narrative of the thesis.

The Chapter demonstrates why passenger journeys and passenger revenue provide a flawed measure of output in the NSW context, and why reconstructed time series of seat kilometres and passenger kilometres provide satisfactory measures. Details on the construction of these series in contained in Appendix 2. The input measures, labour, capital, fuel and materials, are the same as other TFP studies. The construction of these series, cost allocation procedures etc. are also contained in Appendix 2.

CHAPTER FIVE

Innovation as an Input to Model HF1

5.1 INTRODUCTION

In Chapter 3, innovation was identified as an input which has an important effect upon a firm's productivity. It is also an important linkage between a firm's pricing efficiency and product/service acceptance by the firm's customers. Furthermore, it is a vital linkage between government sponsored action aimed at improving the firm's acceptance by its customers. In all these manifestations, innovation is a dynamic process. However, in this Chapter, innovation is examined in depth in relation to its impact upon the measurement of total factor productivity (TFP), the key emphasis of this thesis.

In this Chapter, an attempt is made to define innovation. The definition is followed by an examination of some of the general parameters which influence the innovation process. In particular it examines the issue of whether innovation is practicable in organisations supplying public goods and where there is a situation of market failure. A notion of "failure management" is canvassed and NSW railway passenger services tested as a possible paradigm in failure management. This notion, which is linked to this thesis' concept of innovation, concludes with the hypothesis that where failure management exists, innovation will not proceed even if significant technological changes occur. Finally, the outcomes or consequences of the innovation process are examined, and again a railway paradigm is sought. Conclusions are drawn as to the kind of model of an innovating (or non-innovating) enterprise NSW rail passenger services might have come to represent.

5.2 DEFINITIONS OF INNOVATION

The notion of innovation as a dynamic force operating in successful firms in the advanced economies of the first Industrial Revolution largely escaped the attention of the classical economists. It took a neo-classicist of the stature of Joseph Schumpeter to define the importance of innovation (Schumpeter 1939). For Schumpeter, innovation

had two fundamental microeconomic qualities. First, it created a new production function for the firm (In the parlance of modern management theory, it "re-engineered" the firm). This happened because innovation had the capacity to change the form of the firm's production function. Second, it created a new total and/or marginal cost curve for the firm which was lower than the ones which existed before the innovation. Thus, an innovation could be envisaged as (Schumpeter 1939):

> ... technological change in the production of commodities already in use, the opening up of new markets or of new sources of supply, Taylorization of work, improved handling of material, the setting up of new business organisations such as department stores—in short, any 'doing things differently' in the realm of economic life.

Thus an innovation is perceived as being broader than simply the production of a new technological invention or even the use of that invention to create technological change in the firm. Even though technological change may be a necessary part of an innovation, it may not be sufficient.

For Penrose, innovation is not simply technological change. Instead, it is no less than the introduction of "... a new combination of resources" within the firm (Penrose 1959). These combinations may include the factors of production, the introduction of new processes of production or a reorganisation of the firm.

As the second Industrial Revolution gathered pace in the latter part of the 20th Century, analysts have re-focussed attention upon the nature and significance of the innovation process within the firm. In this period, some of the most useful insights have been provided by management analysts. Peter Drucker contends that innovation works on both the supply and demand functions of the firm. He sees it as an "economic or social term" which describes the process by which the firm is able to "change the yield of resources" which it controls. Successful innovation needs to be systematic (Drucker 1986):

> Systematic innovation therefore consists in the purposeful and organised search for changes, and in the systematic analysis of the opportunities such changes might offer for economic or social innovation.

Innovation has been defined for the Business Council of Australia as follows (Carnegie and Butlin 1993):

1. "In business, innovation is something that is new or improved, done by an enterprise to create significantly added value either directly for the enterprise or indirectly for its customers".
2. (Added Value is defined as) "... higher returns to owners, although the immediate result may be increased market share, new customers or new markets. This is usually

generated by finding new ways to increase the "value for money" an enterprise can offer its customers".

In economics, "value added" has a much more precise meaning. Here it implies the difference between the firm's output and the cost of the inputs of raw materials, components or services brought in to produce that output.

At this point, it is useful to revert to the KAIZEN definition of innovation, quoted in Section 3.5 above (Masaaki 1986):

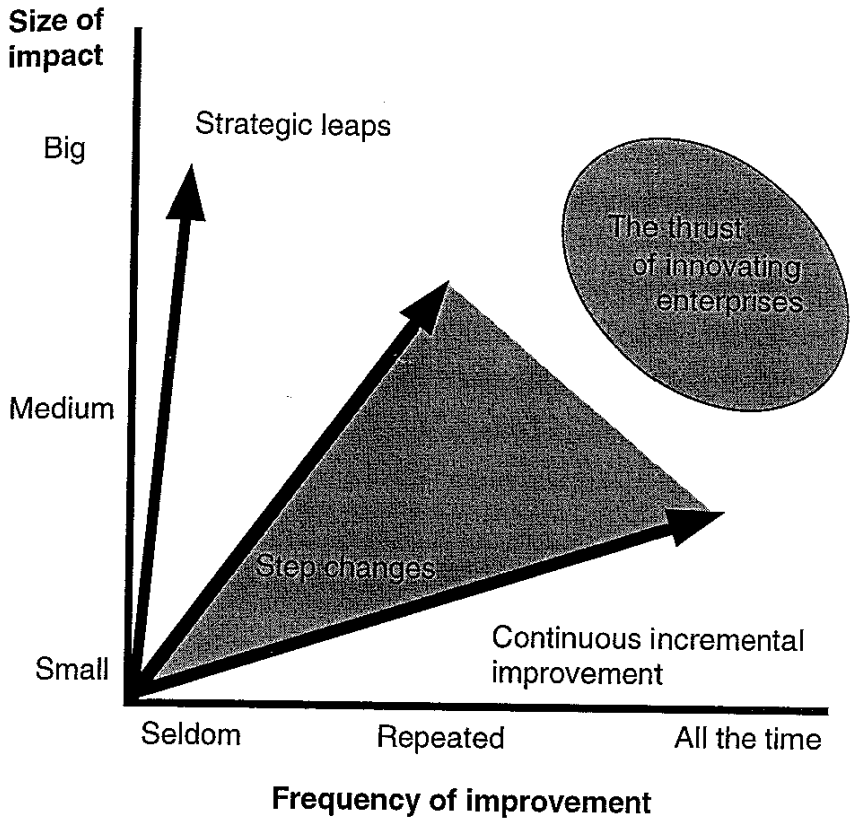
> Western management worships at the alter of innovation. This innovation is seen as major changes in the wake of technological breakthrough, or the introduction of the latest management concepts or production techniques. Innovation is dramatic, a real attention-getter ... innovation is generally a one-shot phenomenon.

This is Drucker's understanding of innovation. All of his case studies tend to emphasise the dramatic changes made to the organisation. But, they also comment on the second order, "ripple effects" (whether positive or negative) which affect the firm after the initial innovation has been made. This is the traditional North American and European conceptualisation of the innovation process as seen by management analysts. And, it is this understanding of innovation that the KAIZEN adherents label as "innovation".

The Business Council of Australia (BCA) recognises that innovation can take two forms:

1. The "strategic leap", which conforms with the "one-shot phenomenon" identified by Masaaki's, and Drucker's examples. For the BCA strategic leap innovation includes the creation of a new business (or "re-engineering" an existing business) and the development of significantly new products and services that create new business units within an existing organisation.
2. The "innovating thrust", where "the essence of the approach was sustained, mainly incremental, performance improvement that built and developed emergent strengths" (Carnegie and Butlin 1993).

The two approaches to innovation are illustrated in Figure 5.1. It will be seen that the "innovating thrust" is very close to the KAIZEN method, in many cases right down to the gradualist, marginalist and measured discipline of KAIZEN.



Source: Carnegie and Butlin (1993)

Figure 5.1 Types of innovation

However, what is not clear from all the recent management analysts' definitions is precisely what impact the innovation process has upon the firm. It is therefore necessary to go back to Schumpeter for a concise statement of an innovation being a process which:

- created a new production function for the firm, and
- created a new total and/or marginal cost curve for the firm which was lower than the ones which existed before the innovation.

Marketing, pricing and organisational changes are assumed to follow when the second condition has been met.

Both of these conditions are required in KAIZEN where the fundamental tenet is the constant improvement in the service or product at the lowest possible cost. This, however, is not clear in the BCA analysis.

As a working definition for this thesis, it is sufficient to consider innovation as that process which creates a new production function within a firm which leads to a net improvement in the total factor productivity (TFP) of that firm. The innovation might be of the kind leading to the creation of a new firm or a re-definition ("re-engineering") of the old firm. But the innovation may also be at the margin of the existing business. This is sufficient to be regarded as an innovation if it creates a new production function leading to a net improvement in TFP. Thus, in terms of the thesis definition, the "strategic leap" and the "innovative thrust" vary only in terms of degree; one is as important as the other.

5.3 ROLE OF TECHNOLOGY CHANGE IN INNOVATION

Schumpeter makes it clear that innovation goes well beyond technology change or "invention" which may or may not be taken by a firm's management to create a new production function and bring about a net improvement in TFP. However, traditionally, most analysis in management and economics has focussed upon technology change as if it were the beginning and the end of the innovation process.

A good demonstration of confusion comes from some attempts to define technology (Goodman, Sproull and Associates 1990).

1. Herlin and Roznowski (1985: 47) (cited in Goodman et al. 1990):

   > We define technology as the physical combined with the intellectual or knowledge processes by which materials in some form are transformed into outputs used by another organisation or subsystem within the same organisation.

   This definition excludes the possibilities of the application of technology in the production of services. Also, there is no reference to costs and revenues as if technology change were value neutral, which clearly it is not.

2. Law (1987: 115) (cited in Goodman et al. 1990) notes technology is:

   > ... a family of methods for associating and channelling other entities and forces, both human and non human. It is a method, one method, for the conduct of heterogeneous engineering, for the construction of a relatively stable system of related bits and pieces with emergent properties in a hostile or indifferent environment.

This is a very foggy and confusing attempt to generalise the process by which technology converts inputs of resources into outputs. Nevertheless it exemplifies the

confusion which exists in some areas of management science regarding the process of technological change.

3. Bernicker (1987: 10) (cited in Goodman et al. 1990):

> Technology refers to a body of knowledge about the means by which we work on the world, our outputs and our methods. Essentially, it is knowledge about the cause and effect relations of our actions...Technology is knowledge that can be studied, codified and taught to others.

Again, this definition illustrates the problem of obtaining precision in providing insights into the process of technological change in the business firm.

The difficulties experienced by management theorists are compounded when attempts are made to incorporate technological change into empirical economic studies. Some of these have been carried out in the transport industry and it is useful to examine the results of these studies to further our understanding of the problems associated with understanding the process of technological change.

In an essay on technical change in the US regulated trucking industry (1974 to 1979), Friedlaender and Bruce attempted to measure the impact of technical change on trucking costs (Friedlaender and Bruce 1985). They concluded that changes in operating characteristics are very difficult to trace over time. These operating characteristics were identified as average length of haul, average load, percentage of less-than-truck load, average shipment size and insurance. All were used as proxies for technical change. An example is given with average haul length. Intuitive reasoning would lead the analyst to conclude that as average haul lengths increased over time, the cost savings associated with the increases would fall rather than rise. However, when average haul length is allowed to interact with the other variables (average load, etc.), the opposite conclusion applies. As with so much analysis in the transport industry, part of the problem is in the data. First, the time span is not long enough. To properly assess the impact of technology, the time span needs to be long, say at least 40 to 50 years. Such a descriptive study was undertaken in the New South Wales *Technological Factors in the Development of the Road Freight Industry in New South Wales 1938/39 to 1988/89 and Beyond* (State Rail Authority of NSW 1989). Second, there are two (and possibly more) distinct segments to the trucking industry. And in each, distinctively different technological factors are in operation. The first segment is the long haul service where productivity has doubled since 1969 and has been growing at an exponential rate since the 1980s. On the other hand, in the second segment, short haul services, productivity steadily declined between 1969 and early 1980s but stabilised in 1988. Technology improvement in short haul services has occurred in parallel with long haul but has been

constrained by poor vehicle utilisation, inadequate management of vehicle fleets, and poor road systems in cities and towns.

Third, the technology itself needs to be dissected into its components as component technology has changed at different rates with differing impacts as follows:

Vehicle architecture
Since the 1960s, vehicles have grown longer with increased cubic capacity to accommodate the rapid growth in low density freight.

Motive power
Until the 1960s, road freight vehicles were mostly petrol driven with low tare weights and relatively small carrying capacity. Dieselisation in the 1960s led to greater gross vehicle masses and more powerful vehicle engines. In the 1970s, the fuel crisis led to an engine redesign emphasising fuel economy. In the 1980s, the emphasis was on payload leading to the emergence of the Medium Combination Vehicle (MCV); the most common one being the B-Double.

Ergonomics
Improvements here included air-conditioning of drivers' cabs, personalised seating, dashboard design and CB Radio communication.

Freight handling
The biggest improvements came in the 1960s with palletised loads and small size consignments and containerisation.

Management systems, data
Major changes are foreshadowed in processing and communications including data flows being carried on freight consignments on the move, on-board data processors and satellite communications.

Roads
A major factor in improved technology has been the interaction between improved road vehicles and improved roads. The most significant of these has been the introduction of the freeway system since the late 1960s.

All of these factors have had an impact on productivity but without a detailed analysis, it would be difficult to measure the timing and extent of the impacts.

For the purpose of the thesis, it will be useful to develop a working definition and some thoughts on identification and measurement. Technological change is a component of

the innovation process and very often its key component. As such it contributes to the creation of a new production function for the firm leading to a net improvement in TFP. Technology is a firm-specific body of information which enables that firm to organise its production equipment and systems to produce goods and services for its customers. The key phrase is "body of information", the significance of which is elaborated later in this Chapter.

The measurement of the impact of technology as part of the innovation process requires that the following conditions be met:

1. Technological change needs to be measured over long time spans, as it usually takes a long time to have a measurable impact.
2. Technological change is not a smooth and seamless process and occurs in different parts of a production unit at different times. It is definitely non-linear. Consequently, it is necessary to disaggregate the production unit into its component sub-systems and measure the impacts separately.
3. Technological change affects different markets served by one firm differently. It is, therefore, important to disaggregate the study of technological change into industry and market segments.

5.4 THE INNOVATION PROCESS ACCORDING TO SCHUMPETER

In order to identify and measure the innovation process, it is useful to develop some general observations as to how the typical innovation process works in a firm.

Again, a good starting point is Schumpeter (1939). He postulated three characteristics of the innovation process.

1. It necessitated investment for the construction of new plant and equipment (or the re-building of old plant) of sufficient magnitude as to change the firm's production function.
2. It created a new set of markets, production processes, administration, etc., within the existing firm, as if "... a new firm (were) founded for the purpose (of implementing the innovation)" (Schumpeter 1939).
3. It is associated with the rise of New Men (Schumpeter 1939):

> ... innovations are always associated with the rise to leadership of New Men ... In fact, it explains why new production functions do not typically grow out of old businesses—if a New Man takes hold of an old business, they may—(but normally) their insertion proceeds by competing the old ones out of existence or by enforcing the transformation of them.

One further idea introduced by Schumpeter was the innovating New Man (henceforward, New Person) working towards a new Horizon where "untried possibilities" are available and where profits may be made. These innovating New

Persons responding to these new Horizons are "entrepreneurs" engaging in "entrepreneurial activity". Typically, the original innovating activity has a life cycle at the end of which no further profits are possible. However, during this life-cycle, it will upset the equilibrium of the markets and industry in which it occurs. Second-order fluctuations occur as other firms adapt to the new situation increasing the risk of failure. This "secondary wave" may be much easier to identify and measure than the originating innovation (Schumpeter 1939):

> The cyclical clusters of errors, excesses of optimism and pessimism and the like are, as we have seen, not necessarily inherent in the primary process—which process would produce ups and downs and, be it particularly remembered, also losses without errors—although they can be adequately motivated by it.

Finally, the second-order cycle needs to spend itself reaching a new state of equilibrium before the next round of innovating activity can commence. Schumpeter also notes that some innovations have second-order effects in markets and industries outside their own, some of these effects being profound enough to change populations and their life style, thus (Schumpeter 1939):

> The railroadization, the electrification, the motorization of the world are instances. One railroad or a few lines may be all and more than all that can be successfully built in a given environment at a given time. Reaction and absorption may have to follow before a new wave of railroad construction becomes possible. The motor car would never have acquired its present importance and become so potent a reformer of life if it had remained what it was thirty years ago and if it had failed to shape the environmental conditions—roads among them—for its own further development. In such cases innovation is carried out in steps each of which constitutes a cycle.

5.5 TOWARDS A THEORY OF INNOVATION: NSW RAILWAYS 1855 TO 1938/39

The starting point is the definition of innovation, proposed above in Section 5.2:

> That process which creates a new production function within a firm which leads to a net improvement in the total factor productivity (TFP) of that firm.

The innovation might be of the kind leading to the creation of a new firm or a re-definition of the old firm. But the innovation may also be at the margin of the existing business. This is sufficient to be regarded as an innovation if it creates a new production function leading to a net improvement in TFP.

