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Comparative analysis of outcomes under PPP and traditional modes of delivery: A study of schools in Melbourne

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Abstract

Public Private Partnership (PPP) arrangements are perceived as compelling alternatives to traditional infrastructure development to raise finances and improve efficiency. However, with the substantial improvement in the provision of services through traditionally developed infrastructure, the benefits of PPP implementation need to be continually evaluated. This research investigates three categories of outcomes (educational, stakeholder satisfaction, and general outcomes) for schools in Melbourne implemented under PPP arrangement to those implemented under a traditional procurement method. Data Envelopment Analysis is used to assess the efficiency of these outcomes, based on the consumption of teaching, financial and physical resources. The results indicate that there is no substantial difference between the performance of both arrangements. While the schools implemented under the PPP arrangement have provided better education outcomes, the traditional schools perform better in stakeholder satisfaction and general outcomes. The results indicate that the policymakers need to evaluate infrastructure based PPP arrangements more closely and align with the desired outcomes.

Keywords: Data Envelopment Analysis, DMU, Education, Public Private Partnership, Schools.

Introduction

The use of Public-Private Partnership (PPP) arrangements has been advocated in several countries during the last three decades, with a rapid increase in adoption across various social and economic infrastructure sectors (Bovaird 2010a, Liu *et al.* 2014, Narbaev *et al.* 2020, Ruiz Díaz 2020). PPP arrangements have been used to capitalise on the benefits of financing and cost outcomes, time, project delivery, risks and project delivery (Chowdhury *et al.* 2011, Geng *et al.* 2020). In a typical PPP arrangement, a defined set of activities (a combination of one or more of design, engineer, build, finance, operate, maintain etc.) are transferred to the private sector under a long term contract, with payments linked to performance-based outputs. The arrangement contours are expected to motivate the private sector to perform efficiently than the public procurement alternative, as risks are allocated equitably between the two entities (Yescombe 2011). However, the PPP arrangements have not been an unqualified success but are a mixed bag with a diverse set of determinants affecting the performance across sectors and geographies (Regan *et al.* 2011, Narbaev *et al.* 2020, Ruiz Díaz 2020). Many countries continue to explore PPP arrangements in different sectors as they perceive that the benefits outweigh the challenges (Geng *et al.* 2020, Ruiz Diaz 2020).

The performance of schools is increasingly being researched in recent years to provide pointers for their improvement (Johnes 2015). Policymakers and researchers have used a range of indicators to measure the performance of schools spanning from student marks at different grades/ years, satisfaction levels of various stakeholders and improvements in socioeconomic standards, environment-related parameters (Okpala *et al.* 2001, Raisbeck *et al.* 2010, Hanushek and Rivkin 2006, Javier *et al.* 2016, Blackburn *et al.* 2014, Agasisti and Longobardi 2014, Jehangir *et al.*2015). The PPP arrangements that have been implemented in schools typically involve improvement in physical infrastructure and do not focus on performance indicators relating to the achievement of higher student marks or satisfaction level of different

stakeholders (Raisbeck *et al.* 2010, Saeed *et al.* 2018, O'shea *et al.* 2019). However, the physical environment has been stated as one of the important factors determining school performance (Berman *et al.* 2018, Schlaffer and Burge, 2020, Uline and Tschannen-Moran, 2008), justifying the continued interest in exploring PPPs.

Governments usually provide revenue guarantees in many forms to make the PPP projects viable (Carbonara and Pellegrino 2018). Business models of most PPP projects in the social sector are based on public project proponent (government entity) paying the private developer for the services rendered (for developing and maintaining the schools), as the projects have limited revenues (fees that could be charged from the students) (Bovaird 2010a, Liu *et al.* 2014, Yescombe 2011). This would also mean that the private developers would need to be paid much larger sums than currently in practice if the project scope of the PPP partner is extended to include responsibilities for other school performance measures such as marks received by students or satisfaction with the overall education, which the government or the users are unwilling to pay. As the philosophy of choosing, a PPP arrangement is for achieving a better outcome in the overall project performance (Carbonara and Pellegrino 2018, Geng *et al.* 2020), and it is helpful to investigate whether the same has been realized. There is a relatively lesser quantum of empirical evidence that compares the actual performance of schools when implemented in the two arrangements (PPP and traditional procurement). This research compares a range of outcomes, categorised into education outcomes, satisfaction outcomes and other general outcomes, provided with inputs relating to human capital, expenditure and socio-economical backgrounds. This research uses data envelopment analysis, a non-parametric tool, and the data from schools in Melbourne, which are traditionally procured and under PPP arrangements.

The findings will help policy-makers base their decisions on measuring the relative performance of the PPP model compared to the traditional procurement model in schools.

Review of literature

PPP research is diverse and covers a range of topics across various disciplines (Narbaev *et al*. 2020). However, comparative analysis of traditional procurement (TRD) performance with PPP arrangements has received scant attention in the literature to date. Most studies tend to compare the time and cost-based performance of traditional projects in relation to PPP projects (Chowdhury *et al.,* 2011). However, very few have compared the project performance post the completion of the projects. In a seminal comparative assessment conducted in Australia, Raisbeck et al (2010) studied two groups of schools, one traditionally procured, while the other implemented on PPP arrangements, on time and cost performance. The study found that schools implemented through PPP arrangements had better efficiency measured as a ratio to output parameters to input parameters (Raisbeck, *et al.* 2010).

In assessing the construction project life cycle, the economic aspect usually receives more emphasis than the social aspects (Kordi *et al*. 2021); however, in the case of schools, social factors play an important role in students' performance which are essential in evaluating schools. The factors that determine the performance of students in schools include a range of attributes, including human capital (teachers' ability), family background (socio-economic composition) and school infrastructure (Okpala *et al.* 2001, Scippacercola and D'Ambra 2014, Johnes and Virmani 2020). Various studies have also dwelt into how these variables affected the school efficiency, providing valuable inputs to policymakers and practitioners (Blackburn *et al.* 2014). However, the contextual factors and the setting substantially influence the success or failure of the procurement model (Liu *et al*. 2014, Ruiz Díaz 2020).

Human capital, comprising the teaching and non-teaching staff, substantially impacts the school performance ((Wolszczak-Derlacz and Parteka 2011, Kantabutra 2012, Alexander *et al.* 2010, Hanushek and Rivkin 2006, Javier *et al.* 2016). The degree of teachers' knowledge about their respective subject positively influences the student outcomes (Treputtharat and

Tayiam 2014, Buddin and Zamarro 2009, Darling Hammond *et al.* 2001, Fetler 2001, Brewer and Goldhaber 1996, Monk 1994), while insufficient engagement of teachers negatively impacts the student performance (Lee *et al.* 2019). The quality and adequacy of teaching staff have a substantial bearing on the school efficiency, with a positive correlation (Hanushek and Woessmann 2017, Meunier 2008, D'Aiglepierre 2011).

In addition to the ability of teaching staff, class size and teacher-student ratio can affect schools' outcomes (Kantabutra 2012, Lee *et al.* 2019, Duran 2008). Class size is an indicator of the availability of teachers' capacity to interact with students (Okpala *et al.* 2000). The teacher-student ratio can be understood as a proxy to reflect average class size. Studies on the teacher-student ratio found that there is a trade-off between cost efficiency and student achievement (Conroy and Arguea 2008, Barrett and Toma 2013). If the teacher-student ratio is lower, it can reduce the cost, however, it can negatively impact the students' performance. Previous studies on the relationship between class size and student achievement do not always show similar results. Some researchers have recommended that children learn better in smaller classes (McGiverin *et al.* 1989, Finn and Achilles 1990), while other authors, such as Nyhan and Alkadry (1999) and Sanders, Wright, and Horn (1997), identified an opposite relationship between class size and student achievement in primary and secondary education. Despite these differences, the investigation on the relationship between class size and learning performance continues to be carried out, suggesting that smaller class size is a policy option that needs to be considered (Wößmann and West 2006, Conroy and Arguea 2008, Barrett and Toma 2013).

