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Abstract

Attempts to enhance the efficiency and effectiveness of local government have lagged behind the higher tiers of governance in Australia and it is only in the comparatively recent past that systematic efforts have been made to measure the performance of Australian local government. This paper seeks to review municipal efficiency measurement in Australia. We summarise progress made in efficiency measurement on a state by state basis, examine performance measurement in water and waste water, discuss Data Envelopment Analysis, and consider service quality measures. On the basis of this review of empirical work on local government performance measurement in Australia, we argue there is an urgent need to develop methodologies for assessing overall efficiencies, which include service quality measures.

Local Government Efficiency Measurement in Australia

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Local government plays a significant role in providing essential services to the Australian public. More than 700 local councils outlay some $13 billion per year representing about 5% of total government expenditure or around 1.6% of GDP (Industry Commission 1997, NOLG 1999 and NOLG 2001: 3) providing important community services as well as regulating many domestic and commercial activities.

Council activities affect the population daily through the broad range of services it provides. These include road and footpath maintenance, garbage pick-up and waste disposal, park maintenance, library services, building and development approvals, water supply, wastewater collection and treatment, art galleries, community facilities, stormwater drainage, airport management and tourism promotion. The benefits of improving performance in local government are therefore very important both economically and to the quality of life of communities in Australia.

The view that local government should be seen as a special case in relation to its function and the services it provides has all but disappeared in Australia over the past few years. The role of performance measurement and comparison is now seen as a critical step in improving the efficiency and effectiveness of local government and the public sector generally.

Indeed, the majority of services provided by municipal councils are not exclusive to local government. For instance, state government authorities and the private sector also provide road maintenance services. So too waste disposal, library services, water supply, art galleries, conference facilities, stormwater drainage, airport management and many other typical local public services are also supplied by other organisations across the country.

A key strategy in improving local government performance has been the development of performance measures for use in the benchmarking of services. To measure performance and assess the efficiencies of councils, the states and territories in Australia have required councils to provide information on key service areas. Although this has varied somewhat between the states, more detailed and better-defined data continues to be collected every year. It was not

until 1995 that national performance indicators were first proposed at the Local Government Ministers' Conference, and since then the federal National Office of Local Government has facilitated a voluntary process of developing and adopting standard performance measures and indicators with the states, peak industry bodies and technical committees.

To date, performance has almost exclusively been assessed by comparing performance indicators against the "average council" statistic for that state. For example, the performance of Tamworth City Council's domestic waste collection service is assessed by comparing the cost per service for domestic waste collection for Tamworth against the New South Wales (NSW) state average. Performance indicators used by state authorities have been single input, single output indicators. In the above example, for instance, total collection cost is the input and total number of services is the output. As a result more than one indicator is often applicable to the single service area. Thus in the waste services area single input/output performance indicators can apply to waste disposal, recycling and waste management as well as collection. Each measure, then, is only a partial appraisal of the overall performance of the service.

In order to compare the performance of particular council services there is a need for a method of calculating performance indicators which caters for multiple inputs and outputs. The Data Envelopment Analysis (DEA) method can be used in such circumstances to measure technical and scale efficiencies, and productivity changes in council services over time (Coelli, Rao & Battese 1998).

Numerous factors have affected local government over the past several years and have resulted in significant changes to the delivery of council services. Firstly, the environmental controls and regulations which have been introduced across Australia over the last 15 years have recently manifested in the development of licences to operate by the Environmental Protection Authorities (EPAs) in the areas of water, wastewater (sewerage) and waste disposal. These licences usually contain stringent conditions which often require major capital works to be carried out. For example, treatment plant upgrades have been commissioned at various locations to meet higher drinking water quality standards that are now required and more comprehensive testing requirements.

Secondly, expectations from the community concerning levels of service have continued to increase. As the property tax or "rates income" from council has been "pegged" to the

consumer price index (CPI) by many of the states, and with wage rates rising at a faster rate, this has meant that efficiency improvements are necessary to continue to meet community expectations in the future. Other input costs have also increased faster than the CPI. For instance, purchasing bulk water charges from the state government have increased dramatically as the social costs of water have been realised and the value of environmental flows in rivers recognised.

