SUBMISSION TO THE PRODUCTIVITY COMMISSION ON PERFORMANCE MEASUREMENT AND ACCOUNTABILITY ISSUES IN THE AUSTRALIAN SCHOOL EDUCATION SECTORS, UTILISING FINANCIAL AND NON FINANCIAL DATA SETS CONTAINED IN THE SCHOOL EDUCATION EVIDENCE BASE

Background

Performance measurement studies that utilise school level financial and non-financial data sets evolved initially in diverse Management Accounting, Management Control, Public Finance and Production Modelling applications derived from the Production Economics and Operational Science literatures, (Harrison et. al. 2012). Particularly in the management accounting literature these approaches were developed in the context of private sector organisations where stakeholder objectives primarily related to the maximisation of firm value and survival in competitive environments. Such frameworks are still useful in public sector organisations, however issues of accountability related to nonfinancial performance are more important in the public sector than in private sector organisations. The purpose in the private sector relates to management decision making and control whereas public sector purposes relate to public accountability, efficiency of service provision, and containment of costs.

An appropriate starting point for performance measurement studies in both public and private sector schools utilises a benefit-cost framework focused on inputs, output and outcomes, which considers the relationships between efficiency in addition to effectiveness, concepts adapted from the private sector. However the concept of economy or value for money and public accountability is unique to the public sector. Efficiency is typically defined as the ratio of outputs to inputs, with the goal being to maximise output for a fixed level of input, minimise input for a fixed level of output, or a combination of both. Recent Australian School Efficiency and Performance studies are Blackburn 1983, Chakraborty and Blackburn 2013, Blackburn, Brennan and Ruggiero 2013 and 2014, Pugh, Mangan, Blackburn and Radicic 2014, and Wanke, Blackburn, and Barros 2016. In these empirical studies efficiency and effectiveness is clearly considered in relation to the accomplishment of organisational objectives often defined as the ratio of costs to outcomes. Value for money or economy measures in the public sector economics literature relates to the containment of costs within annual budgetary appropriations.

Initial School Performance Measurement studies utilising Efficiency and Productivity analytics

Ramanathan (1985) was the first Management Accounting academic to operationalise the analytical perspective that has since become known as the “THREE E” conceptual framework using such benefit-cost criteria. Ramanathan’s objective was to link expenditure to results that embodied the social mission of the relevant public sector organisation, thereby providing the rationale for its existence. Based upon the initial path breaking research by Bradford, Malt and Oates (1969), one of the first group of Econometricians and Management Accounting adaptors of such research efficiency analytics using Data Envelopment Analysis (DEA) research methodologies was the classic study of Duncombe, Miner and Ruggerio (1997), followed by Dopuch and Gupta (1997), using Stochastic Frontier Analytical (SFA) research methodologies. Both used this “THREE E” Ramanathan conceptual framework whereby their studies integrated both management control and performance benchmark evaluation issues, such work influencing the subsequent ‘D3’ Data Driven Decision Making (DDDM) analytical framework of Mandinach, (2012). Ramanathan disaggregates the benefit- cost criteria into a series of control linkages that intimately connect benefits to costs as follows:-

B/C = (B/OC) (OC/O) (O/I) (I/C)

Each of the above ratios reflects a control perspective linked through to an overarching Social Benefit/Social Cost whereby the social benefit per dollar spent (B/C) is equal to the multiple of the social benefit per successful outcome (B/OC), the success rate at achieving outcomes (OC/O), the productivity rate (O/I), and the resources available per dollar spent (I/C). The social benefits (B) are the financial measures of the social value of the benefits provided by the organisation and should reflect the organisation's social mission. Outcomes (OC) are the nonfinancial measures of the social benefits. Outputs (O) are the nonfinancial measures of the volume of activity of the organisation. Inputs (I) are the nonfinancial measures of the resources consumed by the organisation linked to the production of outputs. Finally, costs (C) are the financial measures of the resources consumed by the organisation and used as the basis for standard costs and expense budgets.

As outlined by Harrison (2012), in a public sector entity, it is important that different parts of the organisation should only be evaluated in terms of the control linkages over which managers have direct control or that directly affect managers' 'modus operandi'. In the context of Australia the Commonwealth Government's perspective would include the entire model. The Commonwealth Department of Education would focus on outcomes, outputs, inputs, and costs; State Government service providers (State Government Education Departments), would focus on outputs, inputs and costs; and users of the State Education Departments services would focus on outputs and outcomes. The application of the preferred Ramanathan's 3E (1985) perspective using both the extant DEA, SFA and newer 'hybrid' school efficiency modelling analytics underpins E3's research perspectives. Such an analytical framework is equally relevant to the diverse School Education systems in each of the eight Australian State Government Education Departments, as well as the Catholic Systemic schools Education Offices and the Association of Independent Schools. Nationally across each of the eight Australian States and Territories E3 in the near future will further utilise this empirical framework of control linkages as outlined in Table 1, similar to those recently completed in a series of empirical efficiency and productivity studies by E3 in the context of New South Wales Government schools. Such empirical studies will provide much needed examples of measures of the currently prevailing school cost and learning efficiency drivers across all school sectors, for use by the respective school sector stakeholders.

