Critical Data Envelopment Analysis (DEA): A *Critical* Approach for Evaluating Homogenous Organizations

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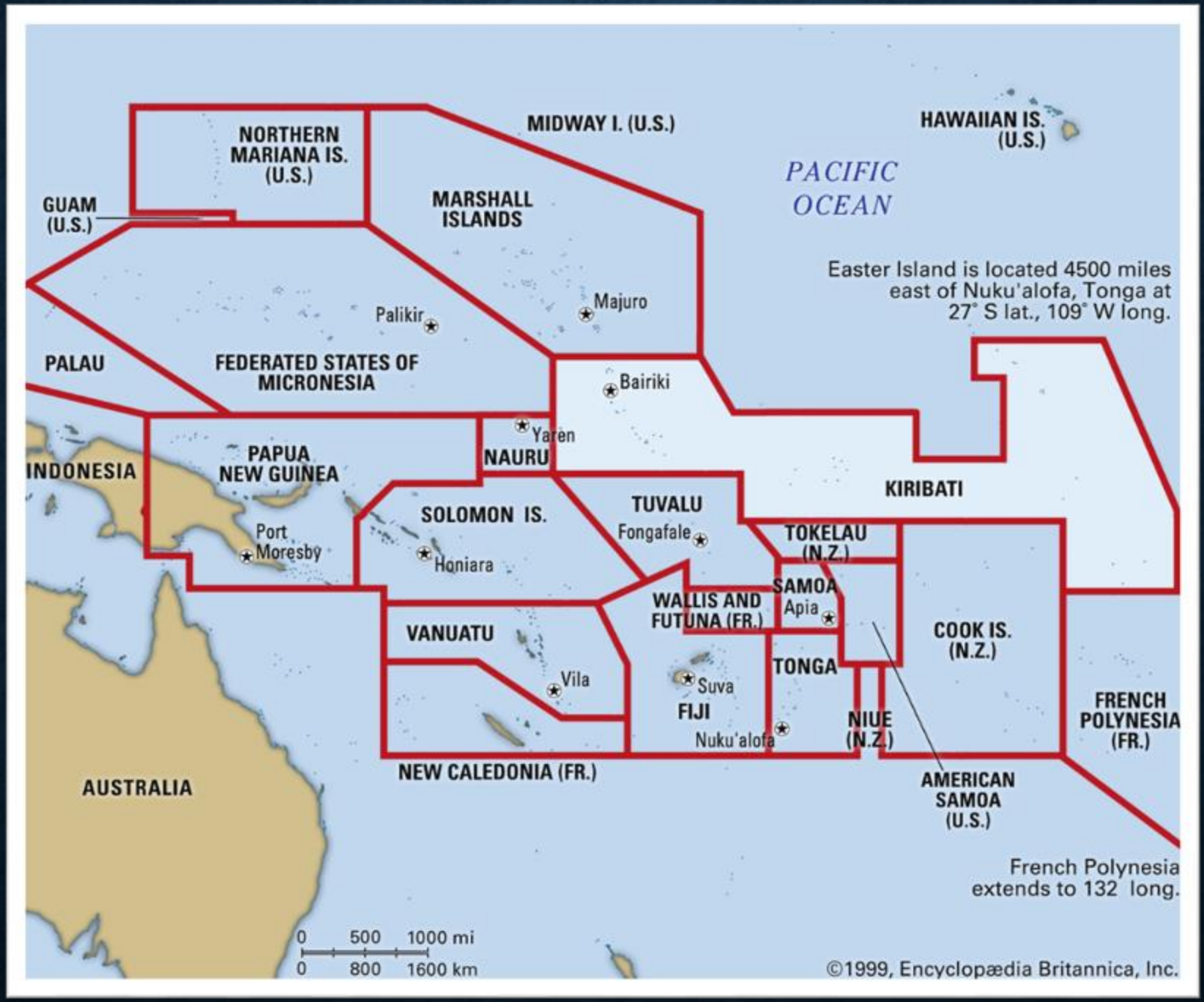
AGENDA

1. Positionality
2. Data Envelopment Analysis (DEA)
3. Critical DEA
4. Application: Queensland State Primary Schools
    a. Motivations
    b. Red-dirt Thinking
5. Conclusion