In terms of the Quadrae in Chapter 3, this definition concentrates upon Triangle HF1 dealing with cost efficiency. It has nothing to say about innovation leading to pricing efficiency (Triangle HF2) or Government innovatory initiatives leading to economic

cost or gain (Triangle HF3). This latter aspect of innovation has been heavily underscored by both the BCA and the Porter studies. The primary reason for narrowing the definition towards TFP and cost efficiency is that the subject of the thesis requires this. Also, for innovation to succeed, it must first and foremost react upon cost efficiency. If it does not do this, then it is not, by definition, an innovation. Thus, the innovation process to be discussed (in later works, perhaps) may be thought of as a precursor of second-order events or processes. Some initial ideas along these lines are proposed at the end of this Chapter.

The starting point in this attempt to develop a theory is the firm's production function: which, as defined by the *Collins Dictionary of Economics* (Pass 1993)

> ... shows for a given state of technological knowledge the relationship between physical quantities of factor inputs and the physical quantities of output involved in producing a good or service.

A quantification of the production function for NSW rail passenger services will be shown below for the years 1951/52 to 1991/92 in an attempt to provide insights into the innovation process at work in that industry. However, it is first necessary to look at the early years of the railway services, before they reached maturity and when innovation in the classic sense of Schumpeter was present.

Like most technologically based industries in Australia until the mid 20th century, railways were a derivative of similar systems in Europe or North America. In the case of the NSW Railways, the systems and culture borrowed very heavily from the British railway system.

In his monumental history of the world economy, Rostow (1978) notes that railways earned a special place in the first Industrial Revolution:

> It had powerful multiple effects: it lowered transport costs, brought new areas and supplies into national and international markets; helped in some cases to generate new export earnings which permitted the whole process of development to move ahead at a higher rate: stimulated expansion in output and the accelerated adoption of new technologies in the coal, iron and engineering industries; set up pressures (via the need for more durable rails) which helped give birth to the modern steel industry; altered and modernised the institutions of capital formation; and accelerated the pace of urbanisation, with all its dynamic playback (i.e. multiplier) effects or economic as well as social and political development.

Australia has generally been in the forefront of industrial nations in accepting innovations of a major nature and railways were no exception. The matter of a railway was first raised in 1846 with the formation of a Committee in NSW to collect information regarding the building of a railway from Sydney to Goulburn and Windsor and Bathurst, if practicable. At the time, such a project could hardly be justified. The

colony of NSW had a population of about 200,000, convict transports had only stopped in 1840 and only the wool industry seemed capable of sustainable growth, that served export markets.

Nevertheless, by 1857, NSW had 22 kilometres of double track between Sydney and Parramatta and 27 kilometres between Honeysuckle Point, at Newcastle, to Maitland. All rails and rolling stock and other major fabrications were imported from England. A telegraph to serve the railway was also imported.

The crossing of the Blue Mountains and Southern Highlands presented a major technical challenge. These mountain obstacles, together with the rivers, presented unique obstacles to British railway engineers used to the benign climate and geology of Europe. The colony developed an expertise in cutting and handling sandstone of major dimensions to build the Nepean Bridge, and to commence the zig-zag up the steep ascent from Emu Plains. The Zig-Zag Railway at Lithgow is regarded as one of the finest railway engineering achievements anywhere in the world in the 19th Century.

The first attempt at the local manufacture of rollingstock came in 1869 when two colonial firms were offered substantial contracts: Messrs Vale and Lacy to make locomotives and Messrs P N Russell and Co. to make other rollingstock (Gunn 1989). John Whitton, the Schumpeterian New Person of the time, provided local and overseas supplies of locomotives with a table of locomotive weights and performance capabilities to suit the unique operating conditions to be found in NSW. By 1 January 1876, NSW operated 100 locomotives, 344 passenger carriages and 1,610 goods wagons. About one third of these had been supplied by local manufacturers. Some 700 kilometres of track were in existence and there were constant complaints about the quality of steel used in the British-imported rails. However, labour shortages (in skilled categories in particular) prevented the colonial contractors from seeking further contracts and importers once more filled all contracts. The lack of sufficient supplies of skilled labour was to continue to bedevil the NSW railways and its suppliers in their high-growth phase and represented a continuing constraint on the development of an indigenous innovation effort in railways (Gunn 1989).

Nevertheless the second-order effects of the building of the railways in NSW were immense. Much of this second-order was associated with the growth of the wheat and other agricultural industries in the State. In 1860, 129,000 acres of land was under wheat, nearly 60 per cent in the well watered coastal belt of the state. By 1890, the area had grown to 333,000 acres, 70 per cent of which was located inland and a further 29 per cent in the NSW Tablelands (Dunsdorfs 1956). Wheat growing needed a mode of transport geared to moving bulk products quickly on demand to state ports where it

could be moved quickly again by clipper-type sailing ships to the expanding markets in industrialising Europe. Railways, working in conjunction with bulk storage facilities, and the developers of a distinctively Australian approach to dry-land farming in the harsh Australian hinterland, led to NSW becoming one of the major world grain exporters in the late 19th Century. In the process, NSW country towns acquired regular and relatively inexpensive access to the State's major cities. Thus began an institution which buried itself deeply in the psyche of the NSW country dweller well into the 20th Century. By 1904, the estimated area under wheat in NSW was nearly 2 million acres. Only 27,000 acres of this was not served by a railway line (Dunsdorfs 1956).

The NSW Railways remained a derivative industry of Britain until a further attempt was made in 1890 to have locomotives manufactured in NSW. Inadequate plant and equipment and lack of skilled personnel continued to hamper the prospects for an indigenous industry catering to railways.

In 1904, a Royal Commission established that locomotive manufacture could be undertaken at the NSW Railway Workshops at Eveleigh. At the same time a private firm, Clyde Engineering Company, was nominated as contractor to build 60 P (designed by the NSW Chief Mechanical Engineer) and T locomotives over a seven year period. The Eveleigh workshops received an order for 15 locomotives. This re-established rollingstock engineering skills and Government policy in succeeding years increasingly favoured local sources. Nevertheless, for technological advice, the NSW railway mechanical engineers were still heavily dependent upon their peers in Britain. The rapidly expanding needs of the NSW railways meant that between 1907 and 1912, Clyde had built 225 locomotives and Eveleigh 87. Even so, the two establishments could not keep up with orders. Labour costs of production were increasing and there was added pressure to renew imports.

During the 1914-18 World War, the NSW railways were diverted to a war footing with Eveleigh workshops concentrating on munitions production. In August 1917, an innocuous attempt to introduce costing cards at Eveleigh was misinterpreted by unions as an attempt to introduce Henry Ford's Taylor Card System of continuous production lines. This system had been lauded by management and economic analysts as one of the profound innovations in the manufacturing process in the 20th Century. It caused a 5 week strike and was probably the last time any major innovation was attempted in the production process at Eveleigh. The strike, which spread to all areas of railways, was to establish a paradigm for railway management and labour relations for the next 60 years. It was a major contributor to the retardation of innovation in this period.

The next major technological change was the electrification of the suburban rail system in Sydney. Electric train systems began to flourish in Europe and America after the establishment of London's deep-level tube railway in 1890. It was seen as a clean, efficient and relatively comfortable way of moving large numbers of commuters between their homes and centralised workplace, quickly. By 1915, Melbourne was in the process of converting its suburban railways to electric traction. In 1914, Dr J J C Bradfield, a NSW Public Works Department engineer, was despatched overseas to study electric train systems. He was appointed Chief Engineer for Metropolitan Railway Construction and reported his findings in 1915. Like John Whitton, he was to be another railways' New Person. The suburban electric train system with the Sydney Harbour Bridge at its core has firmly fixed the pattern and scope for Sydney's urban development forever.

Apart from his plans for the Sydney Harbour Bridge (itself a major civil engineering innovation), Bradfield proposed electrification of an inner suburban railway zone followed by an outer zone at a later time. Loop lines were also recommended, where possible including underground railways and tramways where possible. Electrification would increase the capacity of Central Railway Station by 60 per cent and new electric trains would increase the carrying capacity of suburban trains by 100 per cent. The Government's decision to proceed with the project was a purely political one, subject only to the constraint of raising the funds for the project. No economic evidence has ever been produced to justify the expenditure.

Since the definitive biography of John Whitton is yet to be done, it is perhaps appropriate to access Richard Raxworthy's account of Bradfield (Raxworthy 1989) which helps to explain the stature of men needed by huge, neolithic organisations like the railways, so that bold ideas can be turned into realities:

> Bradfield was an example of Shaw's "unreasonable man"*. He was a paradox: a bold visionary planner, as an engineer he was the soul of caution. He had an enormous capacity for hard work, but retained the ability to relax and was an accomplished catnapper. A short man, he planned on a vast scale; and though his visions were futuristic, they had a notably old-fashioned look about them. He was a brilliant communicator and publicist with a deep appreciation of history, but he allowed nothing to stand in the way of progress...Of working class origins, he could communicate equally at all levels, with his workmen or the Governor, but he was no social climber...His detractors, who were particularly from the Railways, regarded him as arrogant and inclined to take credit for the ideas of others...A flexible planner and good organiser, he used his own and anyone else's half-formed plans and made them a reality. A dreamer and a man of action, he made decisions and persuaded others to follow him. All his schemes had to pass the test of public meetings and inquiries.

* From G B Shaw's play *Man and Superman* (1905).

By the time of his 1915 plan for Sydney's railways, Bradfield was already 48 years old. He already had an extensive career in the planning and construction of roads, dams, bridges and railways for the NSW Department of Public Works and the Sydney University Engineering Society.

However, it was not until 1926 that electric train services were inaugurated on the Illawarra Line, and the first electric train ran from Central to St James station, via Museum. For the railways, a City Railway and Harbour Bridge notwithstanding, the plan was to electrify the lines to Hornsby in the north, Campbelltown in the south, Penrith in the west, National Park in the south west and the Sydenham-Bankstown and Lidcombe-Cabramatta branch lines. By 1926, two large capacity power generation plants were being operated by the railways at Ultimo and White Bay. These created alternating current electricity which then had to be transmitted, transformed and converted to direct current carried by overhead wires to supply the traction motors on the trains themselves. Four substations were constructed to bring about the conversion at Prince Alfred Park, Meeks Road, Hurstville and Sutherland.

At the age of 59, Bradfield held the position of Chief Engineer, Sydney Harbour Bridge and City Railway with the responsibility to implement his 1915 plan which had been approved by NSW Parliament. The Sydney Harbour Bridge, with its electric train service to North Sydney, was opened on 15 March 1932. Prior to this the Metropolitan Railway Construction Branch of the railways, headed by Bradfield, was absorbed into the Existing Lines Branch. Bradfield was "retrenched", but returned to the Public Works Department (Gunn 1989).

The genius of Bradfield was, first, his recognition that Sydney needed a fast, clean, comfortable train service to move large numbers of Sydney people from comfortable homes in the suburbs to centralised work locations, mostly in the Central Business District. This was the characteristic of the essentially radial peak period travel pattern in Sydney. The two keys to this were an underground loop railway system that quickly moved trains through Central to the various radial main lines and at least one harbour crossing for the railway, to join up Sydney. Raxworthy (1989) notes:

> The history of the journey to work in Sydney is one of increasing distance made possible within a constant allocation of the average worker's time by switching from slower to faster means of transport. This enabled the city to grow geographically with a falling population density, and enabled its people to pursue the suburban Australian ideal that each family should live by itself in a house with its own garden.

The second element of Bradfield's genius was that he was able to design and build his own creation despite the entrenched opposition of a powerful railway bureaucracy

which resented this intruder from Public Works and finally got rid of him after his creation was well under construction.

The rollingstock was "state of the art" imported, and was to last a very long time and eventually become derisively known as the "red rattler". Up to 1938/39 the railways continued to remain a largely derivative industry although it developed interesting interior designs for inter-city trains. Nevertheless it was quick to adopt new ideas developed overseas such as power controlled signalling. World War II was to see the NSW Railways plunge into all kinds of activities related to the war effort, but unrelated to innovation in railways.

5.6 THE IMPACT OF MAJOR TECHNOLOGICAL CHANGE ON NSW RAIL PASSENGER SERVICES FROM 1951/52

In this section, the major technological changes made in NSW rail passenger services between 1951/52 and 1991/92 are examined to determine whether they led to innovation, i.e. the creation of a new production function leading to a net improvement of TFP.

The method proposed to analyse the major technological changes which have occurred is as follows:

1. Services are segmented into their market segments and operating sub-systems, train running, corridor, terminals (stations) and business/corporate management.
2. Where important, operating sub-systems are further dissected into processes in order to isolate the impact of technological change.
3. Whilst formal production functions are not drawn up, quantitative data on outputs and inputs are examined to see if the technological change did lead to innovation. The functional relationships between inputs and output are dissected to the level of market segments.
4. Intermediate output is measured by train kilometres and seat kilometres. Final output is measured by passenger journeys. Inputs are the standard ones of labour, fuel, capital and materials.
5. Partial productivity indicators are then set up between input and output measures to test conclusions on the impact of the innovations.

5.6.1 Dieselisation of Passenger Trains

In the context of NSW rail passenger services, dieselisation refers to the replacement of steam locomotives with diesel locomotives. Also, dieselisation's impact was confined

largely to the Country and Interstate market segments and the train running sub-system; and within this sub-system, to fuel consumption and locomotive maintenance.

Dieselisation was only just under way in 1951/52, and took until 1966/67, fifteen years later, to be completed. Annual Reports of the NSW Railways of the 1950s also indicate that external circumstances forced the change: because of severe coal shortages in the early 1950s, continuing inability to obtain coal of a suitable quality to feed the locomotive boilers, inability to obtain the right quality steel for boilers, the increasing casualty rates of locomotives and the inability to find adequate numbers of tradespeople in the ranges of skills needed to maintain the locomotives.

Tables 5.1 and 5.2 provide the raw data on intermediate outputs and inputs between 1951/52 and 1966/67 and then as partial productivity indicators (PPIs). Intermediate output indicators of train kilometres and seat kilometres are used, in this instance, because they are considered to be more sensitive linkages to the train running sub-system and the inputs it uses. PPIs are used as a first cut to determine whether dieselisation had any impact on TFP. This will help in establishing hypotheses in Chapter 7.

Table 5.1 shows that in the fifteen years between 1951/52 and 1966/67, Country services had decreased by 13 per cent (measured by train kilometres) and 22 per cent (measured by seat kilometres). This was partly due to the re-definition of boundaries between Country and Interurban market segments. Interstate services had increased by 15 per cent (train kilometres) and 4 per cent (seat kilometres).

In technological terms the change from a disintegrating steam locomotive fleet to a modern diesel locomotive fleet was a quantum leap. In both Country and Interstate services, the statistics in Table 5.2 show that locomotive maintenance labour productivity increased by 89.3% (Country) and 72.7% (Interstate), measured in train kilometres. Fuel productivity increased by 730% (Country) and 760% (Interstate). This was a direct, expected and unavoidable result as a whole new technology was brought into locomotive workshops and depots geared to a steam technology that had not basically changed since the 1850s.

But maintenance labour productivity gains should have been higher, given the very labour intensive steam locomotive maintenance practices. Workshop rules and re-deployment policies kept labour available long after their need was gone.

Table 5.1 Country and Interstate train services: intermediate output and input measures, 1951/52 and 1966/67

Measures	Country		Interstate	
	1951/52	1966/67	1951/52	1966/67
1. Output				
Train kms ('000)	13100	11373	3100	3570
Seat kms ('000)	3981410	3122772	940502	975878
2. Input (train running)				
2.1 Labour				
Train crew (no.)	557	362	131	114
On-train crew (no.)	1043	503	247	158
Loco maint. (no.	1495	867	703	471
Total	3095	1732	1081	743
2.2 Fuel				
Solid fuel (Gigajoules)	12,400,000	162,000	2,900,000	38,000
Liquid fuel (Gigajoules)	448,210	1,204,942	105,830	378,404
Total	12,848,210	1,366,942	3,005,830	416,404
2.3 Capital				
Steam locos (no.)	608	30	143	0
Diesel locos (no.)	10	163*	0	55
Total	618	193	143	55

Source: Thesis Appendix 2, RAILDATA.

Notes: * Includes diesel trains and rail motors.

Table 5.2 Country and Interstate train services: partial productivity indicators of intermediate output and input measures, 1951/52 and 1966/67

Partial Productivity Indicators (PPIs)	Country			Interstate		
	1951/52	1966/67	% change	1951/51	1966/67	% change
1. Train kms ('000)						
per train crew	23.5	31.4	33.6%	23.7	31.3	32.1%
per on-train crew	12.6	22.6	79.4%	12.6	22.6	79.4%
per loco maint. labour	8.8	13.1	89.3%	4.4	7.6	72.7%
per '000 GJ	1.0	8.3	730.0%	1.0	8.6	760.0%
per power unit	21.2	59.5	180.7%	21.7	65.0	199.5%
2. Seat kms ('000)						
per train crew	7148	8626	20.7%	7179	8560	19.2%
per on-train crew	3817	6208	62.6%	3808	6176	62.2%
per loco maint. labour	2663	3602	35.2%	1338	2072	54.9%
per '000 GJ	310	2284	637.1%	313	2346	649.7%
per power unit	6442	16350	153.8%	6577	17743	339.6%

Source: Thesis Appendix 2, RAILDATA.

Table 5.2 also shows gains in train crew productivity but at a much more modest level. These gains are more attributable, in the case of Country services, to branch line service cuts than to dieselisation even though diesel traction facilitated these cuts. Nevertheless, crew rostering retained many of its characteristics developed for steam locomotive crews.

The long lead time needed to complete the dieselisation program may have been due to:

1. Constraints on capital which meant that most of the funds allocated to the dieselisation program went towards freight services which were not heavy deficit builders like Country passenger services.
2. The strength of political lobbying in the country areas of NSW to preserve steam branch line services. This was in alliance with the strength of the unions' commitment to a steam engine area.