Ramanathan's Framework Applied to the Education System

Control linkage	Education system
Social mission	Enable students to achieve their full potential in society
Social benefits	Increase in lifetime income of workforce, increase in economic growth, reduction in private training, and reduction in unemployment benefits
Outcomes	Number of students entering further education and number of students gaining employment
Outputs	Number of examination passes, number of higher grades achieved in examinations, number of hours of student learning, average number of years in school, number of days of truancy, number of sporting activities or achievements, number of cultural activities, number of social activities, and number of artistic activities
Inputs	Teacher numbers; administration staff numbers; classroom equipment hours; number of classrooms; number of books, computers, and other educational materials; innate ability and knowledge of students; and students' willingness to learn
Costs	Teachers' salaries, management and administrators' salaries, other staff salaries, expenditure on learning resources, expenditure on property and maintenance, and all other school expenditure

Table 1 Harrison, 2012

If the purpose is to compare the performance of a State Education Department then outputs, inputs and costs are likely to reflect best the variables over which the Department has direct control. This generic analytical framework should be used as a blueprint for designing performance models for different school stakeholder groups indicated above, reflecting their respective and differing school stakeholder objectives.

The simultaneous interconnected cost and learning efficiency driver modelling process pioneered by E3 underpins the development of a similar performance measurement framework for all Government and Private schools in Australia as summarised in Figure 1. The State Departments of Education, the Catholic Education Offices and the Association of Independent Schools each fit into this generic stakeholder performance measurement framework, with appropriate possible modifications. Each school sector would need to appropriately fine tune the exact control links in their respective school service provision model. Nevertheless the school service providers in each school sector would need to articulate the performance variables over which they currently have control, namely outputs, inputs and costs. These data items nevertheless can be downloaded independently from the ACARA MY SCHOOL Finance Data base for all the above 9,600 Schools Australia wide from 2009-2014