NORTHERN MARIANA IS. (U.S.)
MIDWAY I. (U.S.)
HAWAIIAN IS. (U.S.)
GUAM (U.S.)
MARSHALL ISLANDS
PACIFIC OCEAN
Easter Island is located 4500 miles east of Nuku'alofa, Tonga at 27° S lat., 109° W long.
Majuro
Palikir
PALAU
FEDERATED STATES OF MICRONESIA
Bairiki
Yaren
NAURU
INDONESIA
PAPUA NEW GUINEA
KIRIBATI
SOLOMON IS.
TUVALU
Fongafale
TOKELAU (N.Z.)
Port Moresby
Honiara
SAMOA
Apia
WALLIS AND FUTUNA (FR.)
COOK IS. (N.Z.)
VANUATU
TONGA
Vila
Suva
FIJI
NIUE (N.Z.)
FRENCH POLYNESIA (FR.)
Nuku'alofa
NEW CALEDONIA (FR.)
AUSTRALIA
AMERICAN SAMOA (U.S.)
French Polynesia extends to 132 long.
0 500 1000 mi
0 800 1600 km
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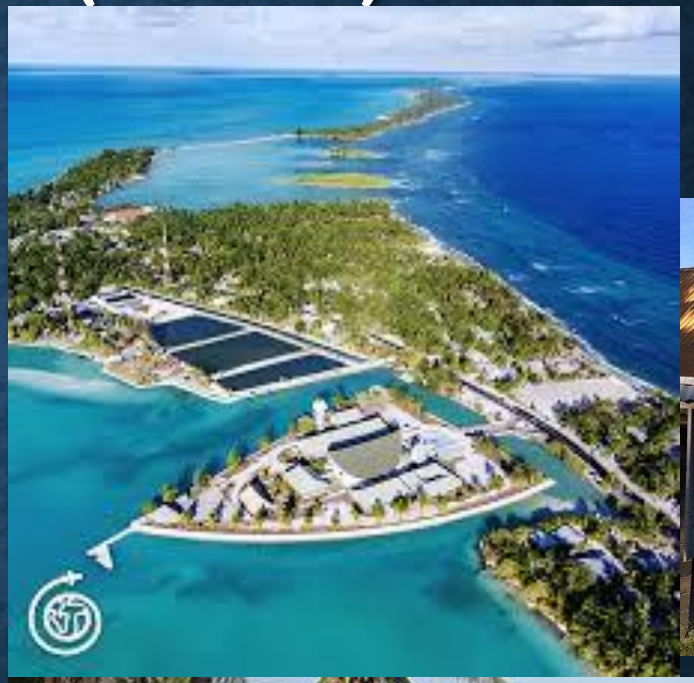
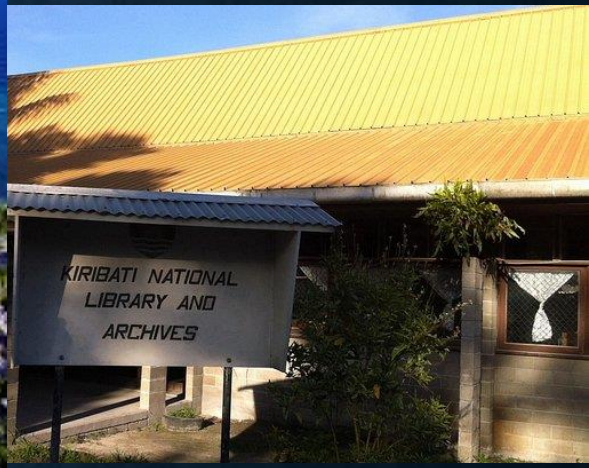
POSITIONALITY

- Elementary & Junior High School: Muribenua village, Nikunau Island (Outer island), Kiribati
- Senior High School: Tarawa (Capital Island), Favorite Subjects: Statistics & Economics, Kiribati
- Undergrad: Economics, University of Queensland, Brisbane, Australia
- Master's Degree: Public Administration: thesis on school performance evaluations, University of Hawaii, Hawaii
- PhD in Quantitative Methodologies, USA

OUTER ISLANDS (LEFT) VS. CAPITAL ISLAND (RIGHT)





HIGH STAKE JUNIOR SECONDARY NATIONAL EXAMINATION IN KIRIBATI

OUTBACK SCHOOL (LEFT) VS. URBAN SCHOOL (RIGHT) IN AUSTRALIA

WHAT IS DATA ENVELOPMENT ANALYSIS (DEA)?