A role played by family, and environmental factors in students' performance have been widely acknowledged after the Coleman Report (Coleman *et al.* 1966). Schools with a higher percentage of socioeconomically disadvantaged students are more likely to underachieve learning outcomes (Tajalli and Opheim 2005, Agasisti and Longobardi 2014, Jehangir *et al.* 2015). Parents' educational level was positively related to students' academic achievements

(Kirjavainen and Loikkanent 1998). A study conducted in Burkina Fasso´s schools, focusing on households' living situations, arrived at similar results (Miningou and Vierstraete 2013). Students from privileged backgrounds and mothers with high socioeconomic status have a higher test score than other children of the same age (Hoff 2003). Parent's education influences the success rate of children in pre-medical entrance exams (Memon *et al.* 2016).

Investment in school infrastructure and human capital positively impacts school performance (Erdogdu and Erdogdu 2015, Prasetyo and Zuhdi 2013, Gershberg and Schuermann 2001) and also has a positive impact on student performance (Dolan and Schmidt 1987, Greenwald *et al.* 1996, Elliott 1998 and Nyhan and Alkadry 1999). These studies indicate that higher per-student expenditure and funding provides students with better infrastructure and more qualified teachers resulting in higher outcomes. A study in Australia, using the data set from the NSW Department of Education's annual financial statements for primary and secondary schools, found that government funding can influence public schools' efficiency (Dancer and Blackburn 2017). The efficiency of Australian primary, secondary schools, measured by NAPLAN results for Grades 3 and 5, based on the operating expenditure per student, indicated that the public expenditure had not been fruitfully deployed (Chakraborty and Blackburn 2013). In another research, it is found that the influence of school expenditure on its performance also depends on the school size (Pugh *et al.* 2015). Schools with less than 1,500 students can positively impact higher ATAR scores. In the case of schools with more than 1,500 students, the impacts decrease. The study found that an increase in expenditure enhances the estimated median ATAR score, however, the impact is negligible.

The physical infrastructure where teaching and learning activities occur influences students' performance (Berman *et al.* 2018, Schlaffer and Burge 2020, Uline and Tschannen-Moran 2008). The way a school building is designed and maintained influences how occupants, including students and teachers, perceive and use the space within the building (Uline and

Tschannen-Moran 2008). Teacher attitudes and behaviours are affected by the quality of buildings they teach in. Teachers are less likely to show enthusiasm and not stretch their abilities with students to support their learning when they teach in buildings they judge to be of poor quality (Uline and Tschannen-Moran 2008). The school climate created by the building quality influences student achievement, however, certain building improvements and design features have stronger effects than others. The quality of various learning spaces can encourage or impede daily interactions between and among students, teachers and parents (Uline and Tschannen-Moran 2008). When physical surroundings force the school occupants to move against each other in crowded spaces, adults and students are more likely to violate personal space and put each other on edge. On the other hand, well-designed hallways allow passers-by to move comfortably to shared destinations (Tanner and Lackney 2006). Many of the design features and classifications were related to student achievement, including flexible classroom arrangements, clearly defined pathways, positive outdoor spaces, large-group meeting rooms, instructional neighbourhoods, and ample egress (Tanner and Lackney 2006, Tanner 2009). Students housed in new or modernized buildings were found to score consistently higher on a range of standardized tests (Chan 1979, Earthman and Lemasters 1996, O'Neill 2000, Leung and Fung 2005, Stafford 2013).

Studies show perceptions and satisfaction of teachers, students and parents reflect the performance of schools (Lee *et al.* 2019, Kantabutra 2012, Liouaeddine *et al.* 2018). Teacher satisfaction is the degree to which a teacher is satisfied with their job as measured by pay, benefits, autonomy, task requirements, teacher policies, interaction, professional status, guidance, co-workers, recognition, and career advancement (Slavitt *et al.* 1986). Student satisfaction is the degree to which a student is satisfied with the overall educational experience as measured by the excellence of instruction in major, ability to get desired classes, knowledgeable advisor, knowledgeable faculty, and overall quality of instruction (Elliot and

Shin 2002). Furthermore, student satisfaction includes worthiness of the investment, advisor approachability, safe and secure campus, clear and reasonable requirements for the major, availability of advisor, adequate computer labs, fair and unbiased faculty, and access to information (Elliot and Shin, 2002, Lee *et al.* 2019).

The scope of PPP arrangements in school infrastructure delivery relates to new infrastructure development followed by a predetermined maintenance period. The public sector entity retains the responsibility of providing the human capital, and accordingly, the key performance indicators do not have any non-physical infrastructure-related measures. (Raisbeck *et al.* 2010, Saeed *et al.* 2018, O'shea *et al.* 2019). There is no noticeable difference in the literature relating to input variables or the outcome indicators for schools delivered under the traditional or PPP arrangements.

Research methods

This research uses Data Envelopment Analysis (DEA), a non-parametric method, to estimate the frontiers of efficiency of schools. The usage of the DEA technique to measure efficiency (as a ratio of outputs over inputs) was mainstreamed after the work by Farrell on measuring efficiency and the doctoral thesis of Rhodes (Farrell 1957, A Charnes *et al.* 1978, Førsund and Sarafoglou 2002). The DEA method, a non-parametric linear programming tool, assesses a series of inputs and outputs to develop an efficiency frontier (envelop) using standard axioms of monotonicity and convexity. The observed values of each of the inputs are then compared with the efficiency envelope. The units that constitute the envelop are termed efficient units, while those away from the envelope are termed inefficient (Blackburn *et al.* 2014). The DEA method addresses the aspect of consumed resources and relates that to the benefit that has been accrued, hence it has been found suitable for assessing efficiencies across a wide range of sectors, including schools (Emrouznejad and Yang 2018).

The DEA method has been applied frequently in schools to understand better how various resources have been used while assessing the efficiency (Katharaki and Katharakis 2010, Harrison and Rouse 2014, Saeed, Duffield and Hui 2018). In this analysis, the schools termed efficient have been identified through the relation between many non-discretionary factors and the education outcomes (Charnes, Cooper and Rhodes 1978). The application of DEA allowed researchers to understand the impact of various factors such as the percentage of poverty on the education outcomes keeping the resources available constant, which indicates that the outcome (production) is dependent on the operating environment (Blackburn *et al.* 2014). In the previous research on the impact of PPP arrangements and traditional procurement, various socio-economic factors such as family background and teacher characteristics are not examined for comparison, even though the PPP schools and TRD schools are compared in similar locations. This article addresses the gap by considering such parameters in the analysis.

A diagrammatic representation of the method adopted is presented in Figure 1 below:

Figure 1. A diagrammatic representation of the method adopted.

[Insert Figure 1 here]

The efficiency is measured in two models - the constant returns model and the variable returns model. The former assumes that the changes in input and output variables are linearly related, i.e. a unit change in an input results in a proportionate increase in outputs. In the latter, the changes are not proportional (Cooper *et al.* 2007). This research presents the outputs from both models.

It is assumed that each of the schools uses a vector $X = (x_1, \ldots, x_m)$ of m discretionary inputs to produce a vector $Y = (y_1, \ldots y_n)$ of n outputs in the environment denoted by exogenous variable, the outcome environment, T. The set is defined as:

$$T = [(y_n, x_m): x_m \text{ can produce } y_n] \quad (1)$$

This analysis considers thirteen input variables (addressing the location, background of school and students, teaching and other staff availability, financial parameters) and three broad groups of outputs (educational outcomes, satisfaction outcomes of different stakeholders and other general outcomes). The input and output variables are discussed in the next section.