Thirdly, local government has come under constant pressure, and in some states obliged, to restructure either through the amalgamation of councils or by amalgamation of specific services from a number of councils into separate regional organisations with a corporate structure which has the potential to be privatised in the future. Recent examples of this are the forced amalgamations and setting up of rural water authorities in Victoria, and the voluntary amalgamation process and formation of regional electricity corporations in NSW.

One of the main thrusts behind amalgamations has been the assumption that efficiency improvements would result in part due to economies of scale. The number of councils across Australia (730 even after major amalgamations in Victoria and Tasmania (NOLG 2001:3)), and the number with very small populations (less then 5,000 persons) suggests that many councils would have increasing returns to scale. However, the efficiency of local government services depends on many other factors (NSW Department of Local Government – 2000). These include population served, population density, distribution of population, population growth, age and type of existing infrastructure, amount of rainfall, topography and soil types.

Accordingly, to determine the likely benefits of restructuring councils (through scale efficiency), as well as encouraging future improvements in efficiency (through technical efficiency) through benchmarking with other councils, the calculation of appropriate performance measures for each service is critical. Efficiency measurement has been an emerging theme over the past decade in all major service areas for local government as well as for the water sector. It is therefore important to track the progress made to date in these areas and this forms the objective of the present article.

This paper itself is divided into six main parts. The first section provides an overview of efficiency measures developed for local government services on a state by state basis. We then examine performance comparisons made in water and wastewater services. The application of DEA for the public sector in Australia, and more specifically for local

government services is investigated in the third part of the paper, followed by the treatment of service quality measures. The article ends with some brief concluding remarks on local government efficiency measurement in Australia.

Efficiency Measures in Australian Local Government

Despite the size of local government in Australia and the services it provides, relatively few studies in the measurement of its efficiency and productivity have been undertaken over the years. This may be in part because of the difficulties in measuring public sector performance.

The lack of performance measures in local government therefore might be due to various factors, not least: A lack of profit seeking or cost minimisation behaviour and hence desire to have suitable monitoring mechanisms; services generally having ill-defined and/or multiple outputs; difficulty in apportioning costs over different services; and the inconsistent and incomplete nature of some of the data that is available.

State Comparisons

A key strategy in improving local government performance over the past decade has been the development of performance measures for use in the benchmarking of services. To measure performance and assess the efficiencies of councils, many of the states and territories have required councils to provide information on key service areas. Although this has varied somewhat between the states, more detailed and better-defined data continues to be collected each year. It was not until 1995 that national performance indicators were first proposed at the Local Government Ministers' Conference and since then the National Office of Local Government has facilitated a voluntary process of developing and adopting standard performance measures and indicators with the states, peak industry bodies and technical committees. No efficiency measures for councils services are currently compared Australia wide since indicators and definitions vary from state to state.

Each state now either releases comparative performance data for local government on a annual basis or is in the process of doing so (NOLG 2001: Appendix J). A summary of the areas for which indicators are produced for each state is given in Table 1.

New South Wales

The NSW Department of Local Government (1998-99, 1999-2000) *Comparative Performance Information* publications contain partial performance indicator time series data since 1994-95 covering financial and corporate, planning, waste management, libraries, water, sewerage, environmental management and health, recreation and leisure services and

community services. Road services comparative performance information has been excluded since it was believed that the methods councils have used to determine maintenance costs varies across NSW and does not make the measure meaningful. Alternative measures for road services are currently being examined.

Apart from comparing performance indicators against the "average council" figure for NSW or against that council's figures for previous years, no analysis of the partial performance measures is made. The limitations of the use of partial measure are identified in the 1999 report:, which argued that "key performance indicators do not show that in some cases councils have made conscious decisions to provide lower or higher levels of service, according to local needs. These limitations do not however invalidate comparisons. Communities have the right to see how their councils compare with others and the right to see how efficiency, economy and resource allocation varies from council to council and to question why it is so." (DLG 1999: 15). Thus a lower cost of service per population may be a result of being more cost efficient (quantity of service measure) or a result of providing a lower level of service (quality of service measure). We will return to this important question later in the paper.