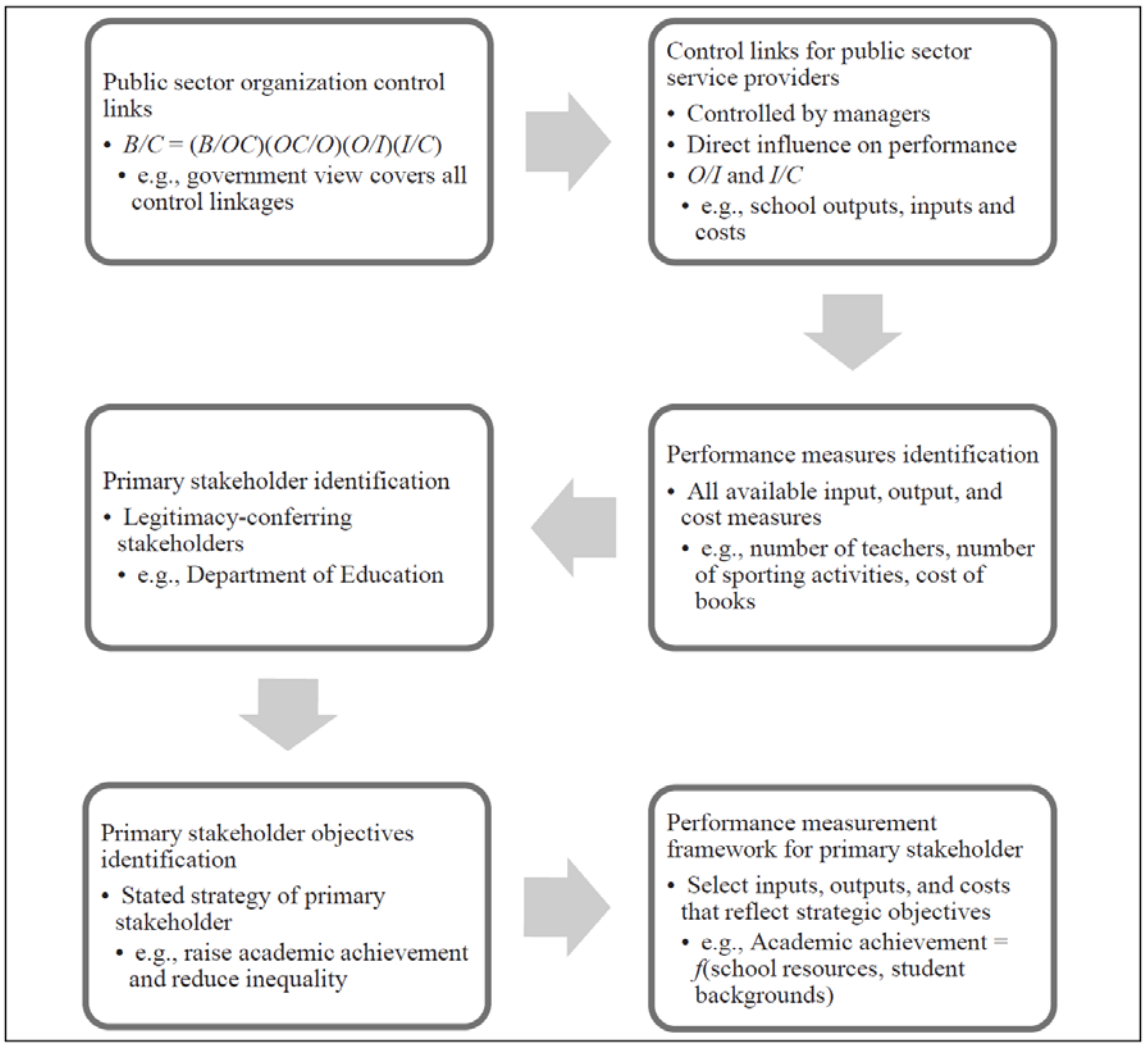


Figure 1, Harrison 2012

Economics of School Education focused on Efficiency and Productivity dimensions

Issues relating to performance measurement in both the public and private sector schools have been examined extensively in the economics of education literature over almost five decades. This literature has developed a conceptual model of school education production and performance measurement whereby the strategic objective of schools is taken to be the maximisation of academic achievement for the available school resources, environment and technology, (Bradford, Malt and Oates 1969, Hanushek, 1979, Ruggiero, Duncombe and Miner, 1995, Duncombe, Miner and Ruggiero, 1997, in an American schooling context and Blackburn, Brennan and Ruggiero, 2013, and Blackburn, Brennan and Ruggiero 2014, in an Australian schooling context. Attachment 1 outlines the Bradford, Malt and Oates 1969, and the Ruggiero, Duncombe and Miner 1995 transformation of school input to school output, decomposed into two processes, (a) 'school activities', called 'D' output and (b) the transformation of school services to school output,'C' output. This methodology forms the basis of the Blackburn, Brennan and Ruggiero 2013 article, and the Blackburn, Brennan and Ruggiero, Springer 2014 book "Non Parametric Estimation of Educational Production and Costs using Data Envelopment Analysis", 2014. In addition Attachment 2 outlines the Hickrod, 1989 Quadriform Analytics perspective that initiated the literature on "value for money" school efficiency models. Their model has recently been adapted and updated by Wanke, Blackburn and Barros, in their recent journal article "Cost and Learning Efficiency Drivers in Australian Schools: A Two Stage Network DEA Approach", Applied Economics, February 2016.

As indicated above the primary stakeholders for schools in the Australian public schooling context are the eight jurisdictional Government School Education Departments. The parallel nongovernment primary school stakeholders are located in the respective eight jurisdictional Catholic Education Commissions and the Australian Independent School Authorities. A summary of the current and proposed future research framework currently being fine- tuned by Essential Education Economics (E3), and its Econometric research arm School Efficiency Metrics Australasia, (SEMETRICA), across all 9,600 Australian Public and Private schools Australia wide is shown in Figure 2. This framework is based on the key objectives of the primary stakeholder for the respective school sector and jurisdictional authorities. The central objectives of each Australian School sector is well summarised in the MCEETYA Melbourne Declaration (2008) on Educational Goals for Young Australians. The missions or objectives agreed upon were "Improving educational outcomes for all young Australians which is central to the nation's social and economic prosperity and will position young people to live fulfilling, productive, and responsible lives. Goal1: Australian Schooling promotes equity and excellence; Goal 2: All young Australians become: * successful learners,* confident and creative individuals, *active and informed citizens". The more recent 2012 Gonski Inquiry recommended more-wide ranging funding initiatives based on a Schools Resourcing Standard to enhance greater equity in Australian schooling with the greatest additional funding initiatives to achieve this objective previously expected to start up in 2017/18 and subsequent years. Any enhanced future equity funding recommendations are currently being fully reviewed and refocused by the current Commonwealth Government, with any major future changes for introduction after 2017 to be decided in the upcoming July 2, 2016 Australian Federal Election.