- **DEA** is a **nonparametric algorithm** used to evaluate the **relative efficiency** of a set of homogenous units such as schools, hospitals, firms—based on their **multiple inputs and outputs**.
- Origin: seminal paper Charnes, Cooper & Rhodes (1978).
- **Approach:** Uses **linear programming** to construct an efficiency frontier from the data, without assuming a specific functional form (unlike regression).
- Efficiency score: Ranges from 0 to 1 (or 0–100%).

DEA OVERVIEW?

1978 – 2007 literature: DEA has been used in 4000 published research articles or book chapters in various fields (Emrouznejad et al., 2008)

DEA takes:

- **Inputs** (e.g., staff, funding, resources)
- **Outputs** (e.g., test scores, attendance)

and uses **mathematical optimization** to find the most efficient "frontier" — the set of schools that turn inputs into outputs best.

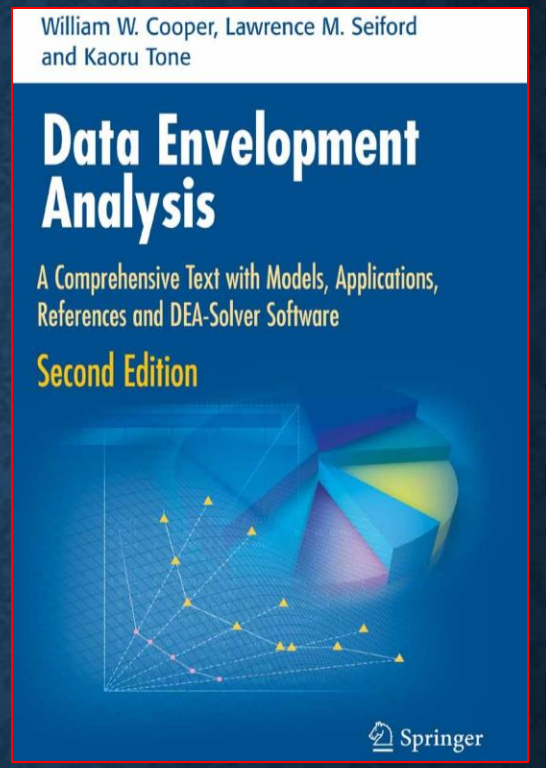
Each school's efficiency is computed by solving a **linear program:**

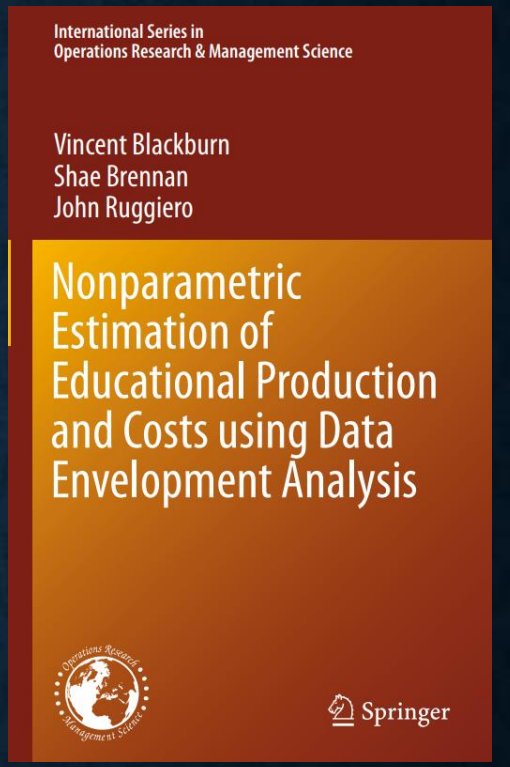
$$Efficiency = \frac{Weighted\ sum\ of\ Outputs}{Weighted\ sum\ of\ Inputs} = \frac{u_1 y_{1i} + u_2 y_2 + ..}{v_1 x_{1i} + v_2 x_{2i} ..}$$

subject to

$$\frac{u_1 y_{1i} + u_2 y_2 + ..}{v_1 x_{1i} + v_2 x_{2i} ..} \leq 1\ for\ all\ j$$

Here the algorithm searches for the *best weights* u, v that make the ratio ≤ 1 for every school, and as high as possible for the school being evaluated.