The analysis has been conducted, taking all the input variables, assessing which schools are efficient in four different scenarios (i) overall with all the outputs are taken together (ii) for educational outcomes (iii) for satisfaction outcomes (iv) for other general outcomes. The output distance function is defined as:

$$D_0 (x_m, y_n) = \inf[\{x_m, y_n/\theta\} \in T \qquad (2)$$

The efficiency is computed using linear programming:

$$\max \theta = D_y (x^0_m, y^k_n))^{-1} \qquad (3)$$

subject to $\Sigma^{n}_{j=1} v_j y^j_n \geq \theta y^j_{n.}$ n = 1, and $\Sigma^{n}_{m=1} \mu_j x^j_m \leq x^j_m$ m = 1 ($v_j \geq 0$ and $\mu_j \geq 0$)

The linear program's maximisation equation indicates the intensity of each Decision Making Unit (DMU) to develop the efficiency envelop. By constraining the coefficients of the input and output variables (v and μ respectively) to the positive region, the model of constant returns to scale are imposed. A variable returns to scale model would need the following conditions to be imposed: $\Sigma^{j}_{j=1} v_j = 1$ and $\Sigma^{j}_{j=1} \mu_j = 1$.

In case the efficiencies estimated under the two models (constant returns to scale and variable returns to scale) are equal, it is assumed that the school is functioning at its optimal level of efficiency, else, the school is assumed to be scale inefficient (as the relation between the input and output is not linear). The ratio of these two models is presented (termed as "scale") to indicate the relationship between the two models.

The analysis has been done using the software DEA-Solver-PRO (Professional Version 15.1).

Data collection

The research uses the data from schools being delivered under traditional procurement and PPP arrangements in Melbourne. The data collection exercise is structured into three parts – identification of schools, input variables and outcome variables.

Identification of Schools

In Melbourne, PPP procurement of schools was done in two main phases, the first phase during the Building the Education Revolution (BER) program in 2009-10 consisting of fifteen schools (Department of Education 2009) and the second phase in 2017-18 consisting of twelve schools (Department of Education 2016). Information on twelve schools available across the two phases of these schools PPP procurement program has been used for this analysis. Schools that are not included either do not have publicly available data, or their annual reports are not yet published at the time of analysis. Among twelve PPP schools, eight are from Phase one, and four are from Phase two. Table 1 below sets out the school details. School code is the identifier used to denote whether the school is developed under a PPP arrangement (prefixed by "PPP") or under traditional mode (prefixed as "TRD"), the number of the school and the location. For instance, PPP1-LocA refers to a school (number 1) developed under PPP arrangement in location A, and TRD1-LocA and TRD2-LocA refer to two comparable schools in location A developed under the traditional model. Each of the schools is taken as a unit for evaluation, termed as DMU.

Table 1. School Codes.

[Insert Table 1 near here]

For each PPP school implemented under the PPP model, two or three comparable schools (which are implemented through traditional arrangement), depending on availability, have been identified for analysis. The comparable schools are chosen based on proximity (generally within a radius of 10 km of a PPP school) in the same postcode, a suburb so that the comparison is similar in socio-economic, physical, and cultural aspects. PPP schools with only one or no traditional schools nearby were not used in this research.

Factors determining the performance – input variables

The performance measures are dependent on numerous inputs, including the profile of the school (its socio-economic composition, location), human capital and financial capital.

Socio-economic composition is a factor that influences school performance. Several studies in the US find that schools, which have higher numbers of white students than students of colour, have better education achievement for students of colour (Schofield 1990, Smith 2004). Similar results indicating the impact of socio-economic factors on student performance have been reported by other researchers (Hanushek 1997, Harrison and Rouse 2014, Johnes and Virmani 2020).

Location: The school's location and regional diversity have an impact on student achievements. Students in urban areas have performed better than their rural counterparts in certain subjects such as reading, maths and science (Cryan *et al.* 1992, Alspaugh 2004). The results are the opposite in other research, with rural students performing better (Alspaugh and Harting 1995). It was found that in New Zealand's public schools in areas with greater competition have performed better (Harrison and Rouse 2014).

Human resources: There are three types of school human resources: principals (administrators), staff (non-teaching) and teachers, with varying educational qualifications and

experience. Human resources influence the students' performance and the schools' efficiency. The relationship of the teachers' ability, qualifications on the student performance has not been conclusively established (Rivkin *et al.* 2005, Harris and Sass 2011). The relationship between the managerial, administrative and support staff on the students' performance is a relatively recent research theme through the "instructional leadership model" and the "transformational leader behaviours model" (Philbin 1997, Dorward 2009). The impact of these staff on student achievement is still not conclusively proven, similar to the teaching staff's findings.

Financial resources can be a measure of overall school resources within the given operating environment, higher levels of spending per student leading to better outcomes. (Gershberg and Schuermann 2001, Prasetyo and Zuhdi 2013, Erdogdu and Erdogdu 2015). It is assumed that the rest of the human capital, infrastructure, and operating environment can be improved with better financial resources. Hence, this variable impacts school efficiency. There is no substantial difference in education outcomes in some instances, even when the resources available are vastly dissimilar (Kleinfeld *et al.* 1985).

[Insert Table 2 near here].

[Insert Table 3 near here]

The data on the schools is taken from the database of the Australian Curriculum, Assessment and Reporting Authority (ACARA) website https://www.myschool.edu.au/. The data includes school type and sector, staff, student background, enrolments, NAPLAN (https://www.nap.edu.au/) score, attendance, location and map showing other schools in the proximity. These data of most schools are available from 2014 to 2019. The average of the last three years data available is used for the analysis. For example, if a school's latest annual report is for 2018, the last three years include 2016, 2017 and 2018. Some schools have data for the last two years or one year only. Financial data used in this study included school expenditure

rather than school funding or income. Data on expenditure included teacher salaries and allowances (among other items) and excluded any capital investment (the requirement to focus on annually recurrent resourcing and funding). Expenditure was used instead of funding as it better reflects the resourcing decisions of schools.

School Performance Indicators - Output Variables

The outcomes are categorised into three groups – education outcome (measured by the NAPLAN scores), satisfaction scores (student, teacher, parent and non-teaching staff) and other general outcomes (Index of Community Socio-Educational Advantage score, attendance of students and the enrolment share of girl students).

The standardised student test score is one of the more commonly used metrics to assess the performance of schools over a period (Hanushek 1997, Blackburn *et al.* 2014). This metric provides an insight into students' achievement (extended to school's performance) following a period of schooling. It is used as a measure that encapsulates all the resources expended to achieve the education outcome. In Australia, the standard test is conducted on reading, writing, grammar, and numeracy at the primary level termed as National Assessment Program – Literacy and Numeracy (NAPLAN) outcomes. Data relating to Year 5 of NAPLAN has been used for this research.

Data of variables parent satisfaction summary, school staff survey, and student's attitudes to school – the sense of connectedness is based on the per cent endorsement, which indicates positive responses (agree or strongly agree). The data are categorised as low (below 25%) = 1, low-mid (between 25% and 50%) = 2, mid (between 50% to 75%) = 3, and high (above 75%) = 4.

Table 4. Sets out the output parameters.

[Insert Table 4 near here]

Table 5. Presents the descriptive statistics of the output variables.

[Insert Table 5 near here]

Results

The efficiency of the schools has been assessed for three categories of outcomes – educational outcomes (measured by the NAPLAN scores), the satisfaction of stakeholders (measured by the satisfaction/ judgement of students, teachers, staff and parents) and general outcomes (measured by the Index of Community Social Advantage, enrolment of girls and attendance of students). The analysis has been conducted for constant returns to scale (denoted by CCR-I) and variable returns to scale (denoted by BCC-I). The results are generally similar between the two models when the share of PPP schools and TRD schools are considered, even though a few differences exist on the actual number and the name of the school. A scale (as a ratio of CCR-I and BCC-I) is also presented to indicate the relationship. As the scale is equal to 1 in most cases, it can be inferred that the relationship between the input variables and the output variables is proportional, in general. For instance, only six out of 38 schools have a scale different than 1 when assessed on the overall outcomes. All the results are discussed in relation to the constant returns to scale model.

The overall efficiency of the schools is presented in Table 6 below. Six of the 38 schools (15.8% of all schools) are inefficient (i.e. the ratio of overall outputs and inputs is lower than the average of all the sample schools), two of them being developed on PPP mode (16.7% of total PPP schools) and four being developed in the traditional mode (15.3% of total traditional schools). The inefficiency score for PPP schools (minimum 0.97431) is higher than traditional schools (minimum 0.92180). This indicates that the PPP schools have a higher proportion of inefficiency than the traditional schools when compared on the basis of all outcomes.