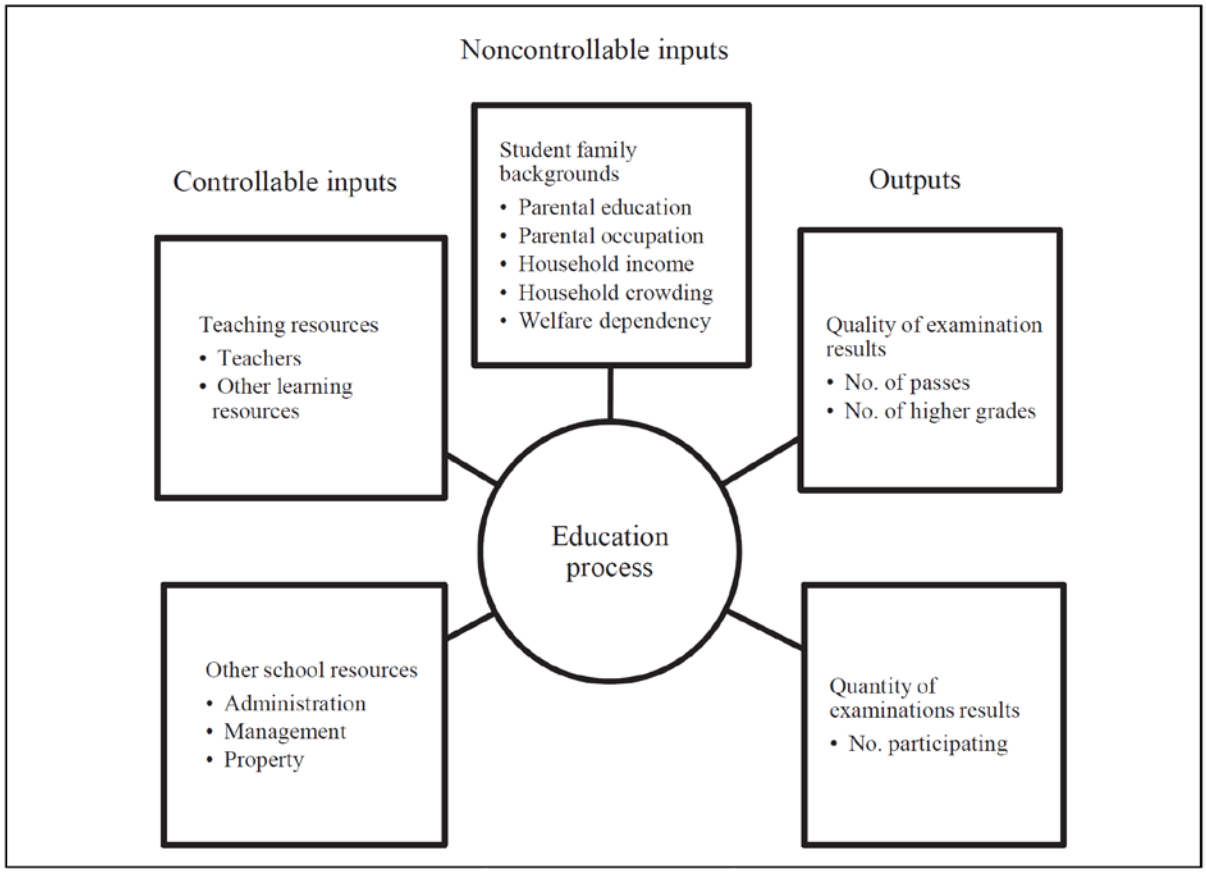


Figure 2 Harrison 2012

In addition to the common objective of increasing the level of academic achievement indicated previously, jurisdictional education Departments and Commissions are responsible for the control of input consumption and for compliance within the budgetary constraints imposed by governments. These twin objectives are consistent with a framework of school performance specified in terms of the maximisation of school outputs for a given level of school inputs. The preliminary research study objectives undertaken thus far by Essential Education Economics (E3) and SEMETRICA, (School Efficiency Metrics Australasia), have already been accomplished with the completion of seven Journal articles/ Working Papers and a recent top selling DEA case study text book, accompanied by very detailed SAS Machine code for all case study empirical model applications. This book is currently in world-wide release in the Springer International Series in Operations Research and Management Science, New York, **("Nonparametric Estimation of Educational Production and Costs using Data Envelopment Analysis, DEA"), Blackburn, Brennan and Ruggiero, 2014).** E3's current focus is to further develop such 3E additional collaborative studies and consultancies within the DDDM, (3DM), conceptual framework across all Public and Private school authorities Australia wide as well as internationally using a recently developed world first "hybrid" research efficiency software.