DEA SIMPLE EXAMPLE: BANK BRANCHES

Branch	Input	Output	Output/Input
	No. of staff employed	Transactions processed (‘000)	Transactions/Staff
New York city	16	64	4
Los Angeles (LA)	10	35	3.5
Cincinnati	20	175	8.75
Miami	22	132	6
Salt Lake city	30	180	6
Kansas city	12	100	8.3

Performance ratio says Cincinnati is the most efficient branch at processing transactions (8750 transactions per staff employed). Los Angeles is the least efficient (3500 per staff employed).

BANK SIMPLE EXAMPLE

- Cincinnati in terms of the performance ratio "transactions/staff" is an example of "best achieved performance" and is the branch which all the other branches should seek to emulate.
- The Cincinnati branch could therefore be used as a ***reference branch*** to set targets for the improved performance of the other branches.
- For example, in order to equal Cincinnati's performance LA branch could be given the output target of increasing its transactions processed from 35,000 to 87,500.
- Its output/input ratio would then be 87,500 / 10 = 8750, the same as Cincinnati's, thus making LA 100% efficient as well.

Branch	Relative Efficiency
New York city	4/8.75=0.46
Los Angeles	3.5/8.75=0.40
Cincinnati	8.75/8.75=1.00
Miami	6/8.75=0.69
Salt Lake city	6/8.75=0.69
Kansas city	8.3/8.75=0.95

BANK SIMPLE EXAMPLE

Branch	Input	Output 1	Output 2
	No. of staff employed	Personal transactions (‘000)	Business Transactions (‘000)
New York city	16	44	20
LA	10	23	12
Cincinnati	20	125	50
Miami	22	80	52
Salt Lake city	30	140	40
Kansas city	12	55	45

In most cases, a unit has more than a single input and a single output. There are usually a number of factors which determine the operational efficiency of a unit.