[Insert Table 6 near here]

Table 7 presents the scores for ICSEA, attendance of students and girls enrolment percentage. 10 (four PPP and six traditional) out of 38 schools are inefficient (26.3%). A third of the PPP schools and 23% of traditional schools fall under this metric. 11 schools are found to be inefficient when measured on the average attendance {(six (50%) PPP schools) and (five (19%) traditional schools)}. On the metric of Girl enrolment percentage, 13 schools are found to be inefficient (five PPP Schools (41.7%) and eight traditional schools (30.8%)). This indicates that PPP schools have relatively underperformed the traditional schools in relation to the general outcomes, measured through ICSEA scores, students' attendance, and girls' share in the total enrolments.

[Insert Table 7 near here]

On the NAPLAN scores, 14 of 38 schools (36.8%) schools are categorised as inefficient, comprising four PPP schools (33.3%) and ten traditional schools (38.5%). The details are presented in Table 8 below. The efficiency scores of the PPP schools are higher than that of traditional schools. The PPP schools have a better relative educational outcome, measured by student marks, compared to traditional schools.

[Insert Table 8 near here]

The efficiency scores relating to the satisfaction of the stakeholders is presented in Table 9. On the satisfaction score of the Parents, 14 of 38 schools (36.8%) schools are categorised as inefficient, comprising six PPP schools (50 %) and eight traditional schools (30.1%). Nineteen schools are found to be inefficient when measured against staff satisfaction (seven PPP schools (58.3%) and 12 traditional schools (46.2%)). When measured on student attitudes, 13 schools are found to be inefficient (seven PPP schools (58.3%) and six traditional schools (23.1%)). Eleven schools are found to be inefficient when measured on teachers' judgements, with six PPP schools (50%) and five traditional schools (19.2%). It appears that

the satisfaction levels with the PPP schools are lower than that of the traditional schools across all the stakeholder groups. The summary of the results is presented in Table 10.

[Insert Table 9 near here]

[Insert Table 10 near here]

The findings from the study indicate that the traditional schools are marginally better than the proportion of the PPP schools in relation to their respective populations in the overall efficiency, considering the education satisfaction and general indicators. A greater proportion of PPP schools have been found to be inefficient than the traditional schools in all output indicators except in NAPLAN score. The proportion of inefficient schools is lower (15-17%) when all the outcome indicators are considered together than when individual outcomes are assessed. This indicates that the overall school profiles and characteristics are similar, and the differences between PPP and traditional schools are not substantially different.

The difference in the efficiency of the two groups (TRD and PPP) could arise due to the variation in the input parameters. The two PPP schools (PPP2-LocB and PPP10-LocJ) and the four traditional schools (TRD9-LocD, TRD14-LocF, TRD15-LocG, TRD17-LocH) are found to be inefficient in the overall performance and also appear as inefficient schools in each of the educational and satisfaction parameters. Values of input variables of these schools show the reasons for their inefficiency. PPP2-LocB has a lower number of non-teaching staff per student. Its operating revenue, operating expenditure, total funds available and financial commitments per student are lower. In PPP10-LocJ, all financial input variables per student (total operating revenue and expenditure, net operating surplus or deficit, total funds, and total financial commitments) are lower than other schools. In TRD14-LocF and TRD15-LocG, the percentages of students with a language background other than English are substantially low. In the case of TRD9-LocD and TRD17-LocH schools, teaching and non-teaching staff per student and financial parameters, including operating revenue and expenditure and funding per

student values, are low. This indicates that the schools with relatively lower resources (human capital, financial resources, or weaker socioeconomic backgrounds) have performed poorly in TRD and PPP schools.

More than a third of the schools from the two categories are inefficient in the educational outcomes, indicating a greater difference in schools' performance across the region. PPP schools fared marginally better (33% are inefficient) than traditional schools (38.5%). Looking at some of the inefficient PPP schools in the education outcomes, PPP4-LocD and PPP5-LocE are located in suburbs where indexes of relative socio-economic disadvantage are not low. However, teaching and non-teaching staff per student and financial parameters, including operating revenue and expenditure, funds and financial commitments per student, are more lacking. Traditional schools which are inefficient in the educational outcomes are TRD2-LocA, TRD4-LocB, TRD5-LocC, TRD7-LocC, TRD18-LocH, TRD19-LocI. They are located in socio-economically disadvantaged suburbs. Most of them have fewer teaching staff per student and lower student family socio-economic profile, and some have low funding and financial commitments per student.

In the general outcomes (ICSEA, girls' enrolment and attendance), the difference between the proportion of inefficient PPP schools (33.3% to 50%) is substantially higher than that of the traditional schools (19.2% to 30.8%). The difference in inefficiency is stark in the students' attendance, with half of PPP schools are found to be inefficient, while less than 20% of traditional schools are inefficient. Some inefficient PPP schools in the general outcomes are PPP1-LocA, PPP4-LocD, and PPP5-LocE are located in suburbs that are not socio-economically disadvantaged. However, these PPP schools are at the lower end in terms of teaching and non-teaching staff per student and financial parameters, including operating revenue and expenditure, and funding per student of the former three schools is below average.

When assessed on the satisfaction levels of the four different stakeholder groups, a greater proportion of PPP schools are found to be inefficient (more than half of the schools in each of groups), while the more traditional schools are found to be inefficient in staff satisfaction levels (46%), in relation to the satisfaction of other three stakeholder groups (19.2% to 30.8%). An analysis based on teacher and student attitudes indicates that the PPP schools fare more inefficiently than traditional schools. PPP9-LocI and PPP11-LocK are among inefficient PPP schools in terms of stakeholder satisfaction levels. The former is located in a relatively disadvantaged suburb in terms of socio-economic index, and the latter is above average in the index. PPP9-LocI has fewer non-teaching staff per student, and its student family occupation and education index are relatively low. PPP11-LocK has a higher student family occupation and education index, however, its teaching and non-teaching staff per student is more lacking. Its financial parameters and percentage of students having a language background other than English are considerably low. Some of the inefficient, traditional schools are TRD10-LocE, TRD12-LocE, TRD13-LocF, TRD20-LocI and TRD25-LocL. The first two schools are located in suburbs that are relatively disadvantaged in terms of the socio-economic index. The overall socio-economic profile of TRD10-LocE, TRD20-LocI and TRD25-LocL is low. TRD12-LocE, TRD20-LocI and TRD25-LocL have a fewer number of teaching and non-teaching staff per student. The financial parameters of TRD10-LocE, TRD-LocE and TRD20-LocI are relatively low. While most of the input variable values of TRD13-LocF are not low, its percentage of students having a language background other than English is one of the lowest.

The two models (constant returns to scale and variable returns to scale) indicated similar results for all the outcome assessments, indicating that the effect of input variables on the output variables is generally proportional.

Discussions

The findings of this study indicate that the PPP schools perform better than the traditional schools in relation to the educational outcomes, corroborating the previous studies in the region (Raisbeck *et al.* 2010, Saeed, Duffield and Hui 2018). However, the results are contrary to these studies if the overall school performance and other measures such as satisfaction and general outcomes are considered. In other countries, such as Ireland, studies have indicated no substantial difference between the two modes of implementation (O'shea *et al.* 2019).

The usage of PPP arrangements to deliver better outcomes was in the ascendancy when the BER initiative was being implemented in Melbourne (Department of Education 2009). The focus on intervention in Melbourne has been on infrastructure improvement in the schools. The reasons for no substantial advantage of PPP schools could be due to multiple reasons – the infrastructure provision of traditional schools is comparable to the PPP arrangements in recent times or the contract provisions that focus on only a particular element at the exclusion of other outcomes.