The evidence for these assertions comes from a careful reading of the Annual Reports of the time.

Where dieselisation of Country services was a strategic defensive retreat from increasing financial losses, the dieselisation of Interstate services was an attempt to establish new markets which was badly mistimed and poorly marketed. NSW entered the market for interstate travel right on the eve of two decades of rapid growth in interstate air, motor car and motor coach travel. NSW's decision rode on the shoulders of a national strategy by Commonwealth and State governments to provide a standard gauge railway line linking all States (excluding Northern Territory and Tasmania).

New, comfortable sleeper and seating carriages were introduced progressively on new services as follows:

Service	Date
Canberra-Monaro Express	May 1955
Intercapital Daylight Express (Sydney-Melbourne)	March 1956
Far West Express	December 1957
Brisbane Limited Express	November 1960
Southern Aurora (Sydney-Melbourne)	April 1962
Spirit of Progress (Melbourne-Sydney)	April 1962
Intercapital Daylight Express	April 1962
Indian Pacific	March 1970

In terms of service quality, these trains were at the apogee of long distance passenger train services. Capital was not spared on them, all political parties supported their introduction and the unions were enthusiastic about them. But, they were too slow for business travellers and major parts of the tourism market; they could not entice car travellers from their cars despite the bad conditions of interstate highways at the time and eventually were undercut on price by long distance coaches at the bottom end of the market. Here was an example of a substantial technological improvement that failed as an innovation because of poor marketing and no business strategy. After some initial growth in patronage in the late 1960s and early 1970s, the service curtailment strategies applying to Country services overtook Interstate services as well.

In conclusion, the dieselisation of Country and Interstate passenger services did improve labour and fuel productivity in train running sub-systems only. Dieselisation failed this test of innovation. It also took too long to implement and in the case of Interstate services completely misjudged the market. There were, however, some positive qualitative impacts which may be regarded as benefits (albeit immeasurable ones). The increasingly poor condition of steam locomotives meant that they often failed in service, and their replacement led to some improvement in service reliability and despite what "steam buffs" say, steam locomotion was dirty, smelly and highly polluting of the air.

5.6.2 The Double-Decked Suburban Train

The ostensible reason for introducing double decked suburban trains was to increase carrying capacity during Sydney's peak periods. As with dieselisation, its impact was confined to the train running sub-system of the Suburban market segment, and within this sub-system to train crew, on-train crew, and carriage maintenance labour. Fuel consumption increased, because of the use of more powerful electric motors that improved operating performance.

Double-decked suburban trains were introduced in 1963/64 and took until 1991/92, twenty eight years later, before the last "red-rattler" single-decked carriage was replaced.

The imperative to replace the "red-rattlers" was not as great as the imperative to replace steam locomotives. Nevertheless, although almost indestructible in their bodies (although prone to rusting in floors and underframes) their electric traction motors were 1920s vintage that needed considerable maintenance and were prone to failure in wet weather.

Tables 5.3 and 5.4 provide the raw data on intermediate outputs and inputs between 1963/64 and 1991/92 and then as partial productivity indicators (PPIs). Again, intermediate output indicators of train kilometres and seat kilometres are used.

Table 5.3 shows that in the twenty eight years between 1963/64 and 1991/92 Suburban services increased by 46.2 % (in train kilometres) and 92.9% (in seat kilometres).

Table 5.3 **Suburban train services: intermediate output and input measures, 1963/64 and 1991/92**

Measures	Suburban	
	1963/64	1991/92
1. Output		
Train kilometres ('000)	16,821	24,600
Seat kilometres ('000)	6,934,028	13,373,490
2. Input (train running)		
2.1 Labour		
Train Crew (No.)	972	792
On-train Crew (No.)	1395	696
Carriage Maintenance (No.)	1308	823
Total	3675	2311
2.2 Fuel		
Electricity (Gigajoules)	614,639,000	1,586,693,000
2.3 Capital		
Single-decked carriages (No.)	1087	130
Double-decked carriages (No.)	7	1070
Total	1094	1200

Source: Thesis Appendix 2, RAILDATA.

Table 5.4 **Suburban train services: partial productivity indicators of intermediate output and input measures, 1963/64 and 1991/92**

Partial Productivity Indicators (PPIs)	Suburban		
	1963/64	1991/92	% change
1. Train kilometres ('000)			
per train crew	17.30	21.10	79.8%
per on-train crew	12.10	35.30	191.7%
per carriage maint. labour	12.90	29.90	131.8%
per '000 GJ	0.03	0.02	33.3%
per power unit	15.40	20.50	33.1%
2. Seat kilometres ('000)			
per train crew	7133.8	16885.7	136.7%
per on-train crew	4970.6	19214.8	386.6%
per carriage maint. labour	5301.2	16249.7	206.5%
per '000 GJ	11.3	8.4	25.7%
per power unit	6338.2	11144.6	75.8%

Source: Thesis Appendix 2, RAILDATA.

As with dieselisation the change to double-decked suburban electric cars was a quantum leap in technological terms. The double-decked train went through several design changes and other modifications which culminated in the Tangara, which is recognised as among the best designed suburban rollingstock in the world, from the point of view of new technology. It has also increased the level of comfort of passengers because of its air conditioning, seating, interior design, etc. Some earlier models of double-decked trains have been scrapped because of poor performances while some are being refurbished.

Whilst the ostensible reason for introducing the double-decked train was to increase carrying capacity in the peaks, and though carrying capacity has almost doubled in terms of seat kilometres since 1963/64, two major problems remain:

1. Overcrowding

Research has found that overcrowding still occurs on some trains because these trains are fast, limited-stop services which are provided during the "peak-of-the-peak", when a majority of people wish to travel. And, because of track capacity limitations, there are constraints upon the number of seat kilometres which can be offered during peak periods. The other feature of suburban train travel in Sydney is that there is a sharp drop in patronage during off-peak periods. This has created significant excess capacity during the off-peak periods, which marketing efforts have been unable to resolve so far.

2. Long lead time

The long lead time taken to convert the single-decked fleet to a double-decked fleet was due in part to the heavy capital costs, the newness of the technology anywhere in the world and a lingering commitment by unions, in the earlier years, to maintaining the old rollingstock.

The statistics in Table 5.4 show that train crew and on-train crew productivity increased substantially, particularly the latter, which almost doubled in train kilometre terms, and quadrupled in seat kilometre terms. This was due to the fact that better design and facilities in guards' compartments allowed improvements in rostering. Carriage maintenance labour productivity also increased sharply with the phasing out of the old single-decked carriages.

Fuel productivity, however, declined, by 33 per cent and 25 per cent, respectively. This was because of heavier trains, higher performance power units, and air conditioning in particular.

In conclusion the implementation of the double-decked suburban train was a brilliant technological advance which failed to develop as an innovation because of its creation of substantial excess capacity, especially in off-peak periods, and the length of time taken in implementation. Only labour productivity in the train running sub-system was improved.

5.6.3 The Double-Decked Interurban Train

In 1975, a long-serving Liberal-Country Party Government lost the election in New South Wales due mainly to transport issues in marginal electorates in peripheral areas of

Sydney. These areas were served by interurban trains mostly consisting of old single-decked carriages which were prone to breakdowns. Their consequent delivery of services was poor.

The incoming Labor Government pledged to replace the trains with new double-decked carriages. It introduced a four-car double-decked interurban train on Sydney to Gosford services in 1969/70. There were still a significant number of single-decked carriages in the system in 1991/92. The political imperative that had brought about their introduction had been overtaken by others, in the 22 years. Also, in the late 1980s, the heavily subsidised fare structure of interurban services was being called into question, together with their capacity to continue servicing the rapidly growing commuter demand. One policy idea which was given serious consideration was the breaking of the rail monopoly on interurban commuter journeys with road coach services. Thus, despite the doubling of train seat kilometres between 1969/70 and 1991/92, there was over-crowding in the peaks. However, over half the trains operating on weekdays had a maximum load factor of less than 40 per cent of train capacity. Also, on weekends, about half the trains have a maximum load factor of less than 20 per cent of train capacity.

Tables 5.5 and 5.6 provide the raw data on intermediate outputs and inputs between 1969/70 and 1991/92, and then as partial productivity indicators (PPIs). Again, intermediate output indicators of train kilometres and seat kilometres are used. Table 5.5 shows that in the 22 years between 1969/70 and 1991/92 interurban services increased by 284% (in train kilometres) and 327% (in seat kilometres).

As with the suburban double-decked trains, the interurbans were a quantum leap in technological terms. It went through several design changes and modifications which culminated in the interurban version of the suburban Tangara. Table 5.6 shows that very significant increases were achieved in train running system productivity in both labour and fuel terms.

The conclusions about interurban service productivity parallel those of suburban service productivity, i.e. technological brilliance which was frittered away because marketing management did not address the very large excess capacity in the off-peak periods. Also, the new rollingstock took too long to introduce partly due to the fact that the political imperatives which led to its introduction in 1969/70 had weakened considerably by the 1980s.

Table 5.5 **Interurban train services: intermediate output and input measures, 1969/70 and 1991/92**

Measures	Interurban	
	1969/70	1991/92
1. Output		
Train kilometres ('000)	2,500	9,600
Seat kilometres ('000)	895,679	3,828,396
2. Input (train running)		
2.1 Labour		
Train Crew (no.)	132	323
On-train Crew (no.)	163	225
Carriage Maintenance (no.)	205	337
Total	500	885
2.2 Fuel		
Electricity (Gigajoules)	69,246,000	66,400,000
2.3 Capital		
Single-decked carriages (no.)	80	73
Double-decked carriages (no.)	4	243
Total	84	316

Source: Thesis Appendix 2, RAILDATA.

Table 5.6 **Interurban train services: partial productivity indicators of intermediate output and input measures, 1969/70 and 1991/92**

Partial Productivity Indicators (PPIs)	Interurban		
	1969/70	1991/92	% change
1. Train kilometres ('000)			
per train crew	18.90	29.70	57.1%
per on-train crew	15.30	42.70	179.1%
per carriage maint. labour	12.20	28.50	133.6%
per '000 GJ	0.04	0.14	250.0%
per power unit	29.80	30.40	2.0%
2. Seat kilometres ('000)			
per train crew	6785.4	11852.6	74.7%
per on-train crew	5495.0	17015.1	209.6%
per carriage maint. labour	4369.2	11360.2	263.7%
per '000 GJ	12.9	57.7	347.3%
per carriage	10662.8	12115.2	13.6%

Source: Thesis Appendix 2, RAILDATA.

5.6.4 The Eastern Suburbs Railway (ESR)

This was a construction which was commenced in the 1890s, when the classic Schumpeterian motive behind new railway line construction was the "second wave" effect of property development. In the intervening years, extensive tramways, and later, bus services, supported an intensive development of the Eastern Suburbs of Sydney. Nevertheless, political and business support for a heavy rail connection to the Eastern

Suburbs persisted through the years, and as such work continued intermittently on the project.

It was completed in June 1979 at a cost of $168 million (current dollars). It had no discernible impact on property values along its route. It did add 18.7 million journeys in its first year, but many of these were former bus travellers whose services had been discontinued.

Patronage of the ESR dropped back to between 14–15 million journeys per year, in subsequent years. Operationally, it enabled Illawarra train services to be run separately from the remainder of the metropolitan network, and insulated the services from difficulties in the rest of the system. The Illawarra services have had a very high on-time running performance as a result.

Station design was close to "world's best practice" in technical terms but there was no discernible impact on the production function. Another feature was that the ESR was to be used as a proving ground for a new fare system, ticketing and automatic barrier equipment. A study of this proving ground one year later showed the following (Planning Division, Public Transport Commission of NSW 1980):

1. A "closed and integrated system" of automatic ticketing and barriers was purchased off-the-shelf from a US supplier at a time just before major new micro-processor technology was to make the technology of this system obsolete.
2. The system, though technically sound in itself, failed when installed in the ESR, for the following reasons:
    - 20 per cent of the journeys made on the ESR were made by passengers carrying paper tickets issued elsewhere in the Sydney System. Travellers carrying these tickets therefore could not go through automatic barriers, and had to exit through staffed barriers.
    - There was a further leakage of 14 per cent, of passengers holding encoded tickets, through manned barriers rather than automatic barriers. At Town Hall station, at the city end of the ESR, the leakage was 50 per cent, because the auto-barriers were shut down for much of the time.
    - Expended, encoded tickets, were not captured by the auto-barriers so there were a great many expired encoded tickets in existence. These could be used easily by fare-evaders through manned barriers.
    - The incursion of non-encoded tickets prohibited a satisfactory audit of ticket sales.
    - There was a serious problem of customer acceptance because insufficient time and resources had been given to customer education.
    - Booking office ticket issuing machines duplicated the function of machines on the platform, and it was in the interest of job preservation for station staff to maintain customers at the ticket windows.

- The essential problem was that a closed system, using auto-barriers and other high-productivity equipment, was grafted onto an overall ticketing and inspection systems which was labour intensive, with a high content of hand labour.

From 1980 onwards a technical failure management strategy was developed to cope with the technical situation. Eventually, many of the machines failed completely and parts were unavailable to fix them. The ESR ticketing system could always be pointed to as a failed experiment. It was not until 1994 that a new automatic ticketing system came into use.

5.6.5 The XPT

It was noted above that the dieselisation of country services did have a significant impact on train running sub-system productivity but nothing else. At the time the XPT was under consideration, the key problems were:

1. A need to replace an ageing fleet of carriages (some not air-conditioned) providing a poor service to NSW country passengers.
2. A perceived need to meet a latent unsatisfied demand for country train services. Subsequent patronage proved this to be an enormous misjudgment by management. But, the argument went, if NSW country people were offered a state-of-the-art train offering a service which was well seated, fast, clean, with air-conditioning, at subsidised prices, they would flock back to railway travel. It did not happen.
3. A perceived need to replace old branch line rail locomotives with suitable self-propelled vehicles.

The central issue of the secular long term decline in NSW Country train travel was not addressed in the planning of the XPT even though, by 1991/92, it was well established in the best available configuration, namely a fast, comfortable mainline train, being supported by privately contracted road coaches to destinations previously on branch railway lines. Instead, in the planning of the XPT, only technical matters received consideration. Like the Tangara, it was very close to world's best practice, technically speaking. But it was like a new Rolls Royce destined to spend its life driving on country laneways, its traffic task becoming less and less relevant by the year.

Tables 5.7 and 5.8 provide the raw data on intermediate outputs and inputs between 1982/83 and 1991/92, and then as partial productivity indicators (PPIs). Again, intermediate output indicators of train kilometres and seat kilometres are used.

Table 5.7 **Country train services: intermediate output and input measures, 1982/83 and 1991/92**

Measures	Country	
	1982/83	1991/92
1. Output		
Train kilometres ('000)	9,637	2,439
Seat kilometres ('000)	2,399,420	480,480
2. Input (train running)		
2.1 Labour		
Train crew (no.)	219	67
On-train crew (no.)	215	9
Locomotive maintenance (no.)	715	150
Carriage maintenance (no.)	583	
2.2 Liquid fuel ('000 GJ)	1,151	600
2.3 Capital		
Diesel locomotives (no.)	26	0
Diesel power units (not XPT) (no.)	3	0
Rail motors (no.)	33	0
XPT power units (no.)	10	15
Loco hauled carriages (no.)	467	60
XPT carriages (no.)	20	100
Other power units	inc. above	10

Source: Thesis Appendix 2, RAILDATA.

Table 5.8 **Country train services: partial productivity indicators of intermediate output and input measures, 1982/83 and 1991/92**

Partial Productivity Indicators (PPIs)	Country		
	1982/83	1991/92	% change
1. Train kilometres ('000)			
per train crew	44.0	36.4	-17.5%
per on-train crew	44.8	271.0	504.9%
per loco maint. labour	13.5	16.3	20.7%
per carriage maint. labour	16.5	20.2	22.4%
per '000 GJ	8.4	4.1	-51.2%
per power unit	247.1	97.6	-60.5%
per carriage	18.5	15.2	-17.8%
2. Seat kilometres ('000)			
per train crew	10,956.3	7,171.3	-34.5%
per on-train crew	11,160.1	53,386.7	378.4%
per loco maint. labour	3,355.8	3,203.2	-0.5%
per carriage maint. labour	4,115.6	3,970.9	-0.4%
per '000 GJ	2,084.6	800.8	-61.6%
per power unit	61,523.6	4,614.3	-92.5%
per carriage	19,219.2	3,003.0	-84.4%

Source: Thesis Appendix 2, RAILDATA.

Table 5.7 shows that in the nine years between 1982/83 and 1991/92 Country services decreased by 74.7% (in train kilometres) and 80.0% (in seat kilometres). In a situation of such shrinkage in markets, the productivity improvement potential of the XPT was very limited. Only on-train crew productivity showed the sort of gains achieved in

Suburban and Interurban train running. This was so, because non-driving crews were drastically cut reducing service quality to bare bones.

In conclusion, again a technologically brilliant product was introduced into a market which was badly misread. Indeed, so badly misread that it would be reasonable to ask whether market strategy was buried completely by political considerations. But even this does not make sense since no marginal seats were won or lost by the Labor Government then in power. The only answer that makes any sort of sense is a euphoria that gripped decision makers dazzled by the new technology. This euphoria is well chronicled in management literature (e.g. the Ford Edsel).