Key Input and Output variables used in World- wide School Efficiency and Productivity Modelling

From the extensive Economics of Education literature, the key inputs directly influencing school performance are variables related to the consumption of school resources and student characteristics and family background variables, e.g., Hanushek, 1986; Hedges, Laine, Greenwald, 1994; Chakraborty and Blackburn 2013; Blackburn, Brennan and Ruggiero, 2013 and 2014, Pugh, Mangan, Blackburn and Radicic 2014, and Wanke, Blackburn and Barros (2016). For school resource

variables it is important to capture all resources employed related to the education process. Further these variables should be divided between learning resources, inputs directly connected to the learning process, and non -learning resources to allow for an analysis of whether the mix of resources affects student performance. Learning resources include measures of teacher quantity and/or quality (e.g., teacher qualifications and years of experience), and other learning resources (e.g., books, and computers). Other school resources include measures of all other school resources indirectly connected to the operation of schools, including administration, management and operational inputs (e.g., depreciation, capital maintenance, capital asset expenditure, written down value of assets, and the number of nonteaching staff).

It is also necessary to incorporate student and family background variables to ensure schools are not penalised due to the characteristics of their students. Both a student's own family and his or her peers' family backgrounds directly influence a student's level of achievement, (e.g., Feinstein & Symons, 1999; Chakraborty and Blackburn, 2013; Pugh Mangan, Blackburn and Radicic, 2014; Haug and Blackburn, 2014). For government owned schools the ability to control the background characteristics of students is low. However if these important non-controllable variables are excluded, schools with students from higher socioeconomic backgrounds will appear to perform better than those schools with students from lower socioeconomic backgrounds. This could lead to inappropriate corrective action being taken in respect of schools with students from low socioeconomic groups who are performing well. Student achievement in academic examinations is most preferred as the school output measure, in secondary education Year 12 ATAR exam results which are a direct measure of what schools do. Furthermore these exam output results are valued consistently by jurisdictional Government Departments and Commissions of Education, in addition to students, parents, employers, policy makers and are necessary for the continued higher education or employment of students (Hanushek, 1979). In addition standardised achievement tests since 2008 conducted by ACARA in its NAPLAN testing for Australian school years 3, 5, 7 and 9 is standard across all Australian schools and subject to external control and validation. However such standardised tests have somewhat lower validity than do curriculum based examinations because they do not directly assess what schools are teaching, (Hanushek 1979; Rowe, 2000; Ruggiero, 2004). In contrast, curriculum based examinations test what has been taught, providing a high level of validity.

Many researchers treat test scores as a 'level' measure of performance, but more recent researchers use a 'value added' approach. As indicated by Gronberg, Jensen and Taylor (2011), a test score is a 'stock' measure of educational output at a point in time, while a 'value added' measure is a measure of the 'flow' through time. These authors argue that a 'flow' measure is more appropriate when the question being addressed is school performance. In reality test scores cannot tell policy analysts how much a student has improved during a school year. Clearly the 'value added' approach is more appropriate for measuring educational efficiency, effectiveness and economy, (the Three E's as used by Essential Education Economics, E3). Indeed, despite well- known estimation challenges, the Education Economics literature has largely discounted levels in favour of value added measures. The 'value added' approach is accordingly used in recent Australian econometric studies of school performance measurement, (Haug and Blackburn 2015). Some other recent studies in this literature have also used additional school output measures related to school attendance rates and apparent retention rates utilising dynamic Generalised Method of Moments Estimator, (GMM) techniques calibrated with panel data sets, (Pugh, Mangan, Blackburn and Radicic, 2014). A further methodological extension for the first time using a Two Stage Neural Network DEA Approach to simultaneously assess the Cost and Learning Efficiency Drivers of Australian Schools has just been published,(Wanke, Blackburn and Barros), February 2016.