Table 1: State Publication of Local Government Performance Information

Performance Measure	**NSW**	**VIC**	**QLD**	**SA**	**WA**	**TAS**	**NT**
Detailed data from	**94/95**	**97/98**	**97/98**	**99/00**	**94/95**	**99/00**	**97/98**
Number of Indicators	**30**	**76**	**38**	**-**	**30**	**-**	**57**
Asset Management		*		+			
Cleaning		*					
Community	*	*	*				*
Corporate/Admin	*	*			*		
Customer Satisfaction		*		+			
Environmental	*						
Financial	*	*	*	+			
Governance		*		+	*		
Health					*		
Library	*		*		*		
Planning	*	*			*		

Quality of Life				+			
Recreation	*	*			*		
Recycling	*						
Regulatory	*						
Roads		*	*		*		*
Waste	*	*	*		*		*
Water Supply	*		*				
Wastewater	*		*				
Welfare / Family		*			*		

Primary Source: NOLG 2001, 1998/99 Report on the Operation of the Local Government (Financial Assistance) Act 1995 – Appendix F and advice from State Departments of Local Government.

*Note: * indicates performance indicators are compiled*

+ indicates a pilot program only is currently being carried out

Victoria

Victoria currently reports on 29 annual plan indicators and 47 service indicators. However, a review has been undertaken to improve the system and reduce administrative costs by decreasing the total number of indicators. It is recommended that in future only 10 statewide performance indicators in the areas of affordability/cost of government, sustainability, services, infrastructure and governance be produced. The refinement in service specific indicators has yet to be determined. To date the circulation of the indicators has only been amongst Victorian councils, although a document for general publication is now under consideration for the next series of data.

The indicators are not referred to as performance measures, but rather as comparative indicators that may represent different council goals and resource commitments as much as levels of efficiency. The indicators are simply tabulated and not analysed to draw any conclusions.

In addition to these indicators, a community satisfaction survey was undertaken in 2000. This is the third such survey in which residents were asked to score council performance in the areas of services, customer service, advocacy, and overall performance. 88 percent of

councils appeared to have improved their community satisfaction rating from the previous annual survey.

Queensland

The first comprehensive comparative report was the *Queensland Local Government Comparative Information 1997-98*, which provides partial performance indicators for such services as road maintenance, water, wastewater, waste management, library services, rating and financial information. A second publication has now been produced which will also include additional indicators for financial operations and parks. The Department of Local Government and Planning does not currently publish the comparative information and raw figures only are complied after a verification process is completed. Being the first set of partial performance measures, analysis has not been carried out to determine what is an acceptable level of performance for each of the service areas.

South Australia

South Australia's development of performance indicators lags behind other states. A pilot study was commenced in 2000 to develop key performance indicators in governance, financial and asset management, customer satisfaction and quality of life. No formal process currently exists to compare the performance of councils within South Australia and it is not expected that comparative information would be available for at least another year.

Western Australia

The fourth in series of *Comparative Indicators for Western Australian Local Government* is being produced which includes 7 financial and 23 operational indicators. Time series data for each of the four years is to be included in the report. The financial measures give an indication of the financial viability of the council and include debt to equity and debt to rate income ratios. These financial figures bear little relationship to the efficiency of services provided by councils, but rather to the total amount of services provided compared to the total income base. The relevant operational measures are the important factors in determining efficiency and productivity for a particular council service.

Data for 1998/99 was collected in 2000 for compilation. However, the WA Department of Local Government has noted that "the timeliness of data collection and the quality of data being provided to the Department still remain significant problems for which no practical solution has been found" (NOLG 2001: 180). In common with many of the other states reports consist of basic data sets with no analysis, and are not widely circulated apart from the councils themselves.