The overall differences in construction practices of schools in the traditional model and PPP arrangement could have been narrowed down due to advances in technology and management practices (Suharyanto and Simanjuntak 2020), limiting the advantage that infrastructure-based PPP arrangement has (Kordi *et al.* 2021). The PPP contracts comprise a long list of infrastructure-related performance-based metrics but do not have any relating to satisfaction, education or general outcomes. As noticed for different schools, the schools become inefficient when other factors such as human capital, financial expenditure or socioeconomic background are weaker. Merely changing the implementation mode might not overcome the other limitations. The previous research had highlighted the importance of all the factors for satisfactory school performance (Okpala *et al.* 2001, Scippacercola and D'Ambra 2014, Johnes and Virmani 2020), but there is no extant study that assesses the relative

contribution of various factors. This might also indicate that for achieving an acceptable performance that is better than the traditional schools, the scope of PPP arrangements might need to be broader. The performance assessment for the program involving the private sector needs to be seen holistically, considering the total cost of providing infrastructure and costs relating to instruction. To achieve overall school performance outcomes, the policymakers might need to reconsider expanding the scope, structuring a more elaborate PPP arrangement (with a due assessment of risks and responsibilities). There is perhaps a need to evaluate a combination of infrastructure and instruction based PPP arrangements for better achievement of outcomes.

A few of the factors that influence the school performance are within the control of the school management, while the others relate to the external environment. Maintaining an appropriate student-teacher ratio and adequate financial investments on a per-student basis appear to be a common feature of schools with higher efficiency, which are within the control of the schools.

Conclusions

The private sector was expected to bring substantial benefits to delivering services that the public sector was conventionally providing, while the latter is grappling with increasingly stressful fiscal positions. The theoretical basis of PPP arrangements delved into equitable risk transfer, bundling or separation of activities, defined output measures, competition and market dynamics to provide better value for money for the PPP projects. The assessment of traditional arrangements was based on the poor track record of the public sector proponent and the inefficiencies of time, cost and quality controls. The comparison of the arrangements is typically undertaken on a value for money assessment that measures the anticipated time, cost and quality overruns. The literature is relatively scant in studying the broad range of outcomes

(education, stakeholder satisfaction and other general aspects). This research aims to provide broader empirical evidence if schools under a PPP arrangement provide better outcomes than the traditional ones.

The earlier research in the region have indicated that PPPs have performed relatively better when compared to traditionally delivered schools, there are also international studies that indicate the results under the two modalities are similar. This research did not find strong evidence to suggest that the PPP arrangements deliver superior outcomes to the traditional model. In comparison with the earlier studies, this research focuses on the outcomes that are broad-based and differs from the value for money that focuses on the whole life costing based approach.

The outcomes (categorized as educational, stakeholder satisfaction and general outcomes in this research) provide a basis for assessing if the school's performance is as desired and provides the policy makers with a framework to monitor the progress continuously. The factors that affect the school performance include the socio-economic composition, location, human and financial resources, in addition to physical infrastructure. There might be a case for policymakers to review the current PPP format in schools largely based on infrastructure improvement to include instruction-based performance indicators. Due to the adoption of better construction practices, the narrowing gap between the physical infrastructure provided under the traditional model and PPP arrangements might also make usage of PPPs for efficiency reasons debatable. The study also offers pointers to school management about the factors that are within their control, which influence the outcomes, such as maintaining an appropriate student-teacher ratio and adequate financial investments on a per-student basis.

This research studied the performance of schools implemented under the traditional mode and under PPP arrangements in schools at Melbourne. More research needs to be

conducted in different Australian states and in international settings to understand the efficacy of adopting PPP arrangements in the sector.

Data availability statement

All of the data and models that support the findings of this study are available from the corresponding author upon reasonable request.

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The authors declare that there are no financial or non-financial competing interests to report.

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List of Tables

List of figures

Table 1. School Codes.

School code	Type of delivery (PPP or TRD)	Distance in Km from PPP school in the area	School Type
PPP1-LocA	PPP		Primary
TRD1-LocA	TRD	6.0	Primary
TRD2-LocA	TRD	3.0	Primary
PPP2-LocB	PPP		Primary
TRD3-LocB	TRD	1.5	Primary
TRD4-LocB	TRD	6.2	Primary
PPP3-LocC	PPP		Primary
TRD5-LocC	TRD	20.3	Primary
TRD6-LocC	TRD	21.2	Primary
TRD7-LocC	TRD	19.1	Primary
PPP4-LocD	PPP		Secondary
TRD8-LocD	TRD	8.0	Primary
TRD9-LocD	TRD	2.5	Secondary
PPP5-LocE	PPP		Primary
TRD10-LocE	TRD	1.5	Primary
TRD11-LocE	TRD	2.4	Primary
TRD12-LocE	TRD	1.6	Primary
PPP6-LocF	PPP		Secondary
TRD13-LocF	TRD	9.2	Primary
TRD14-LocF	TRD	10.3	Primary
PPP7-LocG	PPP		Secondary
TRD15-LocG	TRD	3.2	Secondary
TRD16-LocG	TRD	5.0	Primary
PPP8-LocH	PPP		Primary
TRD17-LocH	TRD	2.6	Primary
TRD18-LocH	TRD	4.5	Primary
PPP9-LocI	PPP		Primary
TRD19-LocI	TRD	7.5	Primary
TRD20-LocI	TRD	0.9	Primary
PPP10-LocJ	PPP		Primary
TRD21-LocJ	TRD	1.5	Primary
TRD22-LocJ	TRD	2.5	Primary
PPP11-LocK	PPP		Primary
TRD23-LocK	TRD	5.2	Primary
TRD24-LocK	TRD	3.8	Primary
PPP12-LocL	PPP		Primary
TRD25-LocL	TRD	7.9	Primary
TRD26-LocL	TRD	7.5	Primary

Table 2. List of input variables

Input Variables	Codes	Description	Source
PPP or non-PPP government schools (DMUs)	PPP or TRD	which shows either schools are PPP or not.	Partnerships Victoria In Schools Project Summary, Department of Education and Early Childhood Development, State Gov of Victoria March 2009 Project Summary – New Schools Public Private Partnership (PPP) project, Education and Training, State of Victoria, Feb 2016
Index of Relative Socio-economic Disadvantage based on Suburbs where the schools are located.	Loc - SEIFA	A lower score indicates that an area is relatively disadvantaged compared to an area with a higher score. The data is taken from ABS 2016.	Australian Bureau of Statistics (ABS), Socio-economic Indexes for areas (SEIFA) 2016
Number of Teaching Staff per student	Tch-stf/stu	which shows the number of full-time and part-time teaching staff members per student	ACARA (Australian Curriculum, Assessment and Reporting Authority)
Full Time Equivalent Teaching Staff per student	Tch-FT-eq/stu	which shows the full-time equivalent of full-time and part-time teaching members per student. The full time equivalent teaching staff data is rounded to one decimal place. A full-time teacher is counted as 1.0, a teacher who works three days a week is counted as 0.6.	ACARA (Australian Curriculum, Assessment and Reporting Authority)

Non-Teaching Staff per student	N-Tch-stf/stu	which shows the number of full-time and part-time non-teaching staff members per student	ACARA (Australian Curriculum, Assessment and Reporting Authority)
Full Time Equivalent Non-Teaching Staff per student	N-Tch-FT-eq/stu	which shows the full-time equivalent of full-time and part-time non-teaching staff members per student. The full-time equivalent non-teaching staff data is rounded to one decimal place. A full-time staff member is counted as 1.0, a member of staff who works three days a week is counted as 0.6.	ACARA (Australian Curriculum, Assessment and Reporting Authority)
Overall Socio-Economic Profile	SEP-lst-yr	This is based on the school's Student Family Occupation and Education index, which considers parents' occupations and education. Its data is categorised as low = 1, low-mid = 2, mid = 3, and high = 4.	Annual reports of the respective schools
Total Operating Revenue per student	Op-Rev/stu	The operating revenue unitised per student	Annual reports of the respective schools
Total Operating Expenditure per student	Op-Ex/stu	The operating expenditure unitised per student	Annual reports of the respective schools
Net Operating Surplus/-Deficit per	Net-Op/stu	The net operating surplus or deficit sunitised per student	Annual reports of the respective schools

student, which is different between no. 8 and no.9			
Total Funds Available per student	Fnd/stu	The total funds available unitised per student	Annual reports of the respective schools
Total Financial Commitments per student	Finc/stu	The total financial commitments sunitised per student	Annual reports of the respective schools
Language Background Other Than English (%)	Lngbg	which shows a percentage of students who use English as an additional language.	ACARA (Australian Curriculum, Assessment and Reporting Authority)