School Sector Performance Measurement and Assessment Utilisation

The initial application of the Ramanathan 3E performance measurement framework by Essential Education Economics (E3), in relation to the context of Australian schools could enable the nationwide respective school Primary Stakeholders, (Government School Education Departments, Catholic Education Commissions, and Association of Independent Schools), to evaluate their respective school systems Efficiency, Effectiveness and Economy, the (3E) dimensions. Each of these three school sector stakeholders could then be able to identify schools that are high performers, intermediate and low performers in terms of the Efficiency, Effectiveness and Economy of resource usage focused on the production of academic outputs. Accordingly such 3E modelling by E3 on their behalf could clearly identify those schools in their jurisdiction and sector with high costs per student and/or with low levels of examination results per student, relative to schools with students from similar educational backgrounds, thereby exhibiting characteristics of low performers. This policy impact analysis would then enable the three major Nation- wide respective school Primary Stakeholders to intervene more quickly in the management of such low performing schools to identify ways that either resource use and/or academic results could be improved. Such studies could also be conducted annually using yearly cross section data sets to more closely identify the year to year cost and learning efficiency trajectories by individual schools to set in train swift remedial action. Utilising E3's comparative modelling approach conditioned for family/student background variables, ensures that school performance is relative to those operating in similar environments in terms of the background characteristics of students. As well practices and processes from high performing schools could be more easily identified and disseminated to schools operating in similar environments in each of the three school sectors Australia wide.

Summary

The aim of this short submission has been to develop a generic efficiency, productivity and 'value for money' policy evaluation framework utilising the Australian National Education Evidence Base, designed to measure comparative school performance for the three major school sector providers across Australia's 8 States and Territories, reflecting the differing goals of each school sectors' Primary Stakeholders. The strategic focus of the three School sector Primary stakeholders should be the maximisation of student educational outputs for a given level of resources. It is this '3E' strategic focus embedded in the '3DM' Data Driven Decision Making framework that is commonly found in international OECD school efficiency and performance measurement studies as well as in the latest world- wide Economics of Education and Econometrics research literature.

Contemporary developments in E3 and SEMETRICA's engagement with UK Central School Education agencies

At the present time a similar yet much less rigorous school efficiency analytical perspective has been rapidly introduced into the UK Department for Education, School Education Policy Evidence base. E3 and SEMETRICA have shared their best practice analytical DEA/SFA Econometric research efficiency modelling publications and value for money perspectives over the last three years with the UK Department for Education. Their less granular comprehensive UK school site financial and non-financial data dissections, compared to the much finer 'grained' Australian school site data sets developed by E3, could not achieve the strict standards needed to meet the necessary DEA/SFA modelling requirements. Nevertheless their alternative less sophisticated approach adequately compensated with a more readily adapted and understandable, second best yet quickly implementable statistical methodology at the UK school site level. Whilst recognising this partial very 'reduced form' measure of school cost and learning efficiency that utilises just two

'standardised' school site variables across all UK schools, it is a great accomplishment in the last three years compared to the pre-existing deficient school efficiency and productivity measurement assessments detailed in the UK Department for Education's path breaking report, "Review of Efficiency in the Schools System", June 2013. Essential Education Economics and its Econometric research arm, School Efficiency Metrics Australasia, SEMETRICA, has kept abreast of these developments liaising continuously with the key econometric and research and policy makers since 2012 in the UK Department for Education, by providing requested copies of the range of all E3's previous research papers focused on the already completed Australian School Efficiency and Productivity Studies based on world best practice research methodologies. Such engagement with the less granular data sources has been quickly progressed with much more enthusiasm following the election of a majority Conservative Government in the UK in early 2014. E3 and SEMETRICA are now closely following and being engaged in these wide ranging developments with the key UK school education econometricians.

This collaborative venture has greatly assisted in the more precisely defined yet 'second best' School Performance, (Efficiency and Productivity) Measurement systems now being rapidly implemented across the entire UK school education system. Their UK 'School Efficiency Metric' outlined in February 2016 by the UK Department for Education, was fully informed and supported by SEMETRICA's world wide experience in School Efficiency and Productivity research and policy development expertise accumulated over the last 4 decades. This positive engagement is a good example of E3's fruitful international collaborative school efficiency and productivity research capabilities. Such positive well managed internationally collaborative policy modelling school research projects have also extended to peer researchers in the US, Canada, Scandinavia, NZ, South Korea and Brazil. Such accomplishments have been achieved through detailed genuinely collegiate mutually beneficial engagement, which is a good example of E3 and SEMETRICA's outwardly focused 'modus operandi' underlying its open world -wide agile policy research and relevant collaborative engagement and delivery processes.