Tasmania

Tasmania is in a similar situation to that of South Australia. A Measuring Council Performance Project has been set up to establish key performance indicators. The indicators will be available for the 1999-2000 financial year. Until this information is forthcoming, no formal procedure currently exists to compare the performance of councils within the State.

Northern Territory

The second *Northern Territory Local Government Performance Report (1998-99)* has been produced with improved measures in road maintenance, waste management and community management. No overall results are documented in the report. Relative performance can be ascertained by comparing indicators with other similar councils or with the previous year's data.

Because of the remoteness and low population densities in much of the territory, the municipal and larger councils use a separate set of indicators to that of the smaller and remote councils. Not all of the councils are included in the second report.

In sum, there are now comparative partial performance indicators documented for a variety of councils in a majority of the Australian states. However, performance has been exclusively assessed by either comparing performance indicators against that for similar councils, the "average council" figure for that state, or by comparing with previous years indicators for that council. Little effort has been directed at explaining why there are differences between councils, determining what constitutes best practice levels of efficiency, or the state governments applying direct pressure to force inefficient councils to improve performance (through linking grant funding to performance).

Efficiency Measures in Water and Wastewater

A study carried out by the Australian Water Resources Council (AWRC) in 1991 was the first formal inter-agency study on performance in the water industry in Australia. The AWRC study compared the cost of providing water and wastewater services per head of population across metropolitan and non-metropolitan regions of Australia for the year 1988/89. The metropolitan regions consisted primarily of GTE water authorities (eg. Melbourne Water). The non-metropolitan regions comprised a mixture of GTE water authorities (eg. the non-metropolitan division of the Water Authority of Western Australian) and aggregated figures from country urban water authorities which included local government water authorities (eg.

an aggregate of Tasmania's country urban water authorities). Representative data was therefore obtained for the following areas:

Metropolitan Water Utilities	*Country Water Utilities*
ACT Electricity and Water	Qld Country
Brisbane City Council	NSW Country
Hunter Water	SA Country
Melbourne Water	Vic Country
SA Water (Adelaide)	WA Country
Sydney Water	Tas Country
WA Water (Perth)	

While costs for individual council services were not given, the study highlighted large variations in the two partial performance measures employed; namely operating cost and total cost per population as shown in Table 2. One limitation on the use of partial performance indicators is that they can not account for any effects from differences in the scale of operation.

Table 2: Cost per Population for Water and Wastewater Services across Australia in 1988/89

Region and Service	**Cost Type**	**Lowest ($ per capita)**	**Highest ($ per capita)**
Metropolitan Water	Operating Cost	45 Melbourne	84 Hunter
	Total Cost	118 Perth	196 Hunter
Metropolitan Wastewater	Operating Cost	35 Adelaide	67 Hunter
	Total Cost	114 Melbourne	193 ACT
Metropolitan Total	Operating Cost	84 Melbourne	151 Hunter
	Total Cost	264 Perth	357 ACT
Country Urban Water	Operating Cost	44 Tasmania	154 WA
	Total Cost	101 Tasmania	559 SA
Country Urban Wastewater	Operating Cost	40 Qld, Vic	53 SA
	Total Cost	99 Victoria	202 SA
Country Urban Total	Operating Cost	86 Victoria	203 WA

Total Cost	216 Victoria	761 SA

Source: AWRC 1991, (cited in Industry Commission 1992: 54)

Note: Figures in dollars per population

Figures include a 4% real rate of return

The study provided the following comments on the results obtained:

- Variations may be in part explained by the use of the population base in developing the indicators, as it does not take into account "environmental factors"; that is factors which influence costs but are not at the discretion of management to change (sometimes also called non-discretionary factors). Some of these factors were identified as the industrial base serviced, geographic and topographic characteristics, and age of the assets;

- Hunter Water's high cost could not be explained solely in terms of different environmental factors (ie. the service was inefficient compared to other organisations even after allowing for these factors);

- Very high costs of country water services in Western Australia and South Australia reflect the topography and the cost of maintaining extensive pipe networks with relatively small customer bases;

- High total costs for ACT Electricity and Water could be partly explained by its relatively new assets, which were not being used at full capacity; and

- Any differences in standards of services were not taken into account.