5.7 THE LESSONS FOR INNOVATION IN THE RECORD OF NSW RAIL PASSENGER SERVICES

How could an organisation which had shaped the economy of the State from 1855 to 1939, get it so wrong with such technologically brilliant ideas as the XPT and Tangara? Some thoughts are offered below:

5.7.1 Institutional, Organisational and Management Factors

By 1951/52, the NSW Railways had been in existence for nearly 100 years, operating as a government-owned monopoly and with an organisation structure and management culture which had changed only marginally in that time. As discussed elsewhere, the Railways were organised around individual Branches, run as individual fiefdoms, often in conflict with each other. The "generic" organisation of NSW Railways, despite restructuring over the years, was explained in Chpater 4.

The three Senior Branches were Traffic (train running), Way and Works (track and infrastructure), and Mechanical (rollingstock). To a significant extent, two of the Branches were prisoners of the past. The Traffic Branch was locked into safeworking and train operating procedures developed many years previously but with a demonstrably high record of success most of the time. The Way and Works Branch's efforts went mainly towards network maintenance and network upgrading such as track duplication, track re-laying etc. However, significant resources were also expended on the Eastern Suburbs Railway. This project required civil engineering skills of a high order. Many engineers obtained their skills and experience on this project. The Mechanical Branch were stewards of the railway rollingstock. It remained for this

Branch to conceive and develop the principal rail passenger technological improvements from 1951/52 often with considerable help from rollingstock suppliers.

The technical concept of the XPT was based upon British Rail's Inter-City 125, high speed train. The Mechanical Branch of State Rail, together with Commonwealth Engineering (NSW) Pty. Ltd., developed the concept to suit Australian operating conditions. It had state of the art lines, bogies and suspensions, wide view tinted windows, aircraft seats and refreshment facilities. Each train was powered by nearly 3000 horsepower power cars. It was a world class train.

Of the five technological changes studies above, four were rollingstock. All had some impact on factor productivity improvement but in the train running sub-system only. The histories of these technological changes also help us to make some generalisations to enable an understanding of the innovation process in the public sector.

Organisation and management

The Mechanical Branch's responsibility was for the technological development of rollingstock. Its responsibility began and ended once the rollingstock was in service, and facilities for the maintenance of this rollingstock were functioning.

By nature, the management of the Branch was averse to risk taking, in case some of the new developments turned out to be "lemons", which they sometimes did. But in later years there is evidence to suggest that the Branch was becoming more confident in its abilities to manage state of the art technology. This is most clearly demonstrated by the Tangara, which started life as an artist's drawing on a poster in an election campaign conference presided over by NSW Premier Wran and emerged a few years later as one of the world's most advanced urban passenger carriages.

This general risk aversion was a factor in slowing down the implementation of innovation—15 years in the case of dieselisation, 28 years in the case of suburban double decked carriages and probably 28 years for inter-urban double-decked carriages.

Other institutional factors

There are essentially two groupings of institutional factors here. First, there are industrial factors. All rollingstock innovations presented major opportunities for reduction in labour costs of train running and maintenance. It was, therefore, in the interests of the unions and their membership, to slow down the process of change, to

introduce a sense of gradualism, to allow adequate time for the retirement, re-deployment and re-training of its members.

Second, there are political factors. Under the Westminster system, Governments very quickly carry the blame for technological changes which are perceived to fail in State-owned service enterprises. Governments need to be constantly reassured about new technology and tend to be very cautious about its introduction. It is therefore in the Government's interest to slow down and "politically manage" the introduction of new technology. There was a notable exception to this in both terms of the Wran Government in NSW. At the Premier's instigation the Governments pushed the NSW Railways into the Tangara, double-decked interurban cars, the ESR and the XPT, sometimes over-riding the objections or words of caution from engineering experts.

5.7.2 Capital Supply Factors

The NSW Railways, as with other State Government instrumentalities, must obtain its capital funds from Treasury. Even where it by-passes the normal processes (such as in the leasing of rollingstock), there is a strong Treasury input to the transaction. In doing so, the NSW Railways enters a complex arena of political lobbying and economic policymaking, with influences extending from Commonwealth Treasury and other States' Treasuries. In the final analysis, and even in the most favourable political circumstances (as applied in the Hill–Wran era, in the 1980s), capital is provided sporadically. This sporadic provisioning of capital has had the effect of extending the implementation of a new investment programs over very long periods. The extreme case was the Eastern Suburbs Railways.

5.7.3 Rollingstock Supply Factors

Traditionally, rollingstock manufacturers have operated in a "feast or famine" situation, geared to Australian railways' needs only, which tend to fluctuate wildly from year to year. When orders were completed, there was a "famine" period when skills were lost, plant and machinery fell into disuse and severe cash flow problems beset the firm. It was, therefore, in the interests of the manufacturers to have smaller production runs with longer delivery times.

All of the factors mentioned slowed down the rate of implementation of dieselisation, the double-decked suburban carriage and the double-decked interurban carriage contributing to the dissipation of the impact of these innovations. For example, had dieselisation been completed in 5 years instead of 15 years, accompanied by strong

political and industrial management, a strong and efficient Country and Interstate train service based on modern diesel trains could have been in place by the end of the 1950s. This would have readied the service to meet the onslaught of competition from road and air, in the 1960s. This, of course, assumes that the NSW Railways also had the other skills needed by successful innovators, such as the ability to make correct strategic business decisions and the capacity to market the new services. Neither of these was apparent in the NSW Railways of the 1950s. Reginald Winsor (Commissioner of Railways 1952–1956) certainly had the right ideas and a flair for marketing. But he would have needed the considerable skills of a Victor Richardson (of lawn-mower fame) to effectively market diesel train services.

5.7.4 Marketing Factors

Two important considerations need to be kept in mind when looking at the lessons of NSW passenger services for the innovation process. First, in NSW all rail passenger services have operated for most of the time in monopoly markets. Second, as will be demonstrated in the succeeding empirical analysis, pricing of NSW rail passenger services has been essentially a function of the political process rather than the market process. By definition, both of these conditions imply a failure of the market, i.e. where the market fails to achieve an optimum allocation of resources.

The creation of the double-decked suburban and interurban carriages solved the problem of peak period crowding of trains to a significant extent. However, the failure of the market has so far prevented any signals being given to management which would help them resolve the question of the enormous increase in non-paying, empty seat kilometres. The problem is exacerbated by a management reluctance to find out what these market signals might have been, by undertaking suitable market research. Indeed, there has been a marked reluctance to fill the major and chronic information gaps about markets and the needs of customers and potential customers. Thus, mental models are created in the minds of managements, unions and governments based on poor and incomplete information invariably leading to wrong decisions.

Nowhere were these consequences felt as strongly as in the introduction of the XPT and in the opening of the ESR. In both cases, the products were allowed to sell themselves with no real understanding of the needs of customers and potential customers. In addition, in the ESR, there was the technical failure of the fares and ticketing systems which has been discussed above. It may be contrasted and compared with the success of a related technology, Automatic Teller Machines (ATMs), introduced by the banking industry (Diebold 1991). The key success factors with ATMs seemed to be the

recruitment of the right people to manage the project, a new approach to consumer banking based on solid market research, a comprehensive marketing plan and a competitive market.

The XPT was another case of lost opportunities, created by market failure. The XPT was a "state of the art" technical and customer friendly innovation, which, in other rail systems, would have become a "flagship" service. Instead, it was introduced to a market which was dying on its feet and where the size of the operating deficit was causing alarm in both NSW and Commonwealth Treasuries. Technically, its capacity to run at high speeds over long distances was crippled by track curves and gradients built for steam engines. Since 1982/83, the trains have lived out their lives as graceful, high-performance vehicles operating essentially to steam engine timetables serving a market which continues to die. This is akin to using a thoroughbred racehorse to pull a country dray.

In Chapter 6, we demonstrate that there is a strong institutional nexus between the NSW Government and the NSW Railways. If the Government allows market failure to persist then railway management has very little option other than to acquiesce. Thus, a mutually supportive paradigm of failure can persist for many years, regardless of which Government remains in power. This does not necessarily mean that, in every case, a necessary pre-condition for successful innovation has to be competitiveness in the market. Nevertheless, it is probably too much to expect that Governments have the skills and information needed to establish the levels of Community Service Obligations (CSOs) at Pareto-optimal efficiency. In the case of Country and Interstate train services, the point is being reached where railways have a choice of getting out of the business altogether or initiating a radical shift in production functions and the creation of a whole new industry: akin to the introduction of railways in the 19th Century. Such a radical shift would be based upon fast train technology using new track and infrastructure. Such an innovation has the potential to again re-shape NSW and the eastern seaboard of Australia, as the first railways did. An additional land-use impact of the fast train would be to stretch the commuting distances to the coastal cities well beyond their present limits, giving the old Tablelands cities a new lease of life as regional cities within commuting distance of Sydney. In these cases, overseas experience has shown that a relatively high fare structure can be tolerated if the commuters can make their homes on relatively cheap rural land where relatively good quality community services are already available.

5.7.5 Some General Conclusions for Public Sector Innovations

If NSW rail passenger services are to be taken as a paradigm for the fate of innovation in the public sector, then the prognoses are not good for even the most technologically brilliant of innovations by public sector firms. If public sector firms are to be successful innovators, then the following pre-conditions need to be present:

1. The innovation needs to be supervised by a "New Person", in the Schumpeterian sense, i.e. a person able to appreciate the strategic, technological and marketing significance of the innovation and extract the maximum benefits from its implementation. This includes, in the Australian context, an extraordinary ability to overcome political obstacles and generate goodwill for the project at all levels of the community. The "New Person" also needs to be a risk taker and willing to accept the consequences of failure. The person's political mentor (of the rank of Premier or Prime Minister, if the innovation is significant enough) also needs to be adept at risk taking. Premier Wran of NSW is a good role model in this regard.
2. The organisational structure within which the innovation is to be carried out must be totally malleable by its managers to suit the changing circumstances created by the innovation as it develops. It is probably best to throw aside all previous organisational paradigms before the project is started.
3. All employees in whatever organisation is created must have total commitment to the innovation's success and have the blessing of their unions.
4. The organisation needs to be able to raise its capital outside Treasury constraints and in competition with private investment projects. The private capital market is the only one fully equipped to assess project risk.

5.8 THE CONSTRAINTS ON INNOVATION IN THE PUBLIC SECTOR

The NSW rail passenger services' experience between 1951/52 and 1991/92 is a paradigm for failure of the innovation process in a public sector organisation. It raises some generalisations about constraints to innovation in Australian public sector organisations.

1. Failed markets

The public sector in Australia has mostly operated in failed markets, whether these were monopolies, monopsonies or subject to gross government intervention in one form or another. Telstra is one exception, perhaps.

2. Built in process distorting innovation

The organisation of Australian public enterprises in the past, and the governments which have controlled them, have had built-in processes which have prevented, inhibited or distorted the innovation process. Thus, even when a public sector firm has

been able to implement a state-of-the-art technology (and, has often done so) the built-in "failure" processes have either:

- prevented that technology change being further developed into a full-scale innovation, or
- inhibited that technology change, from progressing, in optimal time, to a full-scale innovation, or
- even if a full-scale innovation is achieved the systemic failure mechanism (e.g. market failure) will distort the impact of the innovation.

3. Risk averse management

Managements of public enterprise are averse to risk when it comes to innovation because of the political consequences of failure. Thus managements are the very antithesis of Schumpeter's New Person. They may be good at bringing about "financial turnarounds"; at elegant re-organisations; or, spectacular "reforms", "downsizings" and "rightsizings" etc. But all of these are manifestations of the psychology of the executioner rather than the builder. This is because the systemic failures remain in place until everything is destroyed. It is ironic to note that the only two New Persons produced in the long history of the NSW Railways were treated harshly by the political process after the job was done, namely John Whitton and JJC Bradfield.

We now link this notion to an even more fundamental issue regarding public sector management of business of any kind, that is whether public sector management is inherently inefficient. The notion was seriously considered by North American economists in the 1970s (Moss 1973):

> It might seem at first glance that the explanation of the alleged government inefficiency is obvious: governments are inefficient because they do not or cannot in general use perfectly competitive markets. This is, on reflection, not an explanation at all. To be sure, if a perfectly competitive equilibrium exists, it will be efficient, in the sense that any rational objection to its performance must devolve into a preference for a different distribution of welfare. But it does not follow from this that governments can't also operate with Pareto-optimal efficiency. Moreover, markets in which no entity can effect the price of what it sells or buys are very much the exception, so that observations that governments are supposed to be even less efficient than firms or markets with monopoly or monopsony power. What is needed is an explanation (or a refutation) of the contention that governments are even less efficient than the imperfect markets that are typical.

The BCA argues that there is no reason why government agencies cannot be innovating enterprises in the same way as privately owned firms (Carnegie and Butlin 1993). It quotes the experience of the NSW Roads and Traffic Authority (RTA) which acts as both a "leading edge" customer and an innovator. In conjunction with two private firms, the RTA developed the SCATS system of traffic flow management. This system was developed to manage traffic under limited road building constraints. With the private firms taking up the commercial risk, SCATS has been exported world wide.

Nevertheless, the BCA (Carnegie and Butlin 1993) has some qualifications to public enterprise innovation:

> It is difficult to say whether the publicly owned organisations would become more or less innovative should their ownership change...the RTA might be unable to fund the technical superstructure and the time required to develop systems such as SCATS if it were forced towards a shorter time horizon.

Some analysts have sought an explanation for successful and unsuccessful innovation in the management theory of organisation, and in the theories of the economics of organisation (Goodman, Sproull and Associates 1990). Since public sector corporations tend to have a substantively different organisation structure to privately owned firms, this seemed to be an avenue worth exploring.

The evidence is at best inconclusive, but does suggest some useful areas for further research. The analysts argue that, whilst Schumpeter's is the seminal analysis of the role of innovation in economic growth, it is difficult to carry it further into theoretical or empirical analysis because of the lack of data (Goodman, Sproull and Assoc. 1990). The works of Chandler, Williamson and Teece are quoted with the observation that whilst they attempted to show that technology (in its limited sense, of merely one ingredient in the innovation process) does determine organisation structure it does so in a limited sense only (Goodman, Sproull and Associate 1990):

> Technology is fully determinative of economic organisation only if: (1) there is a single technology that is decisively superior to all others and (2) that technology implies a unique organisation form. Rarely, I submit, is there only a single feasible technology, and even more rarely is the choice among alternative organisation forms determined by technology.

In the final section, the analysts seem to conclude that the poor performance of US firms in the 1980s, as innovators, had more to do with "...better education of managers in the development and adoption of new technologies". This brings us full circle to the concepts like KAIZEN, and the need for a major cultural change in the management of public and private firms in Western industrial economics.

The BCA, on the other hand, sees the various organisations of Government uniquely placed to provide a special and significant contribution to the innovative process in Australia. First, public sector enterprises should emulate the successes of private sector innovation by becoming more competitive, "leading edge customers" (in terms of adoption of new technology) and providing the infrastructure in the Asia-Pacific region, for other Australian innovating firms. Second, government departments should eliminate regulations that inhibit competition in the labour market, and accelerate the process of micro-economic reform. Third, industry policy should be reformed so that it is focussed upon "picking winners", i.e. providing overt support to firms which give a

perception that they are innovators and acting as "handmaidens" to innovators in the private sector by education, and the provision of other infrastructure that will promote innovation. Fourth, directing government-sponsored research and development spending into areas which are perceived to offer the best return on research and development in the form of innovation.

In the light of our opening paragraphs in this Section, the BCA's assessment of the capacity of the public sector organisations to innovate seems simplistic. There are mechanisms within the public sector which prevent, inhibit or distort the innovation process. They need to be identified and neutralised before that organisation can truly operate as an innovator. NSW rail passenger services may be regarded as a useful paradigm for an understanding of the innovation process in the public sector.

5.9 CONCLUSIONS ON THE INNOVATION PROCESS, SUGGESTED BY NSW RAILWAYS HISTORY

The NSW Railways represent a remarkable dichotomy, with the period from 1855 to 1939 representing the innovation process in full flight, in shaping the economy of NSW and the period 1951/52 to 1991/92 representing failure in the form of market failure, institutional failure, technical failure and ultimately management failure. This latter concept is explored in some depth in the following Chapter.

This Chapter suggests that innovation is a resource which can be called upon, like any of the firm's resources, to increase, enhance or change output. But, it is different from other resources in that it is a dynamic process, rather than a physical entity, which enables successful management to marshal the firm's resources in order to create, in the first instance, a net improvement in the TFP of that firm.

The starting point of innovation is a body of knowledge within the firm. This knowledge is often technical but does not have to be. In the case of the NSW Railways, it was totally technical knowledge. Dieselisation started with a handful of diesel engineers in the Mechanical Branch. The skills of the steam engineers progressively became obsolete. Double-decked electric car technology, learned in the 1960s, became the basis for the Tangara design achievements in the 1980s.

But technological achievement, though necessary for innovation, is not sufficient by itself. This is adequately manifested in the case of the NSW Railways. Other conditions for innovation must be pricing efficiency and an increase in the cost effectiveness of

firms. A consideration of these latter two conditions must await the full development of the Quadrae Model.

There is, however, a fundamental problem to be overcome first. Empirical economics attempts to measure only technological change as if it were a surrogate or proxy variable for the innovation process. This creates conceptual problems:

- Innovation takes a long time to work itself through an industry or market.
- Markets need to be segmented to a sufficient level of detail to enable the tracking of the innovation.
- Innovation is non-linear in its rate of absorption through industry or market.