Table 3. Descriptive statistics of the input variables

	Loc - SEIFA	**Tch-stf/stu**	**Tch-FT-eq/stu**	**N-Tch-stf/stu**	**N-Tch-FT-eq/stu**	**SEP-lst-yr**	**Op-Rev/stu**	**Op-Ex/stu**	**Net-Op/stu**	**Fnd/stu**	**Finc/stu**	**Lngbg**
Maximum	1072.00	0.09	0.08	0.09	0.07	1.00	14996.85	14828.44	2490.36	3279.92	3279.92	77.33
Minimum	912.00	0.06	0.06	0.01	0.01	1.00	7853.53	7549.32	6.05	54.93	54.93	1.67
Mean	1003.87	0.07	0.07	0.03	0.02	2.47	10445.79	9968.29	566.89	806.26	854.75	43.62
Median	1013.50	0.07	0.06	0.03	0.02	3.00	10384.68	9832.40	399.12	621.85	621.85	47.17
Std Deviation	47.493	0.008	0.006	0.015	0.010	0.797	1421.284	1439.846	604.064	733.159	734.431	24.653
Variance	2255.58	0.00	0.00	0.00	0.00	0.63	2020048.56	2073155.26	364893.62	537522.84	539388.88	607.75

Table 4. List of output variables

Output Variables	Codes	Description	Source
ICSEA	ICSEA	which is the Index of Community Socio-Educational Advantage score for the school. This score is derived from a number of variables, including parental school and non-school education and occupation, the school's geographical location and proportion of Indigenous students. The data is calculated by averaging last three years.	ACARA (Austra Curriculum, Assessm and Reporting Authorit
The annual average of the attendance rate of all levels (Prep to 6)	Attnd-avg	which shows the attendance rate in a percentage calculated by averaging attendance rate of all levels (Prep to 6). It shows the attendance rate of their published year.	Annual reports of respective schools
Percentage of Girls Enrolments	Grl-enr-pct	which is used as an indicator of the enrolments and is calculated by dividing girls' enrolments by total enrolments. Enrolments include both full-time and part-time students who are enrolled at the school in the calendar year specified. The data is calculated by averaging the last 3 years.	ACARA (Austra Curriculum, Assessm and Reporting Authorit
NAPLAN Year 5	NPL-Yr5-avg	which shows Year 5 students' average NAPLAN scores of all five categories (Reading, Writing, Spelling, Grammar, and Numeracy). The data are calculated by averaging the last three years, including the respective schools' latest annual report year. For example, if a school's latest annual report is for 2018, then the last three years include 2016, 2017 and 2018.	Annual reports of respective schools
Parent Satisfaction Summary	Prnt-stis	which measures the per cent endorsement by parents on their school satisfaction level, as reported in the annual Parent Opinion Survey.	Annual reports of respective schools
School Staff Survey	Stf-srvy	which measures the percent endorsement by staff on School Climate, as reported in the annual School Staff Survey.	Annual reports of respective schools

Students Attitudes to School – Sense of Connectedness Results	Stu-att-cnt	which measures the percent endorsement on the Sense of Connectedness factor, as reported in the Attitudes to School Survey completed annually by Victorian Government school students. The percent is average of latest 2 to 4 years.	Annual reports of respective schools
Teacher Judgement of Student Achievement (Years Prep to 6)	Tch-jud	Teacher Judgement of Student Achievement (Years Prep to 6), which shows Years Prep to 6 students' expected outcomes in the average of English and Mathematics based on Teacher Judgement. The data are categorised as low (below 25%) = 1, low-mid (between 25% and 50%) = 2, mid (between 50% to 75%) = 3, and high (above 75%) = 4.	Annual reports of respective schools

Table 5. Descriptive statistics of the output variables

	ICSEA	Attnd-avg	Grl-enr-pct	NPL-Yr5-avg	Prnt-stis	Stf-srvy	Stu-att-cnt	Tch-jud
Maximum	1062.67	93.14	52.19	524.07	4.00	4.00	4.00	4.00
Minimum	925.00	90.71	42.91	440.50	3.00	2.00	3.00	3.00
Mean	999.81	91.98	48.58	486.23	3.61	3.18	3.61	3.89
Median	1006.17	92.06	48.66	484.80	4.00	3.00	4.00	4.00
Std Deviation	36.406	0.620	1.910	18.541	0.495	0.512	0.495	0.311
Variance	1290.518	0.374	3.552	334.719	0.239	0.256	0.239	0.094

Table 6. Overall Efficiency

	Overall		
DMU	**CCR-I**	**BCC-I**	**Scale**
PPP1-LocA	1.00000	1.00000	1.00000
TRD1-LocA	1.00000	1.00000	1.00000
TRD2-LocA	1.00000	1.00000	1.00000
PPP2-LocB	**0.97431**	**0.97895**	0.99526
TRD3-LocB	1.00000	1.00000	1.00000
TRD4-LocB	1.00000	1.00000	1.00000
PPP3-LocC	1.00000	1.00000	1.00000
TRD5-LocC	1.00000	1.00000	1.00000
TRD6-LocC	1.00000	1.00000	1.00000
TRD7-LocC	1.00000	1.00000	1.00000
PPP4-LocD	1.00000	1.00000	1.00000
TRD8-LocD	1.00000	1.00000	1.00000
TRD9-LocD	**0.92180**	**0.92348**	0.99818
PPP5-LocE	1.00000	1.00000	1.00000
TRD10-LocE	1.00000	1.00000	1.00000
TRD11-LocE	1.00000	1.00000	1.00000
TRD12-LocE	1.00000	1.00000	1.00000
PPP6-LocF	1.00000	1.00000	1.00000
TRD13-LocF	1.00000	1.00000	1.00000
TRD14-LocF	**0.99618**	**0.99847**	0.99771
PPP7-LocG	1.00000	1.00000	1.00000
TRD15-LocG	**0.95484**	**0.95484**	1.00000
TRD16-LocG	1.00000	1.00000	1.00000
PPP8-LocH	1.00000	1.00000	1.00000
TRD17-LocH	**0.99819**	**0.99919**	0.99900
TRD18-LocH	1.00000	1.00000	1.00000
PPP9-LocI	1.00000	1.00000	1.00000
TRD19-LocI	1.00000	1.00000	1.00000
TRD20-LocI	1.00000	1.00000	1.00000
PPP10-LocJ	**0.99412**	**0.99413**	0.99999
TRD21-LocJ	1.00000	1.00000	1.00000
TRD22-LocJ	1.00000	1.00000	1.00000
PPP11-LocK	1.00000	1.00000	1.00000
TRD23-LocK	1.00000	1.00000	1.00000
TRD24-LocK	1.00000	1.00000	1.00000
PPP12-LocL	1.00000	1.00000	1.00000
TRD25-LocL	1.00000	1.00000	1.00000
TRD26-LocL	1.00000	1.00000	1.00000
Inefficient PPP Schools out of 12	**2**	**2**	
Inefficient TRD Schoolsout of 26	**4**	**4**	
Total inefficient schools out of 38	**6**	**6**	