The Steering Committee on National Performance Monitoring of Government Trading Enterprises developed a method of calculating total factor productivity (TFP) using index numbers (SCNPMGTE 1992). This work contained six case studies, including one for Melbourne Water where a single performance measure was obtained for five service areas. The outputs used were the amount of water supplied, wastewater treated, tradewaste agreements, drainage services and parks services. Inputs used were labour, material, capital stock, contract services and all other inputs.

The method utilised a Tornquist index defined in log-change form:

$$\ln (TFP_t/TFP_{t-1}) = \Sigma_i \tfrac{1}{2} (R_{it} + R_{it-1}) \ln (Y_{it}/Y_{it-1}) - \Sigma_j \tfrac{1}{2} (R_{jt} + R_{jt-1}) \ln (X_{jt}/X_{jt-1})$$

where there are i outputs (Y), j inputs (X), R is an output share, S is an input share and t is the relevant year.

The use of revenue shares in the calculation of TFP relies on the rates (prices) being charged accurately representing the values of the services being provided. In monopoly situations, such as the Melbourne Water, as well as most publicly supplied services, this can be problematical since the firm can manipulate prices. The use of revenue shares also limits any comparisons with other firms and the determination of what is the best practice efficiency for the industry.

The report found that for the period 1984/85 to 1990/91 outputs for Melbourne Water increased at an average of 2.2 percent per year, inputs increased by 1.3 percent per year, and TFP increased by 0.9 percent per year. Conclusions included the observation that "the case studies included in this paper illustrate that a good start often can be made on calculating total factor productivity indexes with data that is currently available…. The quality of capital data remains a problem in particular remains a problem in some instances." (SCNPMGTE 1992: iv).

Manning and Molyneux (1993) extended this study. Melbourne Waters TFP was calculated for the period 1984/85 to 1995/96, with estimates used for the last four years. Average annual TFP growth was assessed at 1.4 per cent.

The ACT Auditor General used DEA to measure the overall efficiency of several water authorities, including ACT Electricity and Water (ACTEW) against United Kingdom counterparts (ACT Auditor General 1995). Water, wastewater reticulation and wastewater treatment were assessed separately in the study. Environmental factors such as sources of water and residential/industrial/commercial client mix were taken into account in the DEA. However, the study did not assign individual results to the other water authorities, so that only ACTEW results could be identified. The report suggests that ACTEW had the potential to reduce water, wastewater reticulation and wastewater treatment costs by 36, 12 and 40 per cent respectively.

Partial performance indicators across metropolitan and non-metropolitan regions of Australia have continued to be collated by Water Services Association of Australia (WSAA 1999) and

Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ 2000) for the years 1988/98 to 1998/99. The number of indicators has risen substantially from the two assessed in the Industry Commission (1992) review to nine at present. These indicators now include: water operation cost (operating, maintenance and administration cost) per connected property; wastewater operation cost per connected property;
compliance with 1987 microbiological drinking water guidelines; water main breaks per 100km of pipe; confirmed sewer chokes (pipe blockages) per 100km of pipe; employees per 1000 properties (water and wastewater); economic real rate of return (water and wastewater); properties served per main (water and wastewater); and percentage of waterwater receiving secondary treatment.

Data for the metropolitan water authorities has been sourced from various government reports, such as the NSW Treasury (2000) and Productivity Commission (2000). It was noted that there was limited data for the above parameters for country water utilities in the eastern states other than NSW, where councils mainly supply the service. Data for Tasmania and the Northern Territory was not included. Country water services in Western Australia and South Australia are provided by the Water Authority of Western Australian and the South Australian Water Corporation respectively. In common with the Industry Commission (1992) study no detailed assessment of the collated performance indicators was carried out in either study. The main features of the time series data were: A steady improvement in Hunter Water's costs for both water and wastewater; a continuation of high costs of country water services in Western Australia and South Australia; an improvement in ACT Electricity and Water's water costs but wastewater costs continue to be high; costs for other regions were relatively constant; and for the first time measurement of service quality data provided partial indicators of the level of service (how good the service was) that the utilities were providing.