All of these problems require the development of extensive data bases as a pre-condition to their resolution.

Other pre-conditions for the innovation process to be successful, seem to be:

1. The innovation needs to be supervised by a "New Person", in the Schumpeterian sense—a person able to appreciate the strategic, technological and marketing significance of the innovation, and extract the maximum benefits from its implementation. This includes, in the Australian context, an extraordinary ability to overcome political obstacles, and generate goodwill for the project at all levels of the community. The "New Person" also needs to be a risk taker and be willing to accept the consequences of failure. The person's political mentor (of the rank of State Premier or Prime Minister, if the innovation is significant enough) also needs to be adept at risk taking. Premier Wran of NSW is a good example of this scenario.
2. The organisational structure within which the innovation is to be carried out must be totally malleable by its managers, to suit the changing circumstances created by the innovation as it develops. It is probably best to throw aside all previous organisational paradigms before the project is started.
3. All employees in the organisation must have total commitment to the innovation's success and the blessing of their trades unions.
4. If a public enterprise, then the organisation needs to be able to raise capital, quickly, outside Treasury constraints and in competition with private investment projects.

The consideration of innovation in the broad sense, and technology change in NSW rail passenger services, helps us now to introduce a concept which is examined in depth in the next Chapter, that is the technological changes made which failed to materialise as significant changes to TFP were "failure management" strategies.

The term "failure management" is borrowed and extended from its original use in organisation management theory (Goodman, Sproull and Associates 1990):

> For example, people now face the novel problem of how to recover from incomprehensible failures in production systems and computer systems. To solve this problem, people must assume the role of failure managers who are heavily dependent on their mental models of what might have happened, although they can never be sure because so much is concealed. Not only does failure take on new forms, but there is also continuous intervention, improvement, and redesign, which mean that the implementation never stops.

This refers to technological failure. But there are many other forms of failure that can face the firm, as follows:

1. Market failure

Markets are said to have failed when they prevent the optimum allocation of economic resources. Most usually, market failures occur because of the monopoly position of the suppliers in the market. In the Australian context, the grossest instances of market failure are to be found in public sector monopolies, which sometimes run large deficits paid for by taxpayers.

2. Management failure

In its broadest sense this refers to the consistency of "accident-proneness" of a firm's management over the medium to long term. In normal market conditions, where market failure does not exist, the market corrects the situation by causing the firm to fail or causing a new management to take corrective action. In market failure conditions, management failure might persist for a long time. Indeed, a management paradigm or culture might be constructed around market failure assumptions. Whilst they would not be termed as such, they may be dressed up in the terminology of invalid social welfare considerations.

3. Government failure

This occurs where, by omission or commission, Governments allow market failure to persist. Again, as with management failure, if it persists for a long time, it becomes the paradigm, and may be dressed up in political and other terminology in order to make it palatable for the Government's electors.

Failure management can be re-defined, for the purposes of this thesis, as strategic decisions and actions by decision makers in government, industry or the firm to ameliorate the adverse consequences (be they technological, economic, political, or social) of a long term technological or market failure. And, as pressures mount for the failure to be corrected by government reforms, industry and firm reconstruction, etc., failure management is characterised by continuous intervention by managements,

unions, and governments, each of which have their own mental model of what might be happening, based on poor and incomplete data. Whilst these well-meant interventions are usually aimed at improvement, they may not be successful. In this situation, a successful technological change can occur but often it is not sufficient to make a significant change to reverse market failure, technological failure etc.

An hypothesis may now be set up formally:

Where failure management exists in a firm (whether privately or publicly owned), innovation will not proceed even if significant technological changes are made to existing processes, existing services or existing products.

CHAPTER SIX

Management of NSW Rail Passenger Services

6.1 INTRODUCTION

This Chapter examines the effectiveness of management of NSW rail passenger services from 1951/52 to 1991/92. An earlier study of productivity of Australian railways (Hensher et al. 1995) indicates that managerial variables have a statistically significant impact on variations in the total factor productivity of railways.

This Chapter takes up the theme of failure management, introduced in the previous Chapter, to demonstrate that the potential impact of good technological innovation can be nullified or reduced because of the practice of failure management. This Chapter expands upon the theme to show how failure has operated in NSW since 1951/52. Some theoretical issues are also raised to expand the basic ideas of failure management raised in the previous Chapter.

The period 1951/52 to 1991/92 is organised into "eras" to explain the influence of the Chief Executive Officer of the railways upon the organisation which he ruled. Also, every Chief Executive Officer ruled in the name of the Premier of NSW. So pervasive was the influence of the railways on the political, social and economic life of the State for most of the period that it was a foolish Premier who did not establish a strong nexus between himself and the head of the railways. This had its advantages and disadvantages. The principal disadvantage was that strategic decisions were based upon assumptions made within a political context rather than an economic and business management context. Thus, the essential point was missed for the whole of the period under review. NSW rail passenger services were planned, co-ordinated and controlled within a failure management paradigm as defined in the previous Chapter, that is strategic decisions and actions by decision makers in government, industry or the firm aim to ameliorate the adverse consequences (be they technological, economic, political or social) of a long term technological, market or institutional failure. And, as pressures mount for the failure to be converted by government reforms, industry and firm reconstruction, etc., failure management is characterised by continuous intervention by managements, unions and governments. Whilst these well-meant interventions are

usually aimed at improvement, they are successful only at the margin, at best. At worst, they exacerbate the problem. The only proper solution is to eliminate the originating failure.

If some of this sounds familiar, it ought to be. Nearly every mature industry in Australia has dealt in, or is dealing in, failure management. Those industries which have survived have done so by eliminating the originating failure. The most spectacular example of failure management on a nation-wide scale is the institutional and economic remnant of what was once the USSR. The discourse which follows in this Chapter owes a great debt to Gunn's definitive socio-political chronicle of the NSW Railways, from 1850 to 1986 (Gunn 1989). It captures the essence of the personalities involved in running a large and complex business undertaking their triumphs, their strengths, their failures and their weaknesses.

6.2 1951/52 TO 1958/59: THE WINSOR ERA

Gunn (1989) has entitled this era as "A State Transport System in Crisis". The railway system entered the 1952 financial year still reeling from the impact of the coal strikes. During World War II and the immediate post-war years, the system had carried well over 2000 million passengers (when military tasks are included) and 150 million tonnes of freight (including military). No significant section of railway line had been built since the Sutherland/Cronulla section was finished in December 1939. Maintenance during World War II was geared to keeping the existing system in operation subject to higher priorities for materials and manpower. In 1951/52, there were still severe shortages of rails, timber, sleepers and cement. Also, a Joint Coal Board Order, in operation since 10 February 1951, provided for the reduction of 25 per cent in coal used for railway purposes. This necessitated a similar reduction in electric train services in the off-peak periods. Staff shortages were put at 7 000, caused by early retirements of employees seeking higher salaries and wages in booming post-war industries. Industrial unrest was considerable. Whilst all sectors of Australia's transport industry were in crisis, nowhere was this crisis more apparent than in the rail industry, which had to turn away 3.5 million tonnes of freight for lack of locomotive and engine drivers. The ultimate symbol of crisis was a major disaster which occurred on 7 May 1952, when two electric trains collided at Berala, killing 10 passengers and injuring 81.

A new Commissioner for Railways, K A Fraser, had been in office since February 1952. He died in August 1952 and was succeeded by Reg Winsor. The latter emphasised an optimistic outlook and invested heavily in advertising, improved

passenger services, day tours etc. The market responded with a 4 million increase in patronage. 1,200 new passenger train services were also supplied during the year. On the downside, a shortage of capital funds led to the closing down of several major capital works. Also, this was the first of four years of severe flooding, which was again to demonstrate the vulnerability of the rail system to climates in NSW and its capacity to scramble out of such crises, when necessary.

Winsor regarded himself as a commercially oriented general manager of a large industrial organisation (Gunn 1989). With the backing of the Cahill Government, he cut staff numbers, transferred the Railways' four steam power stations to the Electricity Commission of NSW, increased the locomotive fleet and ended his first year with a modest deficit of $2.8 million (despite reductions in revenue and increased costs beyond management's control). Winsor held the office until his resignation on 25 June 1956, in response to a government ultimatum of resignation or dismissal (Gunn 1989). In many ways, the period 1951/52 to 1955/56 represented momentous years for the railways with some peaks but also some deep troughs.

Nature played capricious tricks from 1952 until 1956, dumping large quantities of rain on the State and causing extensive flooding for prolonged periods. Each flood added its toll of serious damage to the already debilitated network. The depth of this particular trough was reached on 23 February 1955 when a cyclone caused damage on all major North Western and Western river systems and in particular the Goulburn and Hunter Rivers. The most severe damage was caused by the collapse of the Cummins Dam on the Hunter River, and the resulting wall of water which carried away embankments and other railway structures (NSW Department of Railways 1954/55).

The Eveleigh Workshops became the focus for media criticism of railway workshop inefficiency in December 1955, along with rail deficits. The Government responded to these losses in July 1956 by increasing metropolitan fares by 30 per cent and country fares by 15 per cent. Also, in April of that year, it had made public a capital expenditure program put to Government by Winsor, one year previously. It involved the spending of £200 million over 10 years on works, motive power and rollingstock. Winsor's promotion of rail patronage (by increasing the number of services) had added some 13 million passenger journeys between 1952/53 and 1954/55 (NSW Department of Railways 1954/55).

But, the transport portfolio had been a very difficult and unstable one for the Government. Since 1949, there had been five Labor Transport Ministers and one Acting Minister (Gunn 1989). Inevitably, in an atmosphere of mounting political crises with the portfolio, the Commissioner was the person sacrificed. In the context of a controlled

war-time economy, the NSW railways were a significant success. From thence onwards it was a failed industry. The year 1951/52 starkly revealed the post-war failures as follows:

1. There was a serious institutional failure as Federal and State Governments grappled with a restructuring of the Australian economy to a post-war mixed capitalist community. Industrial problems were exacerbated by Communist ideologues who perceived Australia to be on the brink of revolution while severe shortages of labour characterised many key areas of the economy.
2. In the NSW Railways, there was serious technological failure where the materials needed to rehabilitate worn out infrastructure and rollingstock were not available and coal supplies for steam locomotives and electric power stations were unavailable in the needed quantities.
3. In the NSW Railways, the market had been "suspended" during the command economy of World War II. So by definition, market failure did not exist. The pre-war monopoly powers of the railways were simply handed back after 1945, setting the context for market failure for the next 50 years. The ultimate failure of the monopoly firm occurred when its services could not cope with demand and business was turned away.
4. The stresses on management at this time were unbearable. That the office of Chief Commissioner killed another incumbent in 1952 simply underlines the point that the office has always needed very strong individuals to cope with its imperatives.

The regime of Winsor can be viewed as a turnaround from deep crisis but still within the context of failure management. The severe floodings of the network did not cripple it. Despite very substantial fare increases, patronage also increased as a result of a substantial increase in the number of services provided. Institutional failure was evidenced by the fact that between 1949 and 1955, there had been five Transport Ministers and one Acting Minister. The railways portfolio began to demonstrate its post-war capacity to devour political reputations.

Neal McCusker was appointed for one year as Commissioner, on 31 July 1956. By this time, the deficit had reached £7.6 million on a revenue of £75 million. McCusker implemented cuts in country and suburban passenger services from 1 September, drawing immediate media criticism. A new railway tradition was established in February 1957 when the US management consultant, Ebasco, presented its findings and recommendations on NSW Railways including elimination of uneconomic country lines, more diesel locomotives, some changes in the capital works program and a departmental reorganisation.

In the three years to 1958/59, patronage declined by some 11 million journeys wiping out most of the gains made in the Winsor era. But the biggest revenue losses were occurring in freight as competition from road freight was intensified. At their annual

conference in February 1959, Australian and New Zealand Commissioners urged that the accelerating roads building program be directed towards integration with rail rather than segregation and duplication (Gunn 1989). This was the precursor of a long and futile campaign by the railways, and others, to establish an integrated, national land transport plan.

The 1957/58 NSW Auditor General's Report noted that since 1948/49, the Railways had accumulated a deficit of £39 million. McCusker, in 1958, noted that the Railway's capitalisation was now £260 million, on which the annual capital charge was £12.9 million. Unless future capital spending was specifically directed at reducing working expenses or increasing revenue (Gunn 1989):

> ... it will not be very long before the whole financial structure of the railways and perhaps the State as a whole will be in a very serious plight.

30 years later these chickens were to come home to roost.

6.3 1959/60 TO 1971/72: THE MCCUSKER ERA

This era is best described as "The Commissioner's Three Constituencies" (Gunn 1989). This was the era of Neal McCusker as Commissioner for Railways. His rule was one of the most stable in the history of the Railways and the last period of top management stability which the Railways were to experience. As Gunn records, he had three constituencies, each exerting their own inexorable pressures. The first constituency, the public, comprising a mixture of lobbies and interest groups, had expectations of improved services at low cost. The second constituency, the employees and their unions, were fixed to certain industrial positions and loyalties, and needed to be cajoled and sometimes confronted on issues. The Labor Government, with its strong and historic ties to the railway unions, had its own political agenda which did not always conform with Neal McCusker's objectives.

Within the failure management paradigm, McCusker's era demonstrates that failure management can be both "effective" and "efficient". It can be effective in the sense that the negative consequences of the underlying market, institutional and other failures can be neutralised: even for long periods of time. Hence, McCusker's ability to satisfy his three constituencies for so long. Failure management can also be efficient in the sense that efficiency improvements at the margins can yield discernible (though minimal) positive results. Thus, McCusker is remembered in the history as the last chief executive of the NSW railways who made serious attempts to balance the books.

In the period 1959/60 to 1965/66, McCusker worked assiduously within capital constraints to improve passenger services and especially passenger comfort. A number of extensions to suburban and interurban electric train services were completed, including Hornsby to Gosford, and Clyde to Carlingford. The "Heron" was introduced to Blue Mountains commuters as a businessman's express train. A number of new diesel trains were introduced to country services. The Sydney to Melbourne overnight service (Southern Aurora and Spirit of Progress) was inaugurated on 16 April 1962. The first double-decked suburban carriages were designed, ordered and commissioned. Timetable changes were frequent, in an attempt to better fit travel demand. Advertising and sales promotion was accelerated. However, patronage continued to decline partly due to the recession of 1961/62 and resulting unemployment, and partly due to rising motor car usage. A 4 million drop in patronage in 1965/66 was attributed to a 24 hour transport stoppage and a prolonged drought in NSW country areas. This reasoning may have overstated the case for "special causes" in the patronage decline.

McCusker's financial stewardship was demonstrated when he produced an operating profit of £28 000 in 1962/63 despite the recession and its aftermath. This was the first operating profit for nine years. In the following year, he produced an operating profit of £13 million. Gunn notes that the *Australian Financial Review* attributed the recovery of the Railway's financial fortunes to the determined, patient planning of Neal McCusker and good seasons, increased grain exports, economic recovery, three increases in fares and freight rates during the year and a writing down of capital debt.

In May 1965, the long period of Labor rule ended in NSW with the election of the Askin Government. McCusker had been Chief Commissioner for nine years and had brought the organisation from crisis to a condition of restored fortunes and optimism. Within days of the election, the new Minister for Transport was presented with a threatened strike if claims for wage increases were not met. Staff shortages began to recur as many railway employees left for better pay in the booming private sector. A significant railway capital works program was supported by the Government and in October 1965, significant wage increases were awarded by the Senior Arbitration Commissioner. From 1 January 1966 changes to the State Transport (Co-ordination) Act increased the competitiveness of road hauliers whilst still largely preserving the rail monopoly. Nevertheless, rail revenue was immediately affected, exacerbating the impact of a severe drought. The deficit for 1965/66 came in at $12.3 million. Staff turnover was very high due to better opportunities outside the Railways and a deteriorating industrial situation.

In March 1967, to general applause from the NSW Opposition, the Federal Government and the community, the NSW Government approved the re-starting of the Eastern Suburbs Railway at a cost of $95 million. In 1966/67, economic recovery saw another operating profit of $191,000. But, by August 1967, another 24 hour stoppage was called over a wage matter which had remained unresolved since 1965. Nevertheless, record haulages of freight were achieved in 1967/68 and great hope was invested in rail-hauled containers. But the passenger business was becoming a major commercial headache. Gunn (1989) records Minister Morris' comments supporting a fare increase in September 1968:

> Suburban metropolitan passenger services are losing about $8,000,000 a year and country passenger services are losing approximately $19,000,000 a year. A point of interest is that passenger trains require about 55 per cent of rail effort in train miles but produce only 21 per cent of the total revenue of the department.

Declining patronage appears to have stabilised, if we are to believe that the 2 per cent annual decline was attributable to industrial stoppages as indicated in that year's Annual Report. The first complete double-deck suburban train came into service, marginal changes were made to timetables and some extra services were introduced on the South Coast. More rollingstock was ordered for passenger services. 1968/69 was also a watershed year for industrial relations in the NSW Railways resulting in a deep schism between unions, management and the Government which lasted well into the 1970s. Industrial issues were allowed to fester until confronted head-on by the new Railway's Chief Executive, David Hill, after 1980.