Table 7. Efficiency of General Outcomes

	ICSEA			Attnd-avg			Grl-enr-pct		
DMU	**CCR-I**	**BCC-I**	**Scale**	**CCR-I**	**BCC-I**	**Scale**	**CCR-I**	**BCC-I**	**Scale**
PPP1-LocA	1.00	1.00	1.00	**0.97**	**0.98**	0.99	**0.96**	**0.98**	0.97
TRD1-LocA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD2-LocA	1.00	1.00	1.00	1.00	1.00	1.00	**0.97**	1.00	0.97
PPP2-LocB	**0.97**	**0.98**	0.99	**0.93**	**0.95**	0.98	**0.90**	**0.95**	0.95
TRD3-LocB	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD4-LocB	1.00	1.00	1.00	1.00	1.00	1.00	**0.94**	**0.99**	0.94
PPP3-LocC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD5-LocC	**0.96**	**0.99**	0.96	**0.99**	**0.99**	0.99	1.00	1.00	1.00
TRD6-LocC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD7-LocC	1.00	1.00	1.00	1.00	1.00	1.00	**0.97**	1.00	0.97
PPP4-LocD	1.00	1.00	1.00	**0.96**	**0.96**	0.99	**0.92**	**0.96**	0.95
TRD8-LocD	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD9-LocD	**0.92**	**0.92**	0.99	**0.90**	**0.90**	0.99	**0.80**	**0.90**	0.89
PPP5-LocE	**0.97**	**0.99**	0.98	**0.98**	**0.99**	1.00	1.00	1.00	1.00
TRD10-LocE	1.00	1.00	1.00	1.00	1.00	1.00	**0.89**	1.00	0.89
TRD11-LocE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD12-LocE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PPP6-LocF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD13-LocF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD14-LocF	**0.99**	**0.99**	0.99	**0.98**	**0.98**	0.99	**0.94**	**0.98**	0.96
PPP7-LocG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD15-LocG	**0.95**	**0.95**	0.99	**0.93**	**0.93**	1.00	**0.92**	**0.93**	0.99
TRD16-LocG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PPP8-LocH	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD17-LocH	**0.96**	**0.96**	0.99	**0.94**	**0.95**	0.99	**0.93**	**0.96**	0.97
TRD18-LocH	**0.98**	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
PPP9-LocI	**0.99**	1.00	0.99	**0.99**	**0.99**	0.99	**0.97**	**0.99**	0.97
TRD19-LocI	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD20-LocI	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PPP10-LocJ	**0.98**	**0.99**	0.99	**0.97**	**0.98**	0.99	**0.98**	**0.99**	0.99
TRD21-LocJ	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD22-LocJ	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PPP11-LocK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD23-LocK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD24-LocK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PPP12-LocL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD25-LocL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD26-LocL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Inefficient PPP Schools out of 12	4	3		6	6		5	5	
Inefficient TRD Schools out of 26	6	5		5	5		8	5	
Total	**10**	**8**		**11**	**11**		**13**	**10**	

Table 8. Educational Outcome

	Napl.Yr5.Ave		
DMU	**CCR-I**	**BCC-I**	**Scale**
PPP1-LocA	1.00	1.00	1.00
TRD1-LocA	1.00	1.00	1.00
TRD2-LocA	**0.97**	1.00	0.97
PPP2-LocB	**0.94**	**0.95**	0.99
TRD3-LocB	1.00	1.00	1.00
TRD4-LocB	**0.98**	1.00	0.98
PPP3-LocC	1.00	1.00	1.00
TRD5-LocC	**0.98**	**0.99**	0.98
TRD6-LocC	1.00	1.00	1.00
TRD7-LocC	**0.96**	1.00	0.96
PPP4-LocD	**0.94**	**0.96**	0.98
TRD8-LocD	1.00	1.00	1.00
TRD9-LocD	**0.87**	**0.90**	0.96
PPP5-LocE	**0.95**	**0.99**	0.96
TRD10-LocE	1.00	1.00	1.00
TRD11-LocE	1.00	1.00	1.00
TRD12-LocE	1.00	1.00	1.00
PPP6-LocF	1.00	1.00	1.00
TRD13-LocF	1.00	1.00	1.00
TRD14-LocF	**0.93**	**0.98**	0.95
PPP7-LocG	1.00	1.00	1.00
TRD15-LocG	**0.90**	**0.93**	0.97
TRD16-LocG	1.00	1.00	1.00
PPP8-LocH	1.00	1.00	1.00
TRD17-LocH	**0.95**	**0.95**	0.99
TRD18-LocH	**0.96**	1.00	0.96
PPP9-LocI	1.00	1.00	1.00
TRD19-LocI	**0.90**	1.00	0.90
TRD20-LocI	1.00	1.00	1.00
PPP10-LocJ	**0.95**	**0.98**	0.97
TRD21-LocJ	1.00	1.00	1.00
TRD22-LocJ	1.00	1.00	1.00
PPP11-LocK	1.00	1.00	1.00
TRD23-LocK	1.00	1.00	1.00
TRD24-LocK	1.00	1.00	1.00
PPP12-LocL	1.00	1.00	1.00
TRD25-LocL	1.00	1.00	1.00
TRD26-LocL	1.00	1.00	1.00
Inefficient PPP Schools out of 12	4	4	
Inefficient TRD Schools out of 26	10	5	
Total	**14**	**9**	

Table 9. Efficiency relating to the satisfaction of the stakeholders.

	Par.Sat			Sta.Sat			Stu.Atti			Tea.Judg		
DMU	**CCR-I**	**BCC-I**	**Scale**	**CCR-I**	**BCC-I**	**Scale**	**CCR-I**	**BCC-I**	**Scale**	**CCR-I**	**BCC-I**	**Scale**
PPP1-LocA	**0.98**	**0.98**	1.00	**0.98**	**0.98**	1.00	**0.98**	**0.98**	1.00	**0.98**	**0.98**	1.00
TRD1-LocA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD2-LocA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**0.80**	1.00	0.80
PPP2-LocB	**0.96**	**0.96**	1.00	**0.73**	**0.95**	0.77	**0.72**	**0.95**	0.76	**0.95**	**0.95**	1.00
TRD3-LocB	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD4-LocB	1.00	1.00	1.00	**0.77**	1.00	0.77	1.00	1.00	1.00	1.00	1.00	1.00
PPP3-LocC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD5-LocC	1.00	1.00	1.00	**0.87**	1.00	0.87	1.00	1.00	1.00	1.00	1.00	1.00
TRD6-LocC	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD7-LocC	**0.77**	1.00	0.77	**0.90**	1.00	0.90	**0.78**	1.00	0.78	1.00	1.00	1.00
PPP4-LocD	**0.78**	**0.96**	0.81	**0.52**	**0.96**	0.54	**0.75**	**0.96**	0.78	**0.96**	**0.96**	1.00
TRD8-LocD	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD9-LocD	**0.70**	**0.90**	0.78	**0.72**	**0.90**	0.80	**0.70**	**0.90**	0.78	**0.90**	**0.90**	1.00
PPP5-LocE	**0.74**	**0.99**	0.75	**0.99**	**0.99**	1.00	**0.99**	**0.99**	1.00	**0.99**	**0.99**	1.00
TRD10-LocE	1.00	1.00	1.00	**0.89**	1.00	0.89	1.00	1.00	1.00	1.00	1.00	1.00
TRD11-LocE	**0.91**	1.00	0.91	1.00	1.00	1.00	**0.85**	1.00	0.85	1.00	1.00	1.00
TRD12-LocE	1.00	1.00	1.00	**0.81**	1.00	0.81	1.00	1.00	1.00	1.00	1.00	1.00
PPP6-LocF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD13-LocF	**0.98**	1.00	0.98	**0.98**	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00
TRD14-LocF	**0.99**	**0.99**	1.00	**0.74**	**0.98**	0.76	**0.74**	**0.98**	0.75	**0.98**	**0.98**	1.00
PPP7-LocG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD15-LocG	**0.70**	**0.93**	0.76	**0.72**	**0.93**	0.78	**0.94**	**0.94**	1.00	**0.93**	**0.93**	1.00
TRD16-LocG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PPP8-LocH	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD17-LocH	**0.98**	**0.98**	1.00	**0.99**	**0.99**	1.00	**0.98**	**0.98**	1.00	**0.95**	**0.95**	1.00
TRD18-LocH	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	Par.Sat			Sta.Sat			Stu.Atti			Tea.Judg		
DMU	**CCR-I**	**BCC-I**	**Scale**	**CCR-I**	**BCC-I**	**Scale**	**CCR-I**	**BCC-I**	**Scale**	**CCR-I**	**BCC-I**	**Scale**
PPP9-LocI	1.00	1.00	1.00	**0.84**	1.00	0.84	**0.77**	1.00	0.77	**0.75**	1.00	0.75
TRD19-LocI	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD20-LocI	1.00	1.00	1.00	**0.96**	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00
PPP10-LocJ	**0.78**	**0.98**	0.80	**0.78**	**0.98**	0.80	**0.76**	**0.98**	0.78	**0.98**	**0.98**	1.00
TRD21-LocJ	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD22-LocJ	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PPP11-LocK	**0.94**	1.00	0.94	**0.94**	1.00	0.94	**0.89**	1.00	0.89	1.00	1.00	1.00
TRD23-LocK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD24-LocK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PPP12-LocL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRD25-LocL	**0.90**	1.00	0.90	**0.90**	1.00	0.90	1.00	1.00	1.00	1.00	1.00	1.00
TRD26-LocL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Inefficient PPP Schools out of 12	6	5		7	5		7	5		6	5	
Inefficient TRD Schools out of 26	8	4		12	4		6	4		5	4	
Total	**14**	**9**		**19**	**9**		**13**	**9**		**11**	**9**	

Table 10. Summary of Results.