Only NSW to date has compiled comprehensive partial performance indicators for local government water authorities. This consists of some 126 councils that provide water and watewater services (DLWC 2000 and 2001). The indicators are compiled from information submitted by councils to the DLG, and are now updated yearly. The data is not independently audited. However, draft spreadsheets of indicators are first sent to councils to help identify and amend any strange results prior to publication. To avoid the variations experienced previously when comparing authorities from different states, definitions of the indicators are provided to councils to enable consistent interpretations. Indicators included all of those

contained in the WSAA and ARMCANZ reports and in addition the following indicators: Management costs, treatment costs, pumping costs, water and sewer main costs, energy consumption, sewage overflows, re-use of reclaimed water, customer complaints; and customer interruption frequency.

In addition to these indicators, information on business characteristics, charges, typical bills and annual turnover is documented. Data is listed from 1995/96 for basic information and generally from 1998/99 for the more detailed data. Earlier data had been collected but was considered less reliable and therefore was not included in the main tables, although data back to 1991 was included in some state-wide trend graphs.

Results reported from the comparative information included:

- Annual residential water consumption had fallen from 330 to 230 kilolitres per annum between 1991 and 1998/99;
- Average operating (operating, maintenance and administration cost) costs per connected property has remained at $185 for water supply and has increased from $170 to $210 for wastewater between 1991 and 1998/99;
- Average management costs per connected property has increased from $55 to $80 for water supply and has increased from $53 to $70 for wastewater between 1991 and 1998/99;
- Most of the increases in wastewater operating costs are attributable to the increasing standards of wastewater treatment and increasing management costs; and
- Interstate comparisons using indicators from the ARMCANZ study showed that the average water operating costs across NSW are significantly less than for Sydney Water, WA country and SA country utilities. Average wastewater operating costs across NSW are less than for Sydney Water and similar to other Australian utilities.

Because of the number of councils providing water and wastewater services in NSW and the extent and quality of the data now available, the DLWC comparative time series data lends itself to further analysis and the calculation of total efficiency (compared to partial efficiency) and total factor productivity measures.

The Australian Water Association (2001) has recently produced an Australia-wide performance comparison report of the non major urban water utilities. This is its third report

and includes data for the three years, 1997/98 to 1999/2000, on water utilities having between 10,000 and 50,000 assessments (or properties). The approach taken has once again been to compile partial performance indicators. The limitations of such an approach was recognised in the report as follows: "It is important to emphasise that any particular performance indicator provided in this report is only a 'partial indicator'. In order to assess the performance of a utility, it is essential to consider a suite of related indicators. For example, a utility may appear to be a relatively good performer in operating cost per property but, on investigation, has a correspondingly low level of water quality compliance, a high number and duration of service interruptions, or a significant advantage in having high source water quality." (AWA 2000: 8)

Cost driving factors for the water industry were identified in the report (AWA 2000) as being urban planning, health guidelines, environmental standards, variability of wastewater flows, asset life cycles, design and construction standards, cost of capital, government policies, regulatory practices and the physical operating environment (geography, climate and topography). Most of these factors are non-discretionary factors; that is, they are beyond management's ability to control or change.

The report (AWA 2000) consists of tables and graphs using a similar list of indicators as contained in the WSAA and ARMCANZ reports and little in the way of overall finding were given in the report.

In sum, Australian empirical work to date on efficiency and productivity in Australian water and wastewater services have generally involved the use of partial performance measures only. While some performance data is available back to the mid-eighties, it was not until the mid-1990s that reliable, comprehensive performance measures were accumulated. There is a pressing need take a more rigorous holistic approach to the assessment of water and wastewater efficiency and productivity. The NSW Treasury confirms this view by noting that, "IPART has used more sophisticated techniques, such as DEA and stochastic frontiers, to help assess the efficiency of local electricity distributors and gas distributors. These techniques can include different operating environments in the analysis…. Treasury suggests a similar exercise would help IPART to better assess the efficiency of the NSW urban water authorities" (NSW Treasury 2000: 11).