Stringent fiscal controls under the McCusker era, whilst essentially maintaining the antiquated organisation and practices of the railways, had meant that railway pay and working conditions were in a relatively rapid decline by 1968/69. Vacancies could not be filled across a wide spectrum of jobs. Railway unions felt that strike action was the only alternative open to them and unleashed a campaign rarely experienced in the NSW Railways:

- An unannounced 24-hour stoppage on 23 October 1968, stranding metropolitan passengers.
- A nationwide 24-hour strike on 28 October 1968.
- A 3-day state-wide strike commencing 29 January 1969.
- Another strike in mid-February 1969.
- A 24-hour strike on 25 February 1969.
- On 21 May 1969, a 24-hour nationwide strike on all public transport in Australia, over the gaoling of the Victorian branch secretary of Tramways and Motor Omnibus Employers' Association.

Compared with the rest of the New South Wales, in these years, the disputes were minor:

	Industrial disputes in NSW (1968–1972)	
	No. of Disputes	Workers Involved
1968	965	356,000
1969	1133	522,000
1970	1484	741,000
1971	1236	644,000
1972	1174	516,000

Source: Australian Bureau of Census and Statistics (1972).

The Railway Unions were conservative, had lived in relative harmony with management for a long time, tended to look askance at the disputation around them and would have felt sorely provoked in 1968 and 1969.

On 18 June 1969 substantial wages increases were awarded to train drivers and ARU members and freight rates were increased from 1 July 1969. In 1968/69, the railways posted a deficit of $8 million. Patronage increased slightly in 1969/70, and investment in passenger rollingstock continued. Regular Indian-Pacific services were commenced on 1 March 1970. Substantial wage increases flowed on from a national wage case decision in December 1969. Despite a record revenue of $251 million, the railway finished the year with a deficit of $2.8 million.

1970/71 started badly with a national political campaign supporting a 35 hour week and the NSW Premier blaming public transport losses for the State's inability to give tax relief and increase spending on other government services. In January 1971, Dr Robert Nielsen, a USA transport consultant, convinced the Government to launch a three year review of Sydney's transport needs to the year 2000. At this time, long term, comprehensive city transport planning studies were fashionable around the world.

At this very time many commentators on transport perceived a fundamental defect in Australian transport, generally described as the fragmentation of ownership, direction and management of the various modes of transport in the nation. They considered that a common vision, policy and direction was needed. At this stage also, the rail monopoly was still relatively secure in NSW and road freight and road passenger services had not begun their exponential growth.

In 1970/71 the NSW Railway posted a deficit of $26.4 million caused by (NSW Department of Railways 1971/72):

> ... spiralling, uncontrollable expenditure emanating predominantly from industrial award decisions handed down by conciliation and arbitration authorities. The continuously

> increasing level of wage and salary costs, together with the consequent effect on payroll tax and long service leave payments have proved to be an insurmountable barrier to the achievement of satisfactory financial results on railway activities in recent years.

Between the lines of these comments, written by McCusker, is a strong sense of despair. The long boom years of the 1950s and 1960s had led all Australians into a false belief in exponential growth in prosperity. This manifested itself in Union militancy and an arbitration system that generally accommodated itself to this militancy. Some railway unions continued to be in the vanguard of militancy. McCusker had a proud record of achievement behind him where he was viewed as a standard bearer of the balanced profit and loss account in government business undertakings.

But, industrial unrest continued unabated in 1971/72:

- A 48-hour, four-state rail strike in August 1971.
- Wildcat, rolling strikes by guards on suburban and interurban services on 13, 21, 22 and 23 September 1971.
- On 11 April 1972, a strike by engine drivers and fireman on all trains in all States except Western Australia.
- On 6 June 1972, a repetition of the 11 April 1972 strike. It took the intervention of the ACTU President, RJL Hawke, to get the AFULE members back to work. As Leader of the Opposition in Canberra, Gough Whitlam promised that if he was returned to power, he would take over the NSW and Victoria Railways. The NSW Premier announced that mounting railway losses were causing difficulties in NSW finances.

Again, these disputes need to be kept within the perspective of the general industrial situation in NSW at the time, as illustrated in the statistics above.

In 1971/72 the Railway posted another deficit of $32.6 million on a record revenue of $266 million. On 19 October 1972, McCusker retired, and was replaced by Philip Shirley, already retired from Deputy Chairman, Cunard Steamship and the British Railway Board. NSW Railways had reached a new watershed.

In many ways, Neal McCusker's era represents the definitive study of effective failure management. A study of the industrial history of Australia's mature private and public sector firms in this period would undoubtedly reveal many cases of failure management. But no one would match McCusker for longevity or effectiveness in dealing with failures that were so deep and so pervasive and which, in the long run, brought him despair.

The essential failures were market and institutional ones. The long years of monopoly in both freight and passenger markets had made railway management totally incapable

of understanding its markets in any depth or subtlety. When the assaults on these markets came from the road freight industry and the private motor car, railway management was totally unprepared. Institutional failure in the form of country political pressure prevented any serious attempts being made to re-structure the market for country passenger travel, allow competition and investment in new road and rail rollingstock. It would take nearly 30 years for deregulation to occur. As noted in Chapter 5, also, the Eastern Suburbs Railway was allowed to swallow up a disproportionate share of the railway investment dollars for no clear benefits.

One of the few areas open to McCusker for rational action was to hold down labour costs. This was done very effectively. However, in this instance, the railways faced a normally operating market, which a booming economy had turned into a seller's market. Few would work in the skilled and semi-skilled areas for the wages, salaries and conditions being offered by the railways. And those in railway employment watched in dismay as their hard-won relativities evaporated. From 1968 onwards, a great schism was to open between management and labour. Whilst many firms were to experience this manifestation of organisational failure in the 1970s and 1980s, few would experience an impact as devastating as it was in the NSW Railways.

Finally, as subsequent years were to show, overseas rail technology had shot well ahead of NSW, which in many respects was now running a railway which largely belonged in a museum.

6.4 1972/73 TO 1979/80: THE SHIRLEY ERA

Philip Shirley was one of the architects of the Beeching era in British Railways in the 1960s where a significantly useless part of an extensive network of branch lines had been cut back. By now, impervious to opprobrium from small country communities, union organisers, and others, Shirley was expected to do the same thing in New South Wales in the name of service rationalisation. This era may also be characterised as one of constraints on government policy.

In the social turmoil of Australia of the time, when many aspects of Australian culture and ethos were being re-defined by the Whitlam Government, Shirley's appointment was counter-productive. It smacked of neo-colonialism where the "tough Governor" was sent out by the "Mother Country" to sort out an unruly, colonial outpost.

The belief he had was in direct conflict with the Whitlam Government, the Labor Movement, and many in the NSW Country Party. They wanted a railway system which

was reconstructed and rehabilitated. This view was also held by Dr Robert Nielsen, one of Shirley's Assistant Commissioners and supervisor of the seemingly endless Sydney Area Transportation Study. The outcome of this study was to establish him firmly in the "rehabilitators" camp. The other Assistant Commissioner was Jos Trimmer, President of the State Superannuation Board, and ex Treasury of NSW. On his shoulders fell the responsibility for bringing the deficit into check. These three, assisted by other part time and full time Commissioners, were to preside over a Public Transport Commission of NSW comprising railways, public buses and ferries.

In 1972, Shirley had correctly diagnosed the railway problem as follows:

- too much railway track,
- too many stations and freight points open for business but losing substantial sums of taxpayers' money,
- antiquated rollingstock and infrastructure,
- a Branch system of organisation with promotion by seniority where each Branch was a self-perpetuating and semi-independent identity,
- lack of modern management practices, and
- a highly centralised, unwieldy and time-consuming decision-making process which was supported by an administration system where paperwork had become an end in itself but where hard data for management (such as costs) was not available.

In the beginning, and on the surface, there seemed to be cohesion and goodwill between Shirley, the NSW Government, the transport Unions and the Whitlam Government. Shirley established a Planning Division within the Commission to do much of his analysis and original thinking. Through this Division, he intended to rule by Committee. This Division was to become the training ground for a future generation of public transport and public sector Chief Executives and senior management. It was a blend of imports from the private sector and up and coming engineers and a few other professionals already in the Commission. The Planning Division became the leading edge in the rationalisation exercise. However, it became very clear, in the earliest of rationalisation exercises, that very few persons were seriously interested.

A loose coalition of rail consumer groups, some Commission management, transport unions, Country Party members, and the State Opposition Labor Party prevented even the most insignificant attempts to cut stations or branch lines. Tragically, this intransigence was to culminate in the black banning in October 1976, of the pilot Regional Freight Centre at Tamworth, by the Transport Workers Union. The ban lasted two years and had two major destructive effects. It stopped dead the only useful strategic business initiative the Railways have ever come up with to meet road transport competition in the non-bulk freight markets. It sent a clear signal to all political parties

that the Transport Workers Union was now powerful enough to resist moves to reduce its members' rapidly climbing share of land transport markets for freight and passengers. From henceforth, its comrade unions in railways could only watch in dismay at the steady erosion of their business and bewail about poor management, inadequate marketing, political ineptitude or whatever happened to be the current bogey of the month. The Transport Workers Union was to demonstrate its power on many occasions years later, in the era of the Wran Government, with equal vigour.

The penetration of road hauliers into the non-bulk freight markets in NSW rapidly accelerated after the abolition of the State Transport (Co-ordination) Tax on 1 January 1975. This Act had preserved rail's monopoly on freight haulage in NSW country areas since 1931. It had been progressively relaxed since 1969 until its abolition. In the six months from January to June 1975, the railways lost 14 per cent of non-bulk traffic, steel, cement and bulk-loading. The losses continued in later years but at a slower rate. During this process, road hauliers picked up that rail business which was easily consolidable into truck load consignments. Rail, as a common carrier, was left with freight which was low density and high volume, geographically fragmented and often consigned to individuals. Rail was obliged to pick up this traffic at considerable loss under its common carrier obligation. Part of the reason for the swiftness and thoroughness of market penetration by road was the existence of excess road capacity in strategic NSW regional centres. The railways were unable to match the local knowledge, pricing and service flexibility of these small business entrepreneurs. In later years, some of these businesses grew into major enterprises while others were absorbed by the freight forwarders.

During the Shirley era, a Marketing Division was also established, with the objective of giving NSW public transport a market-led, business profile. In freight markets, it was singularly outwitted by the road freight industry in country NSW. It was also hampered by the existing Traffic Branch which was responsible for the operation of the trains and, therefore, the quality of the service delivered. It was severely limited by ageing rollingstock and infrastructure and a reluctance to attempt innovative operating methods. The Division also had a passenger marketing function. In its first year of operation, it established a Customer Service Bureau (which received 50,000 complaints and suggestions in 1973/74). Many small service improvements were able to be implemented from ideas communicated by the public to the Bureau. Railway hoardings were also used to sell a considerable volume of advertising space. In 1974/75, the passenger marketing section introduced a Travel and Tours Centre, a range of discounted fares and greater promotion of the Motor Rail service to Northern NSW and Melbourne.

Meanwhile urban rail patronage fell from 217 million journeys in 1971/72 to 191 million journeys in 1974/75. Non-urban journeys fell from 14 million in 1971/72 to 4 million in 1974/75 due to service cuts and boundary changes between country and interurban markets.

In May 1975 a new urban passenger timetable was implemented but it failed spectacularly. Its complexity confused staff responsible for implementing it and its details were not adequately communicated to the public. A Commission post-mortem of this fiasco showed that the timetable was too drastic a change for the finely balanced, interlocking network which was the Sydney metropolitan rail system. In an attempt to have trains running at three different operating speeds, the slightest difference between actual and timetabled services caused some services to over-run others, and also caused lengthy delays to services on the fringes of the system. It had been a glaring failure that proved a turning point in Shirley's career.

During the Shirley era, the "railway rehabilitator" group became a strong force for up-grading the rail system. At the forefront was Robert Nielsen. In May 1974 he presented his Sydney Area Transportation Study. It recommended a $6,000 million capital works program to build 1,200 kilometres of roads and freeways, new railway lines and purchase of 4,000 new buses over a 25 year period. The Government very quickly backed away from this report. One day later, the Minister produced his own program for cutting $150 million from public transport losses based on the loss of 10,000 jobs by "natural attrition". Air conditioned road coaches were to replace country branch line services and improvements were planned for city to country services.

Meanwhile the State Government reached agreement with the Whitlam Government on a $300 million, five-year modernisation program for NSW urban public transport, on a $2 for $1 basis to be known as the Urban Public Transport Improvement Program (UPTIP) (Gunn 1989). At the same time, a 20 per cent increase in fares and rates was proposed from 1 July 1974, supported by the Federal Government but vehemently opposed by the State Opposition. UPTIP started as a "shopping list" of long suppressed needs, which were then evaluated by the Bureau of Transport Economics, and allocated some investment priority after discussion and bargaining at officer level, between Canberra and Sydney.

Like many such programs before it, and since, it caught the engineering arms of the railways largely unprepared for the sudden gush of money. Also, high political profile projects tended to be favoured by politicians rather than projects like track renewal which would have addressed chronic but largely invisible problems. Nevertheless, some

useful projects were commenced under UPTIP which did not survive the Fraser era in Federal Government.

The Shirley era was characterised by an anarchic streak within some rail unions. This streak has surfaced from time to time, in the union movement, where reason and commonsense seemed to fly out the windows and episodes developed a Gilbert and Sullivan quality. They were far less amusing, however, to its victims, the general community. As a result, the railway industry suffered grievously in later years, when it tried to make a case to unsympathetic Canberra bureaucrats. Gunn has chronicled these events:

- On 19 September 1973, a strike by electric train guards, described by RJL Hawke, as ACTU President, as an act of "bastardry".
- On 31 October 1973, a nationwide strike by locomotive crews, which was extended beyond its allotted 24 hours in NSW.
- Early in 1974, a strike by signalmen at Central halted all trains. It was ostensibly held because the strikers did not have paper towels to wipe their hands, but in reality was a protest over the results of recent union elections.
- Guards, also protesting at union leadership, conducted rolling strikes between 4 and 12 March, and 20 March 1978. These were held in open defiance of the ARU's executive. This was the outward manifestation of a more deep seated industrial malaise throughout many areas of the railways. To a significant extent, bewildered managements ceased to manage the employees under their control for fear of igniting some new industrial mayhem (Gunn 1989).

But even here, the industrial disputation needs to be kept in perspective as follows:

Australian industrial disputes: Working days lost per thousand employees, Transport, Storage & Communication industries, 1974 to 1981

	Stevedoring	Other Transport	Total
1974	6172	1352	7524
1975	2581	379	2960
1976	2276	1010	3286
1977	2625	450	3075
1978	8418	435	8853
1979	8106	1126	9232
1980	2556	359	2910
1981	3041	957	3998
1982	688	688	

Source: Australian Bureau of Statistics (1984).

The statistics show that the disputations in Stevedoring, in particular, were very widespread in terms of their impacts. By comparison, the NSW Railways industrial actions were limited in time and space. It was their "ripple effects" which were more significant, that is their capacity to paralyse Railway management and their political impact.

In the three years 1972/73 to 1974/75, rail losses amounted to $350 million, and were already a serious threat to the financial viability of NSW. Public transport had now emerged as the key issue for the next State Election. Shirley retired in October 1975, two years before the end of his term. Jos Trimmer was appointed as Acting Chief Commissioner until a new appointment was made.

Shirley had correctly diagnosed many of the failures in the NSW Railways, but greatly over-estimated his capacity to deal with them, as follows:

1. *Institutional failure* in the form of an increasingly unstable State Government and many Ministers of Transport after Milton Morris, severely limited Shirley's ability to take bold strategic actions such as a re-organisation. A failure in the form of political influence placed Dr. Nielsen on the Commission. He was in total disagreement with almost every initiative put forward by Shirley.
2. *Market failure* became more apparent despite the fact that a special Marketing Division has been created to understand free market and deal with its consequences However, the Division rarely understood the strategic issues of open competition with the road freight, in the general freight area. Nor did it understand the consequences of the exponentially increasing ownership of private motor vehicles. The black banning of the Tamworth Freight Centre was an example of the road industry's new found strength. The industry's principal union exploited the institutional failures of the time to put an end to the only strategic initiative of the railways to win back lost business.
3. Although Shirley understood the *management and organisational failure*, by now deeply entrenched, he was powerless to do anything about it. It was to take much courage, determination, powerful political backing, and a great deal of time, to break up the power groups clustered around the Branch system of management.

The division between management and labour had become a gulf. And, increasingly, the focus of union opprobrium became Shirley himself. He therefore, was made the scapegoat by the NSW Government.

Shirley had been a major participant in the successful failure management of British Rail. But, he had the considerable support of the British Government behind him. His patrician background also assured him the support of the Civil Service and industrial leaders. That he failed so visibly in NSW was essentially due to institutional failure: the lack of a strong nexus with Government, and lack of support from within the organisation.

On 1 May 1976, the Wran Government was elected in NSW on public transport issues. All of the problems identified by Shirley still existed with the added sinister one of unsafe tracks and bridges (a submission by eleven senior engineers to the Chief Commissioner in March 1976):

> We, the undersigned Division Engineers of the Way and Works Branch (said the submission) do hereby claim that those policies of the Public Transport Commission which determine track and bridge maintenance resources are in need of urgent major reassessment. We advise that maintenance requirements needed for track and bridges have been severely reduced as a result of a staff freeze, non approval of critical staff submissions...track safety in some locations can no longer be guaranteed. This means that track failures...will cause an increasing number of derailments.

Alan Reiher, a distinguished civil engineer and Federal public servant, appointed by the Coalition Government, took up his appointment just prior to that Government's electoral defeat. The new Wran Government promised a new deal for public transport. Peter Cox, the new Minister for Transport, was approved by the Unions. Two early decisions of his were a 20 per cent cut in fares, commencing 1 July 1976 (Hensher and Bullock 1979) and the establishment of a Public Transport Commission Joint Council to improve industrial relations. At the same time, the new Treasurer restricted the Commissioner's capital budget to $156 million. More funds were subsequently allocated.