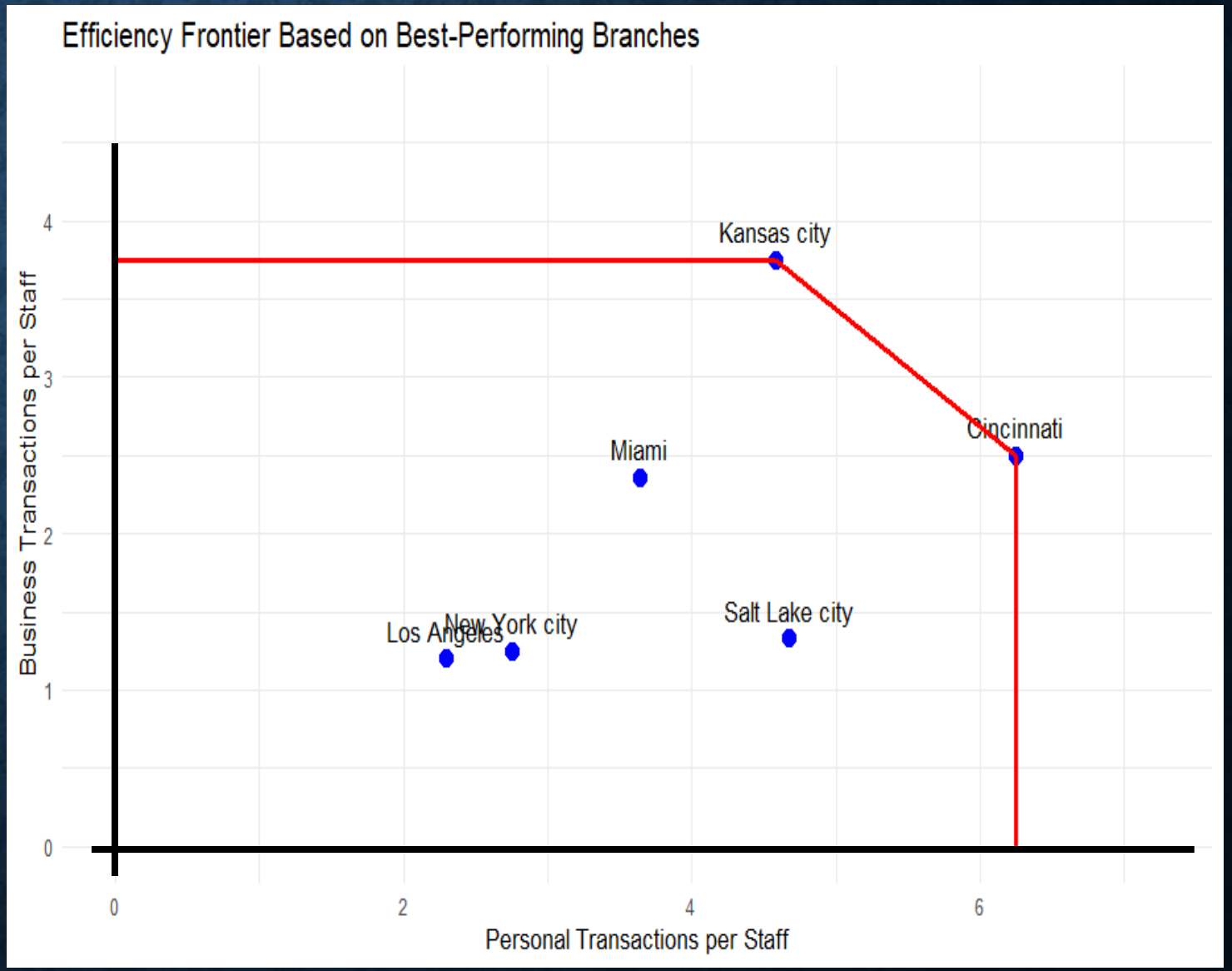
BANK SIMPLE EXAMPLE

Branch	Personal transactions/Staff	Business Transactions/Staff
New York city	2.75	1.25
LA	2.3	1.2
Cincinnati	***6.25***	2.5
Miami	3.64	2.36
Salt Lake city	4.67	1.33
Kansas city	4.58	***3.75***

The branch with the highest ratio of Personal Transactions/Staff is Cincinnati and consequently this branch is the most efficient in processing transactions on personal accounts. However, the branch with the highest ratio of Business Transactions/Staff is Kansas city and so this branch is the most efficient in processing transactions on business accounts. In this situation, the picture of efficiency is less clear.