Application of Data Envelopment Analysis (DEA) to Local Government

With the development of performance measures for the public sector, new techniques to assess the efficiency of government services have been explored. Methods to assess TFP have been examined, but problems have been encountered in applying a TFP approach to government services. This is because price data for each input and output is required to calculate the TFP using index numbers and often these can not be identified for government services.

Alternative ways for measuring productivity and efficiency where there are multiple inputs and/or outputs have also recently been investigated. The most promising of these are DEA and stochastic frontier analysis which use non-parametric and parametric techniques respectively on input and output data to estimate TFP. Price data is not required for these two methods to calculate technical efficiency and TFP provided relevant input and output data is available from a large number of organisations.

It was not until the late 1980s that DEA was first used in the public sector and only in the past few years has it been applied to Australian local government. Worthington and Dollery (2000a) provide a review of problems in efficiency measurement for the public sector and analyse some 27 worldwide studies utilising DEA, stochastic frontier and other methodologies applied to local public sectors. Worthington and Dollery (2000a) concluded that while the number of international studies applying econometric and mathematical frontier techniques to the efficiency of local government has been small, a good foundation had nevertheless been laid. It was reported that some common themes were evident from the studies, advocating that "empirical analysis of local public sector efficiency suggests that it is a unique product of complex non-discretionary inputs and outputs, and inherently complicated political, institutional and cultural factors" (Worthington and Dollery 2000a: 41).

The Steering Committee for the Review of Commonwealth/State Service Provision (1998) presented summaries of five studies where DEA has been employed for Australian public services: Victorian hospitals; Queensland health oral services; NSW correctional services; NSW police patrols; and NSW motor registries. These studies used a relatively simple DEA approach incorporating discretionary input and output variables into a single stage process. Environmental and other variables that may have impacted upon efficiency but were not at the discretion of management to change were not considered in the analysis. In the last two

studies regression analysis was used to assess whether a number of environmental factors had an effect on the measured efficiencies.

The Steering Committee summarised the use of DEA in assessing performance in government services as follows:

> "DEA can be a very useful analytical technique by providing an important first step tool in comparative analysis. But users need to recognise its limitations as an input to the development of public policy. Its theoretical predictions of potential efficiency gains may not be translatable into actual gains when factors such as service quality, fundamental differences between services and the cost of implementing changes are fully accounted for. Non-efficiency objectives such as access and equity are also important policy considerations for government, against which benefits will inevitably be balanced." (SCRCSSP 1997: ix)

It concluded that because of assumptions and limitations, no single performance measure or technique can provide the complete answer. For this reason the committee is interested in applying new techniques and approaches to performance measurement of government services.

Apart from these five studies there has been very limited utilisation of DEA for Australian local government services, mainly due to data quality issues. Worthington (1999) applied DEA to estimate the efficiency of council libraries in NSW. The study showed that depending on the assumptions adopted, 47.6% and 10.1% of the 168 council libraries were technically efficient and scale efficient respectively.

Two DEA calculations were used by Worthington (1999), the first excluded non-discretionary factors and the second included non-discretionary factors in the analysis. The number of councils assessed as inefficient for both methods is given in Table 3.

Table 1: Efficiency Index of Library Services for NSW Councils in 1993

DEA Method Used	**Total Efficiency**	**Technical Efficiency**	**Scale Efficiency**
Excluding non-discretionary factors			

Number of inefficient councils	167	164	166
Mean efficiency score	.177	.221	.837
Including non-discretionary factors			
Number of inefficient councils	152	88	151
Mean efficiency score	.283	.716	.423
Source: Worthington (1999: 37)			
There were 168 council libraries included in the analysis			

The results summarised in Table 3 indicate that scale factors accounted for much of the differences in observed council efficiencies when non-discretionary factors are included in the DEA.