On 18 January 1977, the Granville train disaster killed 83 and injured 213 passengers. Reiher wrote to Cox, quoted in part (Gunn 1989):

> The condition of our railway track in New South Wales, like all systems, is widely variable, ranging from track which is at least as good as our standards, to track which is sufficiently below those standards that in combination with the vehicles using it, it occasionally reaches the point of incipient derailment condition...It is our view that a significant part of our track is sufficiently below our established standards that we should increase the investment in it to significantly raise the state of at least the main traffic areas...We are not in a position, however, to be at all precise about what should be done to achieve this.

As at June 1977, the accumulated rail losses since 1972/73 amounted to $829 million. Very few of the problems identified by Shirley had been effectively tackled and it was clear that a very substantial amount of capital would need to be spent on the rail system just to keep it going. Urban passenger travel had stabilised at about 180 million journeys but in 1976/77 non-urban journeys fell to a low of 3.3 million.

Many studies were commissioned on rail freight and passenger services during 1977/78. All confirmed previous studies which showed a poor level of service. But no one suggested the remedies put forward by Shirley. The only clear agenda of the Government seemed to be to try and improve the capital assets of the railway. In 1976/77 and 1977/78, it spent $240 million on railway assets. On winning a second term in office in October 1978, the Premier undertook two initiatives namely a rapid increase in the length of electrified railway; and the appointment of David Hill as Associate Commissioner, whilst still retaining his role as Head of the Ministerial Advisory Unit. The rapidly accelerated electrification program, once again, showed that

there were ceilings on the rates at which new works could be planned and constructed. Reiher and Hill came into dispute on the matter.

In March 1979, the Government decided to split the Public Transport Commission into the State Rail Authority and the Urban Transit Authority. Also, Minister Cox foreshadowed the closure of branch lines, the upgrading of main country lines and the development of an express passenger train (XPT) for the country services. In June 1979, a 10 day strike by track and signals maintenance workers cost the Commission a substantial loss in revenue. The deficit for the year was $372 million, bringing the accumulated deficit since 1972/73 to $1201 million. Metropolitan patronage reached a long run trough of just over 179 million journeys but non-urban patronage increased slightly to 3.7 million journeys.

A characteristic slide into financial crisis, industrial unrest and deteriorating morale was saved by the opening of the Eastern Suburbs Railway on 23 June 1979. This new line was hailed as a pointer to the future of suburban railway services in Sydney. It had cost $168 million to build and studies indicated a questionable benefit/cost ratio.

The Minister appointed Pat Johnson as the senior industrial officer in the Commission. He had a formidable record as a conciliator and arbitrator but would be tested to the fullest in the years to come. In November 1979, separate bans were imposed, first by electricians, then by maintenance staff. Premier Wran stated "Wherever you look in the railways at the present time there is either some ban or limitation or there's a threat of a ban or limitation" (Gunn 1989).

Reiher was asked by the Government to take three months recreation leave.

It took a threat by Premier Wran to shut down the railways and stand down all workers, to have the bans lifted. But the industrial warfare continued:

- Train examiners halted all trains in December 1979, and some key trains in January 1980.
- January 1980 saw cancellations of peak hour commuter trains on an unprecedented scale. Late running trains were also a major problem.
- On 18 February 1980, another strike, by track maintenance staff, goaded Minister Cox into ordering the termination of all rail services, on safety considerations.

Since January 1978, the Public Transport Commission had had 496 industrial disputes (Gunn 1989). The Commission limped to the end of its life in June 1980. It was essentially leaderless since Reiher's annual leave had been extended.

In its lifetime from 1972/73, it had accumulated a rail deficit of $1,265 million, a bus deficit of $94 million and a ferry service deficit of $16 million. It had lost a significant part of its pre-monopoly non-bulk freight markets, for the foreseeable future. Urban service patronage was still some 9 million journeys per year below the 1972/73 level. Non-urban patronage was also some 9 million journeys below the 1972/73 level. It had expended $987 million in capital funds with no discernible improvements in service levels anywhere in the system. Nevertheless, in terms of new hardware, it had furnished the railways with: 105 locomotives, 435 suburban double-deck carriages and 2,450 freight wagons. It had provided for 30 XPT passenger units and upgrading of 1,000 kilometres of railway line, new bridges and re-signalling. One could, however, argue that much of this capital went towards preventing further deterioration in services.

Industrial relations were in a state of anarchy, paralysing management which was also very despondent at the treatment of Alan Reiher, who was highly respected. In a technically financial sense, the railway was already bankrupt.

The Public Transport Commission model of failure management was disastrous for the NSW Railways. The fates of Reiher and Shirley clearly indicated that the organisation was unmanageable. Had the organisation been privately owned it would have been placed into receivership and sold off piecemeal to one or more of the corporate predators who emerged in the 1980s. The Public Transport Commission had failed publicly, and in a spectacular way, on every criterion of failure management.

6.5 1980/81 TO 1985/86: THE HILL ERA

After the abandonment of the failed Public Transport Commission Model, State Rail Authority of New South Wales was established on 1 July 1980. It commenced business under the stewardship of its first Chief Executive, David Hill. In charge of operations was Ron Christie, an ex-Planning Division staff member who had moved on to the project management of rail facilities at Port Waratah. Pat Johnson was appointed Deputy Chief Executive (Industrial Relations). Chairman of the Authority was Alex Carmichael, a former managing director of TNT Bulkships Ltd, and holder of other directorships. The new Authority inherited all of the disabilities of the Public Transport Commission originally identified by Shirley. Hill did not want the job of Chief Executive. He, more than anyone, knew the railways' financial situation (quoted in Gunn 1989):

> If we had to provide a train service, get the bloody trains to run on time; if we're costing heaps of money, lets try and cost the taxpayers less; and if we've got industrial disarray, let's try and get some industrial order into the place.

Hill and Shirley represent interesting similarities and contrasts which are worth noting in any study of railway management in NSW. They had been born into the opposite ends of the British class system. In Shirley, this had bred an instinctive respect for rank and office which made him reluctant (beyond the occasional vitriolic reprimand) to be ruthless with non-performing executives. On the other hand, rank and file railway persons did not exist for him as real people. Hill understood the battler and appreciated that even the lowliest worker had ideas on improving the railway. He had absolutely no respect for rank or office, per se. In the beginning, this trait served him well. In his later years his treatment of senior managers became capricious and, at times, tyrannical to the point where, in 1986, he had little, if any, loyalty amongst his senior executives. On the other hand, Hill won the affection of the ordinary rail worker. "Call me David!" became a sort of catch-cry on his tours. In an organisation with rigid hierarchical ranks, this was extraordinary and went a considerable way towards undermining Union leaders, in maintaining their credibility, in later confrontations with Hill.

There were marked contrasts between Shirley and Hill in dealing with the public. Shirley was never able to shake his patrician image, which guaranteed an almost psychotic hatred from some members of the public and the press during the periods of crisis. On the other hand Hill is probably one of the best media communicators amongst chief executives in Australia. This was to be an invaluable asset during the difficult times.

Both Shirley and Hill intuitively understood the strategic picture and both revelled in fixing the minutiae of railway problems. The difference was that Hill had a system for vigorously following up his directives. However, where both failed was in the relatively uncritical acceptance of information fed to them. Nevertheless, they probably had no choice because of the many subterfuges used to hide the truth.

Finally, circumstances were unkind to Shirley in that the external economy was in a parlous condition, and the railways were forced to compete with a strong road freight industry and the motor car, for the first time in their history. Also, Australia's industrial climate, generally, was so bad that it had developed a very poor reputation overseas. On the other hand, Hill presided over the railway, for some of the time, during the boom years of the 1980s. This was also the time of the Hawke Labor Government in Canberra which popularised the notion of tripartite consensual behaviour between Government, business and unions. This allowed the wiser heads in the union movement to prevail and laid the foundation for future restructuring of some industries.

Hill obtained approval for a further $1,400 million capital investment program to be spent over five years. 1980/81 saw a marked improvement in railway activities on a number of fronts:

- Urban passenger numbers increased by 3 million for the second year in succession. Non-urban passenger numbers increased by 300 000, continuing a trend which had been in existence since 1977/78.
- The on-time performance of commuter services improved discernibly even though the statistics produced are subject to dispute. More importantly, it was perceived by the public to have improved.
- Tighter financial controls were implemented.
- Whilst industrial stoppages still continued, they were most effectively handled by Pat Johnson.

Nevertheless, in 1980/81, a deficit of $300 million was recorded.

1981/82 was a year of consolidation on the progress made in 1980/81. In particular, it gave the Wran Government a source of pride in achievement and there was a marked improvement in staff morale. Other achievements included:

- A further increase of 8 million urban passenger journeys.
- A slight drop in non-urban passenger journeys, although the introduction of XPT services in April 1982 between Sydney and Orange/Dubbo held the promise of future patronage increases.
- Continued improvement in the on-time running of commuter services.
- The implementation of a Disputes Settlements Procedure which eliminated wildcat stoppages. Overall, the number of stoppages dropped to 172 in 1981/82.
- A staff ceiling was put in place and staff numbers declined by about 1 000.

In 1981/82 the Authority recorded a deficit of $387 million and spent $286 million in its capital works program. It had also become clear to the Government that it could not continue to fund the whole program from traditional sources.

The following year was one of major recession in the State and a rise in unemployment as major sections of industry closed businesses in traditional commercial and industrial areas of Sydney, in a few cases, to re-open as smaller establishments elsewhere. Urban passenger journeys dropped by 12 million, and non-urban by 500 000 despite more new rolling stock, good on-time running, and improved weekend services.

A cost-cutting program, designed to save $70 million in the second half of 1982/83, was put to the Unions in November 1982. A series of strikes followed:

- A wildcat strike on 13 November by train examiners forced the cancellation of 27 country services.

- On 9 December, a strike by train examiners, followed by guards and air-conditioning tradesmen, stopped all services.
- 16 January 1983 saw a further strike by train examiners, and stand downs began of 5,000 rail employers. On January 18, all train crews joined the strike and services were brought to a halt. 7,000 rail employees were stood down on 18 January, and revenue losses were reported at $2.3 million per day. Services were not resumed until 25 January 1983.

In the parlance of bull-fighting, this was the "moment of truth". Hill had confronted the unions (and the old guard of Ministers who had come from the right wing power group of which these Unions were members). He had chosen his own battleground, and had won. Other strikes, worse than the 8 day January strike were to follow, but this was probably the turning point in railway industrial relations. This disputation was unlike any faced by the NSW Railways, before or since. It was fought out in the Cabinet Room, on the floor of the NSW Lower House, and in the media. On one side were the master politician, Wran and his brilliant communicator, Hill. On the other side were honest, old-line, unionists whose intransigence allowed themselves to be painted into a corner.

Export coal haulage increased by 6 million tonnes, giving the first indication of its future importance in the financial viability of the railways. Nevertheless, the deficit rose to $448 million bringing the 3 year accumulated deficit of the Authority to $1,135 million. In 1982/83 capital expenditure was $324 million bringing the 3 year accumulated spending to $855 million. A leveraged leasing scheme was now in place to provide $566 million for the financing of locomotives, passenger carriages and freight wagons. This represented one third of the second five-year capital program.

In mid July 1983, a 17 day strike was commenced by train drivers, and the stand down of 10,000 rail workers commenced on the sixteenth day. Hill had won again.

1983/84 was a year of some achievements and some set backs:

- Urban passenger numbers declined by a further 5 million and non-urban declined by 800,000 journeys.
- Freight tonnage increased by 5 million tonnes, as the State's coal export drive gathered momentum.
- The power of the Traffic Branch was broken. This Branch was the railway in many respects. It ran the trains. Its culture dated back to the 19th Century, and under the winds of change had altered little. Its management was hierarchical and authoritarian. But it had some good features including the fostering of a sense of community. Nevertheless, the Branch was now an impediment to progress. Two business units were created, one for freight and one for passengers. Each unit was

responsible for operations, marketing, customer service and non-corporate administration. Traffic Branch staff were absorbed into the two units.

- A record $402 million was spent on capital works program.
- The deficit for the year was $395 million.
- Under Pat Johnson, a whole range of employee initiatives was commenced.

Cox was removed as Transport Minister in April 1984 and was replaced by Barry Unsworth.

Railway unions were now reassessing their position in the light of changes occurring on the national scene. In August 1984, this re-assessment was reflected in a public dispute between the AFULE representing train drivers and the ARU representing guards. The strike lasted eleven days from August 1984.

On 2 January 1985, train crews in the Hunter Valley went on strike until 17 January, and the AFULE decided to extend this State wide. The Authority ordered drivers to return to work or face dismissal as well as deregistration of the AFULE. Premier Wran and Prime Minister Hawke supported this view. A split in Union ranks occurred on 25 January where Sydney freight trains began operations and the strike was called off on 28 January.

In 1984/85 progress was patchy:

- Urban patronage reached a six-year low at 197 million journeys. Non urban patronage continued to decline despite the XPT services.
- Freight tonnage hauled increased by only 2 million tonnes.
- Capital expenditure was a staggering $421 million.
- The deficit was decreased by a further $30 million to $365 million.

As the mining and property boom gathered pace in NSW, 1985/86 at last began to show the fruits of the hard years since 1980/81.

- Urban patronage increased by 18 million, fuelled by a rapid rise in part-time jobs. Non-urban journeys increased by 400,000.
- Freight haulage increased by 6 million tonnes.
- The deficit declined by a further $35 million to $330 million. The accumulated deficit from 1980/81 to 1985/86 was $2,225 million compared with $2,065 million for the period 1972/73 to 1979/80.
- Capital expenditure in 1985/86 was $422 million. Accumulated since 1980/81, this represented a total spending of $2,100 million. Very little of this spending had been subjected to serious benefits/cost analysis on the grounds that most of it was spent on assets which were used to replace assets that had worn out.

Premier Wran stepped down from office on 4 July 1986, followed by Hill in November 1986. In assessing the Hill era it is appropriate to look at the problem areas identified by Shirley, to see how much progress had been made towards resolving these:

1. Too much railway track

In 1971/72 there were 9,754 route kilometres of railway track. In 1985/86 this had risen to 9,909 route kilometres.

2. Too many stations and freight points losing substantial sums of money

There had been some station closures of a minor nature and many freight points were abandoned as the non bulk freight went to road. The deficit on country passenger services in 1985/86 was $155 million. On freight services, it was down to $30 million due in part to the profitability of bulk freight.

3. Antiquated rolling stock and infrastructure

The rolling stock fleet was well on the way to renewal, although the old "red-rattler" suburban fleet was still very much in evidence. Infrastructure was still an unknown quantity since the rail network was largely intact.

4. Corporate culture based around the Branch system of organisation

The Traffic Branch had been dismantled but the culture still survived (State Rail Annual Reports 1981/82 to 1984/85).

5. Lack of modern management practices

Many worthwhile initiatives were commenced only to wither on the vine when they ran headlong into the traditional corporate cultures of the Branches.

6. Decision making process

This had changed spectacularly. Hill's style was interventionist and he immersed himself in the minutiae. Failure to implement his directives led to drastic action on his part. However, it was counter-productive in the sense that managers spent much valuable time trying to second guess the Chief Executive's current enthusiasms or concerns.

7. Hard data for management

The Authority became a graveyard for failed computer systems. A huge effort was put into producing management statistics, inches thick, every month. Very little thought went into what the statistics actually recorded, and there was no systematic costing of services.

But, the political war with the right wing unions had to be fought first. This was done over six bruising years and was finally won by management. It could not have been won without the partnership of Hill and Premier Wran. In a commercial sense, the railways were in receivership, attempting to trade their way out of financial difficulties. However, unlike most corporations in receivership, they had used up another $2,100 million of shareholders and lenders money, with no clear idea as to when they would be financially viable again.

The State Rail Authority model of failure management replaced the disastrous Public Transport Commission. Some lessons were learned from the experience but others were ignored.

1. Institutional

Perhaps the most important lesson was that there had to be a very strong nexus between the Premier of NSW and the Chief Executive of the Railways. In many ways, this was a unique partnership between Premier Wran and Hill. This partnership was essential if the aftermath of the Public Transport Commission was to be cleaned up. The additional importance of the partnership was that both persons were very strong characters, and brooked no opposition, once embarked upon a course of action. They understood some of the problems but not all of them. The ones they understood they fixed, despite the difficulties. In this sense, the failure management was effective.

2. Industrial relations and management

The acrimony created by the industrial actions finally caused both sides to re-appraise the industrial guerilla warfare which had existed since the 1968 strikes. Out of the re-appraisal came a more realistic understanding of rail's future and the need for management and labour to join together for common purpose. This was so in no small measure due to the conciliation efforts of Pat Johnson.

However, management change and corporate transformation was only half done. In the end it left a legacy of demoralisation and confusion in management ranks. Again, it needed the healing efforts of Pat Johnson to restore morale and a sense of purpose.

3. Technology

As noted above, capital spending amounted to $2,100 million, mostly on replacing worn out assets. This investment did not meet any accepted cost-benefit criteria, and the impact of advanced technologies of some new investment, like the XPT, was negated, as was noted in Chapter 5. Nevertheless, it was a valid failure management strategy in the sense that had the assets which were replaced, failed in service, then the consequences could have been very serious. This was the lesson of Granville accident.