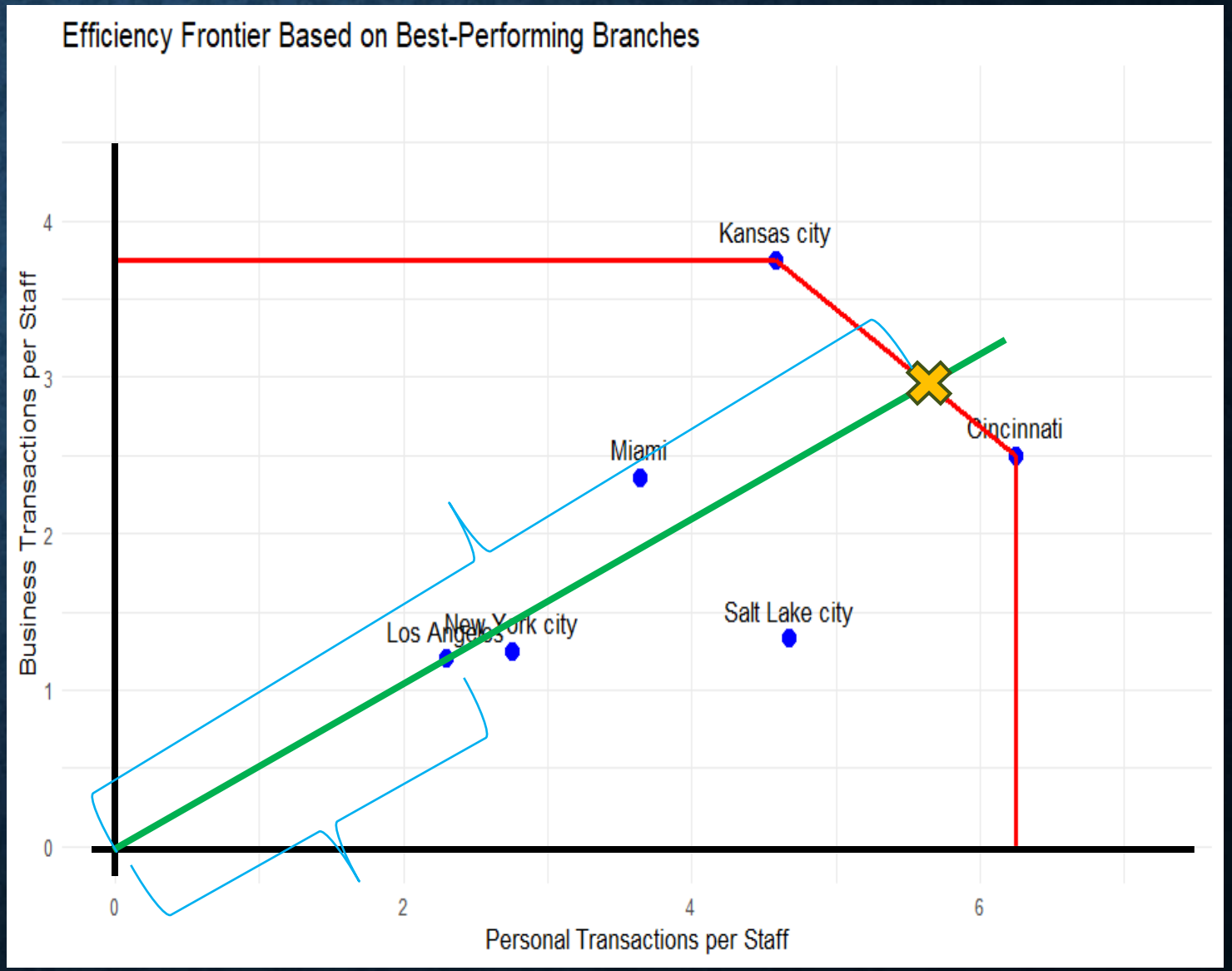
THE FUNDAMENTAL IDEA OF DEA

- The efficiency frontier 'envelops' the inefficient units within it and clearly shows the relative efficiency of each branch. Branches which are located on the frontier are performing better than any branches below the frontier. Any branch on the frontier is considered 100% efficient and any branch below it is relatively less efficient and has an efficiency rating of less than 100%.
- In this example Kanss city and Cincinnati are therefore considered 100% efficient: Cincinnati because it is the most efficient at processing personal transactions and Kansas city because it is the most efficient at processing business transactions.



THE FUNDAMENTAL IDEA OF DEA

- LA, for example, could become efficient if it increased its outputs, in the same proportions, whilst keeping its input the same. If it did this it would eventually reach the efficiency frontier at the point marked ("intersection", orange x).
- Alternatively, it could reduce its input while keeping its outputs constant which would have the same effect. Its actual efficiency is calculated simply by the ratio of its distance from the **origin** over the distance from the **origin** to the point marked **x**. This gives LA an efficiency of 41%.



HOW DO WE CALCULATE LA'S EFFICIENCY (41%)?