In order to further investigate the distribution of efficiency, Worthington (1999) compared councils by their geographic groups (metropolitan, non-metropolitan urban, coastal and rural councils) using the Mann-Whitney and Kolmogorov-Smimov non-parametric test statistics. From the results of the test statistics, Worthington (1999: 38) suggests that "some of the variation in measured efficiency is the result of non-controllable factors being (inappropriately) excluded from the analysis, while other variation is actually the result of a failure to minimise inputs for a given level of outputs."

Worthington and Dollery (2000b) examined technical and scale efficiencies of NSW councils' in the area of development approvals and regulatory functions. The data used consisted of three discretionary inputs (planning expenditure, legal expenditure and full-time equivalent staff), two discretionary outputs (number of building and number of development applications determined) and six non-discretional inputs (population growth, development index, heritage/environmental index, non-residential building index, population distribution index and non-English speaking background rate).

DEA was used to measure the service efficiency of the 173 councils across the state. It was found that that scale efficiency was less important to technical efficiency in contributing towards council inefficiency for the planning and regulatory function. The DEA calculation was followed by the employment of regression techniques to seek to explain the inefficiency. This regression analysis of the efficiency differences in the provision of planning and regulatory services indicated variation across the sample on geographic and demographic

conditions. It was apparent that for urban councils the main source of inefficiency was excessive legal expenses related to the planning process, while for rural councils it was excessive staff numbers that was the main reason for inefficiency.

A third DEA study comparing local government services was recently carried out by Worthington and Dollery (forthcoming). This study looked at domestic waste management services provided by 103 NSW councils, many of which out-sourced the service to the private sector. The studied mirrored the approach undertaken in Worthington and Dollery (2000b) with results suggesting that inputs could be reduced by 35% on average from 1993 levels based on the observed best practice. The results also indicated that congestion and other collection difficulties encountered in densely populated areas accounted largely for inefficiencies in urban developed councils, whilst the scale of operation was the main cause of inefficiency in regional and rural councils.

DEA provides a new approach to local government productivity in that multi-factorial efficiencies can be calculated and productivity measured over time. This new approach should be seen as complimentary to the use of benchmarking and partial performance indicators and it is hoped will provide explanation for some of the differences between the performance of councils and changes observed over time.

Treatment of Service Quality Measures

As well as the cost of a service, the quality of a service is an important factor in the overall value of the service provided. People generally are willing to pay more for a high quality product than they would for a product with poor quality. Partial service quality indicators have been measured in many of the local government and water performance studies outlined above. These partial measures, however, have not been employed to date in any Australian analysis to assess a total efficiency measure for a service.

However, the Western Australian Office of Water Regulation has recently released aggregated indices for water supply services across 32 towns in that state as part of a performance benchmarking study. Four service performance indicators (two water quality and two supply continuity measures) were factored into an unweighted aggregate service quality score, for each town. The decision to use service performance indicators as the main performance measure of the service "was based on the key outcome of the OWR's Customer

Survey (1999-2000) which found that 84% of respondents rated water quality and reliability of supply as the most important aspects of water supply" (OWR 2001: iii). No attempt was made to incorporate quantitative indicators into an aggregate index.

Concluding Comments

It appears that the study of local government efficiency and productivity in Australia has been limited in both magnitude and approach. Most states now produce partial performance measures through their relevant local government departments. DEA of local government services has only been undertaken in the area of library, waste management and planning and regulatory services, and even then the analysis used data for one year. Accordingly, changes in efficiency (TFP) have yet to be investigated. In the area of water and wastewater services relevant state water departments and water industry associations have undertaken performance comparisons, again using partial measures of performance. Only three documented studies could be found for the Australian water industry where overall efficiency or TFP has been estimated (one using DEA and two using index numbers). Moreover, no study on Australian local government or Australian water and wastewater services could be found where service quality measures were incorporated into the calculation of the total efficiency measure. The review of empirical literature contained in this paper thus highlights the pressing need to develop a methodology to assess overall efficiencies and TFP in Australian local government, and to enable the inclusion of service quality measures.