	PPP			Traditional		
Parameter	**Number of schools inefficient**	**% of inefficient PPP Schools**	**School Codes**	**Number of schools inefficient**	**% of inefficient Traditional Schools**	**School Codes**
Overall	2	16.7	PPP2-LocB PPP10-LocJ	4	15.4	TRD9-LocD TRD14-LocF TRD15-LocG TRD17-LocH
NAPLAN	4	33.3	PPP2-LocB PPP4-LocD PPP5-LocE PPP10-LocJ	10	38.5	TRD2-LocA TRD4-LocB TRD5-LocC TRD7-LocC TRD9-LocD TRD14-LocF TRD15-LocG TRD17-LocH TRD18-LocH TRD19-LocI
ICSEA	4	33.3	PPP2-LocB PPP5-LocE PPP9-LocI PPP10-LocJ	6	23.1	TRD5-LocC TRD9-LocD TRD14-LocF TRD15-LocG TRD17-LocH TRD18-LocH
Girls Enrolment	**5**	41.7	PPP1-LocA PPP2-LocB PPP4-LocD PPP9-LocI PPP10-LocJ	8	30.8	TRD2-LocA TRD4-LocB TRD7-LocC TRD9-LocD TRD10-LocE TRD14-LocF TRD15-LocG TRD17-LocH
Attendance %	**6**	**50.0**	PPP1-LocA PPP2-LocB PPP4-LocD PPP5-LocE PPP9-LocI PPP10-LocJ	5	19.2	TRD5-LocC TRD9-LocD TRD14-LocF TRD15-LocG TRD17-LocH
Parent satisfaction	6	50.0	PPP1-LocA PPP2-LocB PPP4-LocD PPP5-LocE PPP10-LocJ PPP11-LocK	8	30.8	TRD7-LocC TRD9-LocD TRD11-LocE TRD13-LocF TRD14-LocF TRD15-LocG TRD17-LocH TRD25-LocL
Teacher Judgment	**6**	50.0	PPP1-LocA PPP2-LocB PPP4-LocD PPP5-LocE PPP9-LocI PPP10-LocJ	5	19.2	TRD2-LocA TRD9-LocD TRD14-LocF TRD15-LocG TRD17-LocH
Staff Satisfaction	7	58.3	PPP1-LocA PPP2-LocB PPP4-LocD PPP5-LocE	12	46.1	TRD4-LocB TRD5-LocC TRD7-LocC TRD9-LocD

			PPP9-LocI PPP10-LocJ PPP11-LocK			TRD10-LocE TRD12-LocE TRD13-LocF TRD14-LocF TRD15-LocG TRD17-LocH TRD20-LocI TRD25-LocL
Student Attitude	**7**	**58.3**	PPP1-LocA PPP2-LocB PPP4-LocD PPP5-LocE PPP9-LocI PPP10-LocJ PPP11-LocK	6	23.1	TRD7-LocC TRD9-LocD TRD11-LocE TRD14-LocF TRD15-LocG TRD17-LocH

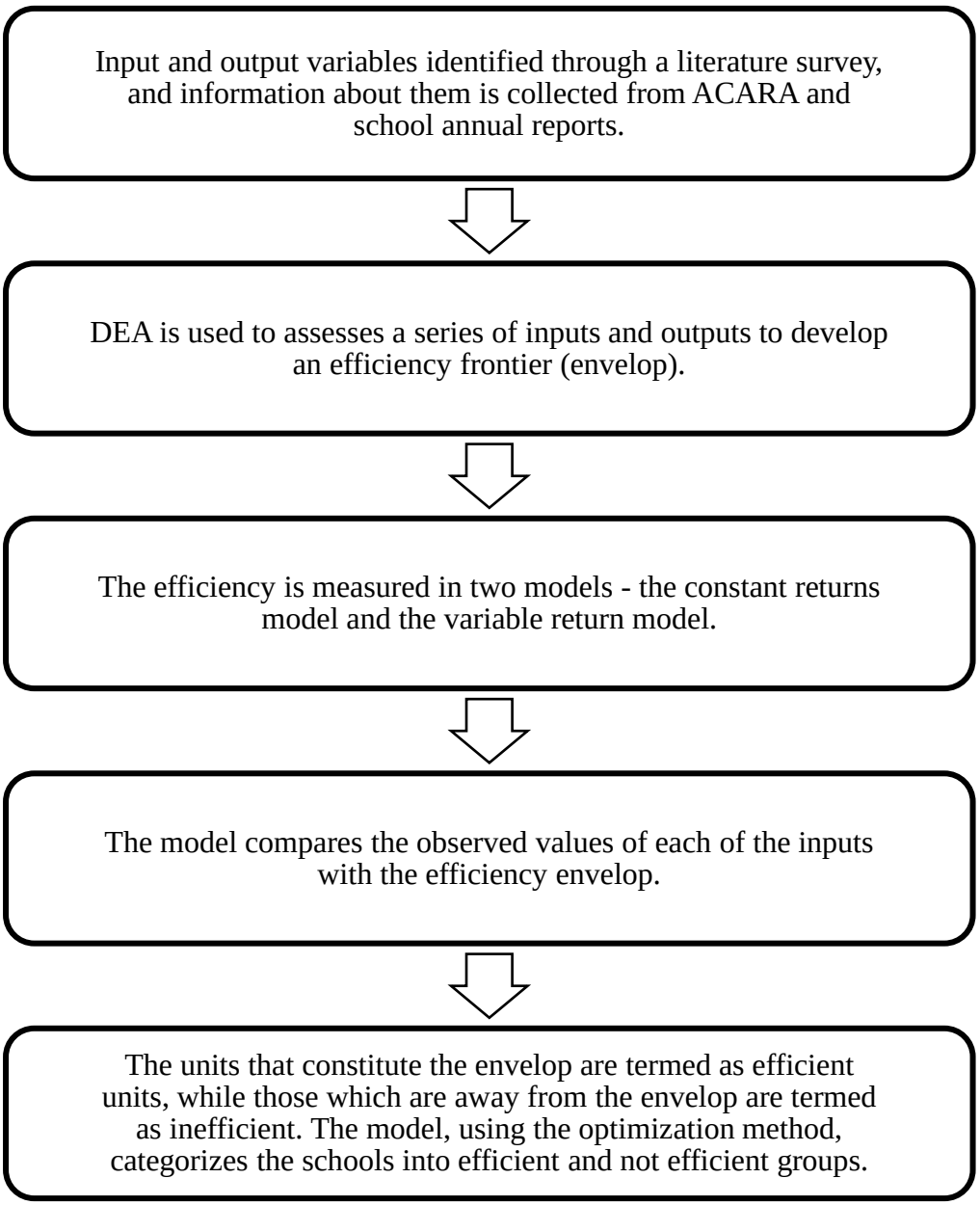

Figure 1. A diagrammatic representation of the method adopted.