Market 'Take up' perspectives for E3 and SEMETRICA's School Performance Analytics

As previously indicated the centre of E3 and SEMETRICAA's evolving School Performance Research implementation agenda is the path breaking research protocols based upon the Ramanathan's 3E Performance Measurement framework, utilising mutually agreed collaborative and beneficial research delivery timetables. Such adaptations crafted by E3 and SEMETRICA are clearly aimed at building a forward looking adaptive policy research entity to create a truly international School Efficiency Metrics presence. This policy based research was focused initially on measuring the Australian School Education Finance three Sector's Primary Stakeholder Efficiency, Effectiveness, Economy, Equity and related Productivity characteristics. This school performance evaluation framework is based on measures of teaching resources, other school resources, student and family background characteristics, and student exam and standardised test score results, (Figure 2 refers). The selection of the respective 8 Australian jurisdictional school sector Primary stakeholders embodied in the 8 Departments of Education, Catholic Education Offices and AIPS Secretariats, is consistent with the applied DEA, SFA and the very recent "Hybrid" Research methodologies used extensively in the universal Economics of Education and Educational Efficiency and Productivity literature. Essential Education Economics (E3) and School Efficiency Metrics Australasia (SEMETRICA), are currently undertaking collaborative research with several Finnish world leading international research colleagues using all the above research methodologies integrated into a comparative META FRONTIER "hybrid" analytical research perspective.

Spin off analytical efficiency and productivity applications for other diverse public and private economic sector industries

The new more recent "hybrid" efficiency and productivity research methodology applications could potentially extend to other sectors of the economy. Additional diversified business opportunities could arise from expanding beyond the School Education Efficiency and Productivity modelling experience accumulated thus far, into the much wider Health, Electricity, Gas, Water, Solar Energy, Infrastructure and related Transport and Urban and Regional Economic Development sectors. Such extensions will enable the building of much more focused 'market ready' Public and Private sector service efficiency and productivity research capabilities across all Australian States and Territories, then into India, China and Indonesia.

However in the first instance E3 and SEMETRICA will focus on building and consolidating to maturity the Public and Private School Efficiency and Productivity sector studies outlined above, linked in with related State Vocational Education and Training perspectives. Such a focus on the immediate and future resource situation is imperative given the current parlous Commonwealth Budgetary perspectives outlined in the December 15, 2015 MYEFO Statement, the May 3, 2016 Commonwealth Budget and the 20 May 2016 PEFO Report,(Pre-Election Economic and Fiscal Outlook). Collectively such 'sign post' documents could imply that no further additional funding to school education in Australia could possibly be contemplated by any post July 2, 2016 Federal Election Commonwealth Government, without a comprehensive Efficiency and Productivity modelling of the impact and value for money of the current COMBINED COMMONWEALTH AND STATE school funding levels on student performance outcomes by both State Government as well as Private school sectors.

Any additional funding in the interim could be tied to achieving an improved focus on delivering much greater STEM teacher capabilities, in order to boost national economic growth. Such a measure will help fill in some of the contractionary national economic impact flowing from lower mineral revenues over time by focusing on upgrading the supply of greater numbers of STEM qualified teachers to guarantee greater STEM literate students capable of finding jobs and setting up businesses in the new innovative technology/ Big Data sectors. Such agile innovation industry capabilities should boost a stronger service export sector focus, made possible by the impact of the future financial services and agricultural demand stemming from the recently concluded Japan, Korean and China Free Trade Agreements.

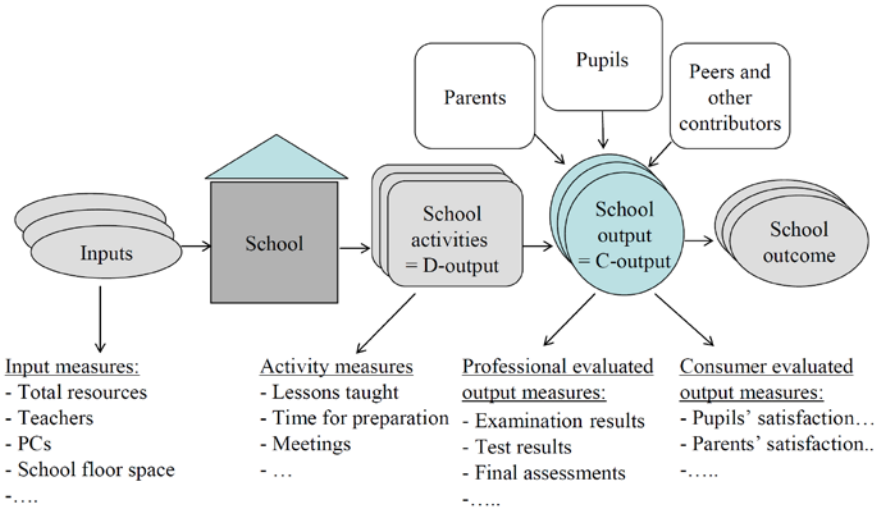
Vincent C Blackburn, Foundation Director, Essential Education Economics (E3), School Efficiency Metrics Australasia (SEMETRICA), National Institute of Budget Studies (NIBS), Northern Australian Sustainable Resource Associates (NASRA), and Australian Generic Innovative Learning Evaluations, (AGILE), Sydney.