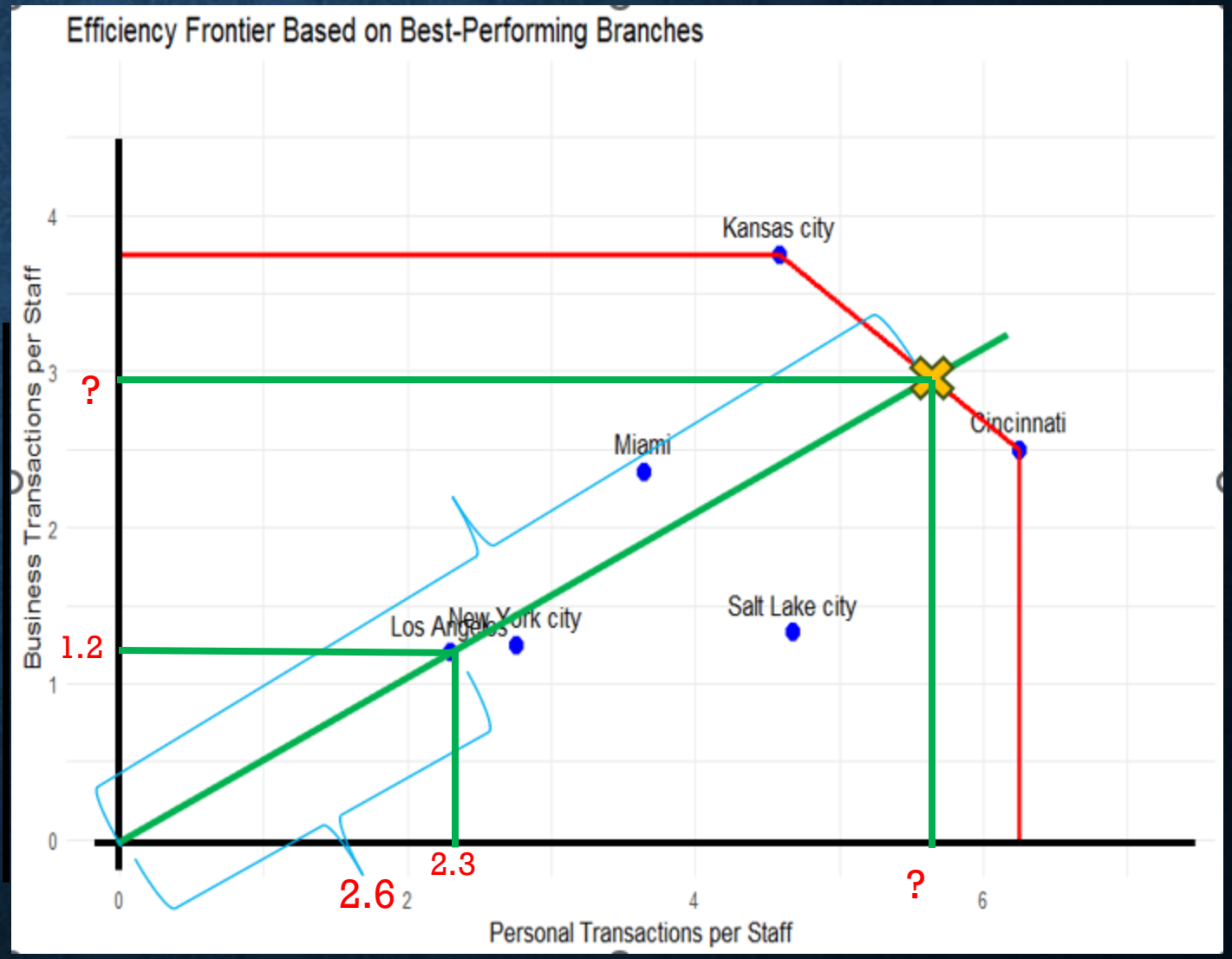
Branch	Personal/Staff	Business/Staff
Cincinnati	6.25	2.50
Kansas city	4.58	3.75
LA	2.30	1.20

COMPUTING LA'S EFFICIENCY SCORE (41%)

- DEA (graphically) defines efficiency as:
- $\text{Efficiency} = \dfrac{\textit{distance from origin to LA}}{\textit{distance from origin to the projected intersection on the frontier}}$
- This is **output-oriented DEA** with **one input (staff)**, so distance from origin means:
- $d = \sqrt{\left(Personal\right)^2 + \left(Business\right)^2}$

- **Distance from origin to LA:**
  - Personal = 2.3
  - Business = 1.2
- $d_{LA} = \sqrt{2.3^2 + 1.2^2}$
- $= \sqrt{5.29 + 1.44} = \sqrt{6.73} = 2.60$

Origin



- **Distance from origin to Intersection point on the frontier** (between Cincinnati and Kansas city):

- **Step A: Compute the slope of the line from origin through LA**
  - $\text{slope}_{OL} = \frac{1.2}{2.3} = 0.52$
  - So any point on that ray has:
  - $y = 0.52x$