One could argue indefinitely whether a cheaper option than say the XPT could have been chosen to replace worn out Country trains. The fact was that no option would have yielded a positive benefit/cost ratio on the existing structure of Country train services. Nevertheless the XPT did introduce new technology which had some benefits in later years at the same time enabling the Australian railway rollingstock industry to acquire new knowledge. In the end, a political decision was made that the NSW taxpayer should pay the bill for this failure management strategy.

4. Markets

The export freight markets were kind to the Railways and the growth in revenue masked serious problems in other areas of freight. Because of their relatively smaller contribution to revenue, no serious attempt was made to recognise the problems nor rectify them.

On the passenger side of the business, market information was rudimentary and knowledge of costs non-existent. For the most part, at many times, it seemed as if market knowledge was irrelevant. This had the inevitable financial consequences, as revealed three years later by the Curran Commission that once again the NSW Railways were technically bankrupt.

6.6 1986/87 TO 1987/88: THE JOHNSON ERA

These two years were essentially years of interregnum—a period of respite for the next round of inevitable drastic change. Nevertheless, the Johnson years may be characterised as years of the second Change Agent. On the industrial front, it was a period of armistice at least, if not one of active co-operation.

With the departure of Premier Wran and David Hill, the dormant anti-rail, pro-road groups became more active. At the Federal level, a barrage of studies was launched to examine the railway systems in all states with particular targets being those of Victoria and NSW. Most were designed to expose their inadequacies. A useful initiative was undertaken by the establishment of the Railway Industry Council in December 1986 by the Australian Transport Advisory Council. It was tripartite in nature from the Council down to the Working Groups and comprised government, union and railway representatives. Its main objective was to develop and recommend a medium and long term strategy to improve the viability and competitiveness of the rail industry. It reported in May 1990, by which time events in NSW had passed it by. But it came up with realistic recommendations and was an important co-operative enterprise.

The road lobby was also much more active, both in response to a succession of inquiries on road cost recovery and because of the capital funds being channelled into NSW railways. Much of this debate was, in the end, inconclusive because of the rubberiness of the various estimates of road costs.

1986/87 was a year of accomplishment under the new Chief Executive, Pat Johnson, the second Change Agent.

- Urban passenger journeys reached 221 million, surpassing 1971/72 journeys. Non-urban journeys declined by 100,000.
- Freight hauled reached 55 million tonnes, in response to solid growth in coal exports.
- An enormous effort was directed at human resources, the new term for employees. Industrial stoppages were a mere 25 and staff numbers began to decline. Importantly, a more benign culture allowed management to concentrate better upon the tasks allotted to it.
- Capital spending was $402 million and for the first time, the Authority sold $50 million worth of assets to contribute to the program. Future programs were now being subjected to evaluation.
- Johnson understood the inevitable direction that had to be taken by the Authority from corporate planning work undertaken during the year. However, he was determined to follow a gradualist and humane approach with union co-operation at every step.

In March 1988, the long reign of Labor ended in NSW with the victory of the Liberal–National Coalition. It had been elected on a platform of public sector reform, and the Authority was a principal target. One of the first steps that the Greiner administration took was the appointment of a Commission of Audit, chaired by Charles Curran, with the task of providing a true accounting of the State's assets and liabilities and its financial commitments. At about the same time, the Minister for Transport commissioned PA Consulting Services to review the performance of State Rail. Specifically, the consultants were asked to obtain a broad, independent view of the railways on which to base strategic decisions, develop and examine options for the future and initiate a dialogue between Government and State Rail about the broad directions the latter should pursue. By the end of 1988, the Government had a clear view of State Rail's position.

The Curran Commission: Findings and recommendations

Findings and recommendations by the NSW Commission of Audit (1988) included:

- State Rail's finances were in critical condition as liabilities exceeded assets by $500 million.

- State Rail's ability to operate as a commercially competitive enterprise was inhibited by:
  - non-level transport "playing field"
  - lack of business expertise on the Board
  - too many layers in the organisation
  - debt charges not borne on investments.
- State Rail was required to operate uneconomic services.
- State Rail was involved in peripheral activities which were not part of its core business.
- State Rail had too much under-utilised track.
- Ministerial intervention had often worked against State Rail's business interests.
- Productivity was low, due to:
  - operational characteristics
  - inefficient work practices
  - high staff absenteeism
  - staffing peaks
  - lack of targeted redundancy packages.
- Financial management systems and strategic planning were clearly inadequate:
  - no satisfactory strategic plan
  - profitability of particular traffics unidentified
  - project appraisal standards inadequate
  - incomplete property, stock and personnel records.
- There was an inability to allocate costs to specific services, inhibiting rational pricing.
- The Government should consider withdrawing SRA from parcels, general freight and non-grain rural products, and some low-demand passenger services.
- Government should meet the cost of social obligations provided by the SRA.
- Government and State Rail need to agree on a clear mission statement.
- Performance data is collected, but put to little strategic use.
- Average freight rates were higher than other systems averages.
- To record a reasonable return on assets, the operating surplus would need to be over $500 million, before interest (1987/88 figures).
- State Rail received significant benefits from exemptions to taxes and charges, but had also missed out on compensation for property transferred to other Government entities.

PA Consulting Services findings

Findings by PA Consulting Services (1988) included:

- State Rail costs the NSW taxpayer about $3 million per day.
- State Rail owes more than $6 billion (including former PTC debt).
- Farebox revenue from commuters only covered 25% of the total cost of providing the service. This meant each commuter passenger journey was subsidised by an average of $2.50.
- Freight required a $372 million Government contribution in 1987/88. The main loss-making businesses were: Smalls Freight; General; Intermodal. To become commercially viable, State Rail needed to increase revenue, reduce costs and consider withdrawing from uneconomic services.
- Farebox revenue from long distance passenger rail service only covered 18% of the total cost of providing the service. This meant each passenger journey was subsidised by approximately $125. Road coach operators had been gaining much of this market.
- Modest improvements of recent years had not significantly altered financial performance.
- The annual Government subsidy for NSW rail services including capital charges and rebates exceeded $1.2 billion (NSW Commission of Audit 1988).

6.7 1988/89 TO 1991/92: THE SAYERS ERA

This was the era of Ross Sayers. He was the third Change Agent, and the most commercially effective. He was fresh from New Zealand Railways, where he had accomplished a turnaround in the corporate fortunes of that system. He epitomised the new breed of public authority managers beginning to emerge in the late 1980s. An accountant by profession, he had also received part of his education at the Harvard Business School. He brought with him the ethos of the one hundred hour working week and an ascetic dedication to achieving a corporate turnaround in State Rail. This dedication survived a near fatal heart attack and enabled him to finish the task he had set out to do.

In October 1988, he commissioned the US consultancy firm, Booz Allen and Hamilton, to carry out a strategic review of the operations and administration of the NSW railway system. This was done in considerable secrecy, and with swiftness and thoroughness, by US personnel, working in relays (Booz Allen and Hamilton 1989). An early outcome of their deliberations was a new organisation which provided the coup de grace to the remnants of the railway Branch structure. What emerged was an organisation which was designed to turn the freight and country passenger businesses into commercial enterprises (Freight Rail and Countrylink), and metropolitan passenger services

(Cityrail) into a service organisation which would be ranked with the best commuter railways in the world.

The New South Wales Railways entered 1989 in a state of the greatest upheaval in its history. It had made a complete break from its past, which was largely irreversible. The first impact of this was the retirement and resignation of about 1,900 long-service employees. Many more were to follow in the years ahead.

In the three years to 1991/92, a number of significant achievements were made, which enables this period to be labelled as the era of Corporate Turnaround. They are expressed, again, in terms of the original problems identified by Shirley in 1973.

1. Too much railway track

In 1985/86 this stood at 9,909 route kilometres. By 1991/92, it had come down to 7,600 route kilometres.

2. Too many stations and freight points losing substantial sums of money

In October 1988, the NSW long distance interstate passenger market was deregulated and private sector road coach operators took up many non-main line rail passenger routes. These provided feeder services to main rail stations where they met main line trains. The attrition among smaller stations was considerable. The deficit on country passenger services declined from $155 million in 1985/86 to $72 million in 1991/92.

3. Antiquated rollingstock and infrastructure

Renewal of the rollingstock fleet had continued at a fast pace since 1985/86. The urban passenger system renewal program was centred around the elimination of "red rattlers" which had all but disappeared by 1991/92. A station rebuilding program was about one-third towards completion, and a $600 million signal renewal program had been commenced. A major innovation was a Safety Audit function. History had shown that, in times of crisis or major change, disasters have tended to occur. This needed to be avoided as strongly as possible.

4. Corporate culture based around the Branch system of organisation

The Branch structure was completely shattered. Those who could, had accepted retirement and/or redundancy payments and left. Flat middle-management structures replaced the old hierarchies, and there was a considerable scramble for the few vacant positions. Promotion tended to favour younger executives, who had some prospect of growing into their jobs. There was a great deal of uncertainty, bewilderment and loss of morale very similar to an old-established organisation which has just been taken over. This will take time to sort out, perhaps at a heavy social cost. Most, who had been left

without any of the career certainties of the past, had opted to leave the Authority. In 1985/86, staff numbers were 41,071. In 1991/92, staff numbers had shrunk to 24,467.

5. Lack of modern management practices

The total demolition of the Branch structure meant that all kinds of new practices could be introduced into the new organisation. The difficulty was in getting new management to use them effectively. This is essentially a learning exercise and still has a long way to go.

6. Decision making process

The devolution of responsibility to the Group General Managers of Freight Rail, Countrylink and Cityrail, and flat management structures within these business groups, has essentially resolved this problem. Sayers' style was essentially to leave the three Group General Managers to get on with the business of running their separate business and cost centres.

7. Hard data for management

A costing system (Railcost) was one of the first systems implemented in Freight Rail. A costing system for Cityrail is still being developed. The work of Total Quality Management teams (with a brief to "manage by facts") is still revealing many shortcomings in operational data bases of the past 150 years. In the five years 1987/88 to 1991/92, the key impacts on the State's finances have been as follows:

(Accrual accounting basis)	1987/88 ($M)	1988/89 ($M)	1989/90 ($M)	1990/91 ($M)	1991/92 ($M)	Cumulative ($M)
Operating deficit (before govt contributions)	977	542	325	374	449	2,667
Government contributions	875	461	369	351	264	2,320
Operating (deficit) or surplus	(103)	(81)	44	(24)	(185)	(349)
Capital Grants	244	224	240	394	475	1,557

Source: SRA Annual Report 1991/92.

For the analyst of failure management, the dominant question which must be asked of the Sayers era was: did his stewardship end some sixty years of failure management in the NSW Railways, or was this a new sophisticated model of failure management? The following analysis suggests that it is a new model of failure management but that it is probably the only model which could have been applied, if the next steps are to be taken with less pain.

Institutional

The reforms initiated by Sayers, and heavily backed by an initially strong Premier Greiner, were originally precipitated from a non-ideological perception of what constituted good government in a provincial environment and what constituted good management for major businesses operated by that Government. These were inculcated by the so-called Sturgess Committee (NSW Government Steering Committee on GTEs 1988). Five conditions had to be met for there to be a satisfactory relationship between Government and the businesses (or "trading enterprises") which it operated:

1. Clarity of business objectives,
2. Autonomy for the managers of the trading enterprises,
3. A system for monitoring the performance of the enterprises, and the managers who ran them,
4. A system of rewards and sanctions for the managers, and
5. Competitive neutrality for the business enterprises, i.e. no special market advantages by reason of their ownership by Government.

The Transport Administration Act 1988 was implemented to give effect to these principles in the State Rail Authority (Walker 1991). The Act:

- established an objective that the Authority should conduct its business "in accordance with sound commercial practice".
- explicit funding for the costs imposed on the Authorities by Ministerial direction.
- preparation of Corporate Plans by the Authorities, separately identifying and budgeting for commercial and non-commercial activities.
- relocation of responsibility for co-ordination and regulation of transport in the Department of Transport, with a power for the Director General of the Department to enter into contracts for the supply of goods and services in line with his new responsibilities.

It was also considered by the Government that the five Sturgess Committee conditions could not be met unless a clear separation was made between commercial and non-commercial activities. In the case of commercial activities it was incumbent upon government trading enterprises to maximise the rate of return on investments managed. In the case of non-commercial activities, which are considered to be socially and economically necessary, requiring government intervention in the State's interest, contracts need to be entered into between the State and the operating authority. These contracts specify the terms and conditions of Community Service Obligations (CSOs). The CSO was defined as:

> an activity that an Authority undertakes at the request of the Government which (a) incurs or is expected to incur a significant financial loss and (b) would not be undertaken but for the financial benefit given by the CSO Contract with the Government.

The Government monitors the efficiency of the Authority through the corporate plan, while the Contract provides a barrier between the Government and the Authority, to ensure that the latter meets its objectives and financial commitments.

A strong nexus between the Premier and the Chief Executive, supported by a strong Minister for Transport and a strong Department of Transport, accomplished a relatively rapid "downsizing" of staff numbers in the teeth of the worst recession in Australia since the Great Depression. The downsizing succeeded because of a relatively generous redundancy scheme and the fact that most of those who took advantage of it were relatively long-serving staff members whose jobs or career prospects had disappeared. Also, it was accomplished, by and large, with the blessing of the ACTU who had "signed-off" on micro-economic reform of the public sector. Major long-term socio-economic issues such as the question of the future employability of staff made redundant and the incidence of poverty among "downsized" railway families took a back seat in Government decision making. These have not yet been studied but would add an important dimension to the analysis.

Nevertheless, in institutional terms, the climate for a radical break with the past was the most propitious than at any time before, in the long history of the railways. This included the legislation.

6.8 CONCLUSION

The devolution of the old structure into separate business groups, with considerable autonomy and a non-interfering Chief Executive meant that the old Branch-style management paradigm was totally demolished. New managers filled new executive positions everywhere. Most were promoted from within and most were relatively young. The expectation was that their youth would bring new energy and fresh ideas to the task of re-building the railways.

One external difficulty the new managers faced was that they were steering their businesses into the worst recession Australia had faced in sixty years. They would see many of their contemporaries in the private sector go down as corporations went bankrupt, closed down or were downsized without the safety nets of redundancy schemes. On the other hand, some of their contemporaries were emerging as the true New Persons (in the Schumpeterian sense) of Australian industry by building new firms based on new ideas and taking great risks to establish the springboards for export-led economic recovery in the late 1990s. The BCA study (Carnegie and Butlin 1993)

indicates the strength of this revitalisation of Australian industry. When the analyst looks past the gloss of the Railway Annual Reports from 1988/89, the obvious labour productivity improvements from downsizing, and the continuation of capital spending, little financial benefit appears to have been achieved for the five years:

- a cumulative operating deficit of $2,667 million.
- Government contributions of $2,320 million.
- a cumulative deficit after Government contributions, of $349 million.
- cumulative capital grants of $1,557 million.
- continued controversy about system safety.
- lack of staff morale arising from uncertainties as to the future direction of the railways.
- continued loss of market share in even monopoly businesses.
- continued pressure to privatise the most profitable businesses.

Some of the reasons for this continuing display of failure management symptoms at the organisational level are an aftermath of the changes already made, and some arise out of the institutional changes created by the Transport Administration Act, as follows:

1. The Greiner Government came to power with no ideological stand on public authorities, other than management reforms which would make the authorities operate like any other corporation.
2. The reforms that were enshrined in legislation related to the "nuts and bolts" of business administration. In the terminology of KAIZEN, it was the "maintenance" end of the management process because you cannot legislate for entrepreneurship, risk-taking or innovation, even if you tried to do so, and because any failure has a major political fallout in a government-owned enterprise.
3. The new managers fulfilled their contractual obligations when they met the requirements of the Transport Administration Act, which did not require them to be entrepreneurs, risk takers or innovators. Their job was to cut operating deficits, which was achievable by cutting staff numbers. However, for various reasons deficits still remained difficult to reduce. The options open to the new managers are now all at the other end of the KAIZEN square, i.e. where only entrepreneurship, risk-taking and innovation will succeed.
4. The Government, however, in 1991/92 was balanced on a knife-edge of voter confidence, where any new failure could precipitate a collapse. It could not afford to take risks. And, entrepreneurship, risk-taking and innovation must obtain their initial impetus in a Government authority by strong, confident, political leadership. The partnership of Hill and Wran was the role model for this.

Thus, if things were to change from the maintenance end of the KAIZEN square to the innovation end, two things needed to happen:

- There needed to be strong confident political leadership willing to take risks, and

- The appointment of new managers who had a track record of entrepreneurship, innovation, and successful risk-taking.

There is now a much greater confidence in the handling of new technology, than ever before. The fundamental problem however still remains. The infrastructure is geared to handle steam trains, not rollingstock which is capable of ever-increasing speeds, and heavier hauls.

Market failure may still be deemed to exist. Between 1987/88 and 1991/92 the Government paid out $2,320 million in CSO contributions. Clearly, the optimisation of resource allocation does not exist. By now, Country and Interstate services ought to be at cost levels which enable them to find a competitive niche in their markets. But, there is still confusion as to what this niche might be. No serious attempt has been made to eliminate the excess capacity in off-peak services. Pricing is still essentially subject to political considerations.

In conclusion, the reforms of 1988 and 1989 put in place a management regime which was good at the "maintenance" end of the KAIZEN square. It was not good at innovation. Also, in key areas, such as markets, political management considerations still prevail. This is not necessarily a bad thing. Broad political judgments, by a strong, confident Government can provide the necessary support for innovative leadership and the initial impetus to a railway management selected for its track record as entrepreneurs, innovators and successful risk-takers.