Vincent Blackburn

B. Econ (University of Queensland, and Master of Political Economy, University of Queensland Economics Department), Master of Administrative Studies, (ANU Department of Economics), Member of the Economics Society of Australia, (NSW Branch).

blackburn.vincent@bigpond.com

Attachment 1



D. F. Bradford et al, **"The Rising Cost of Local Public Services: Some Evidence and Reflections", National Tax Journal, June 1969.**

This Attachment 1 outlines both the **Bradford, et. al, (1969), and the Duncombe, Miner & Ruggiero, " Empirical Evaluation of Bureaucratic Models of Inefficiency", Public Choice, (1997), model** transformation into two processes of school input into school output domains, decomposed into (a) 'school activities', called 'D Output ', and (b) the transformation of these school activities to 'school output', or 'C Output' . This research methodology is fully contained in **Blackburn, Brennan and Ruggiero, "Measuring Efficiency in Australian Schools: A Preliminary Analysis", Socio-Economic Planning Sciences, August 2013.**

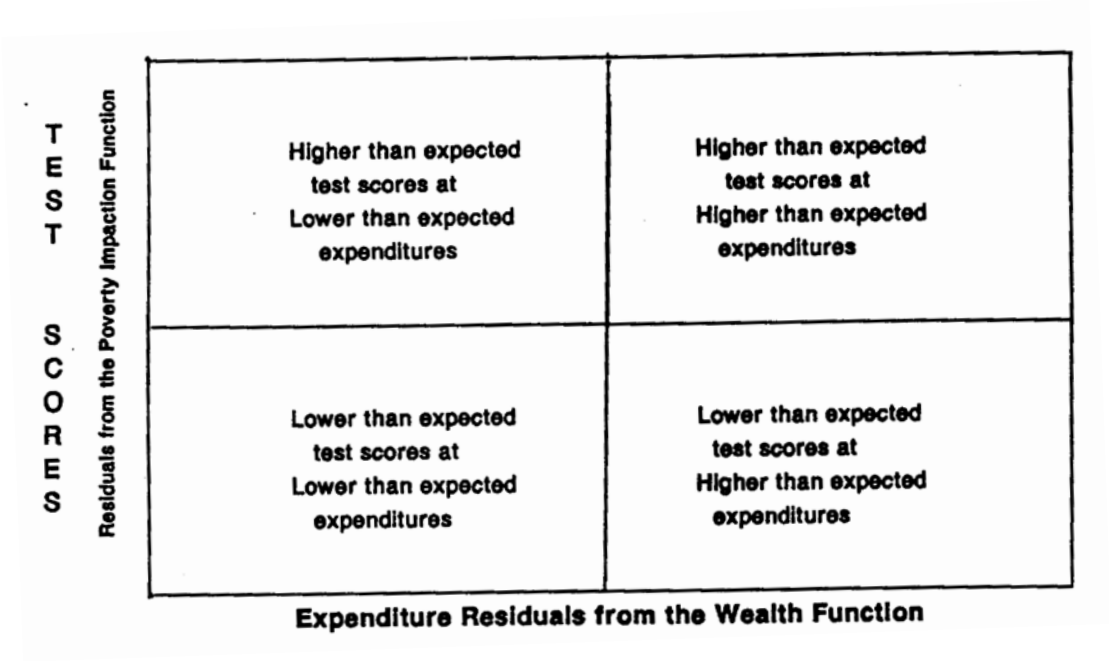
Also much further elaborated over 152 pages with six SAS model application Case Studies, with extensive Machine Code elaborations and full empirical case study write ups, in **Blackburn, Brennan and Ruggiero, "Non Parametric Estimation of Education Production and Costs using Data Envelopment Analysis", Springer New York, International Series in Operations Research and Management Science, 2014.**

Attachment 2

A QUADRIFORM OF

TECHNICALLY ECNOMICALLY EFFICIENT SCHOOLS

VERSUS EFFECTIVE SCHOOLS



G. A. Hickrod et al, The Biggest Bang for the Buck: An Initial Report on Technical Economic Efficiency in Illinios K-12 Schools, Centre for the Study of Educational Finance Illinois State University, Normal Illinois, July 1989.

Attachment 2 outlines the Hickrod et al, 1989 Quadriform Analytics that contain the crucial "VALUE FOR MONEY", or "BIGGEST BANG FOR THE BUCK" perspectives. An updated Australian application version of this analytical research paper is contained **in Peter Wanke, Vincent Blackburn and Carlos Barros, "Cost and Learning Efficiency Drivers in Australian Schools: A Two- Stage Network DEA Approach" published in Applied Economics, Online, 11 February 2016.**

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