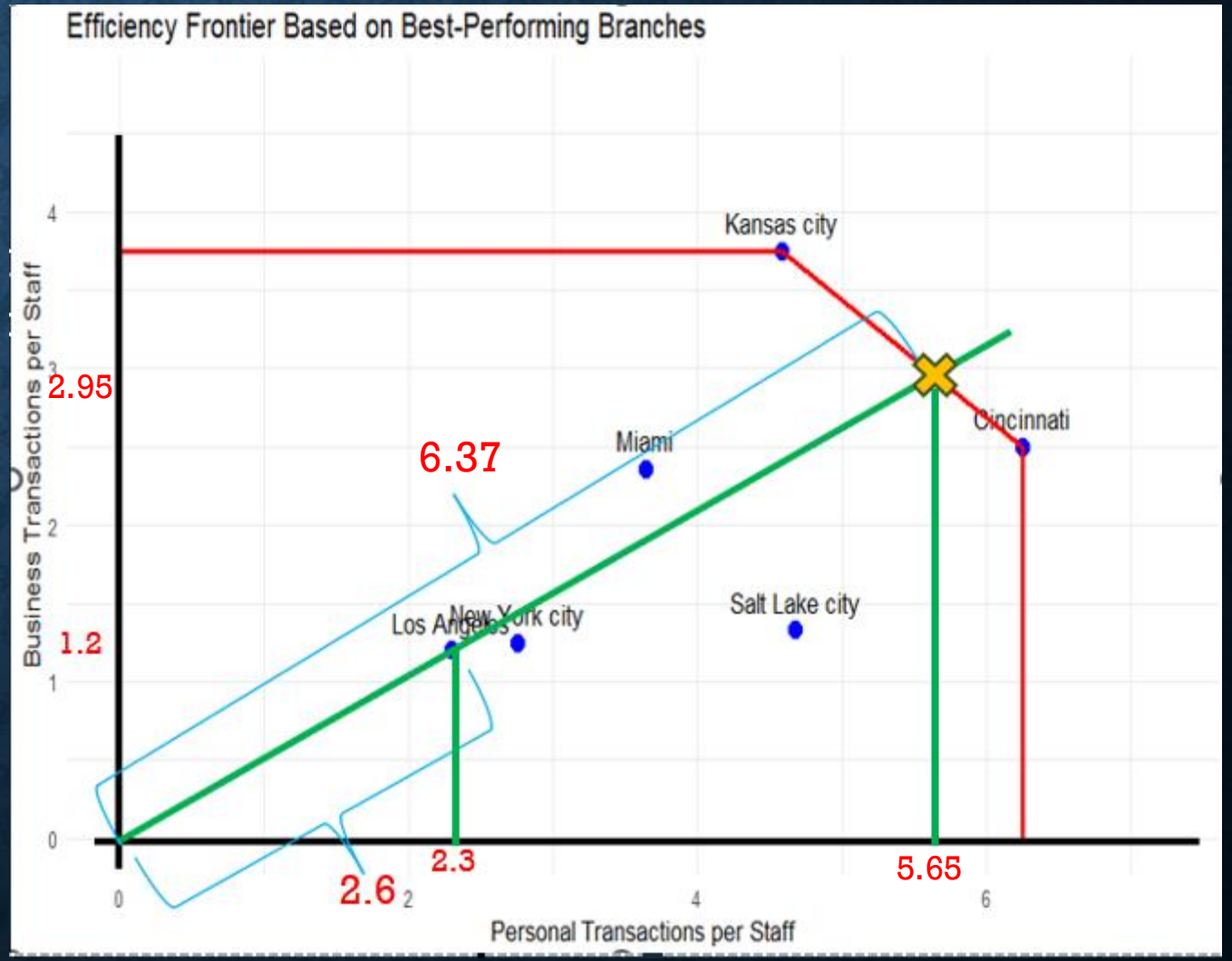
- **Step B: Compute the equation of the frontier line between Cincinnati (C) and Kansas city (K)**
  - Cincinnati: (6.25, 2.50)
    Kansas city: (4.583, 3.75)
- Frontier slope:
  - $m = \frac{3.75-2.50}{4.583-6.25} = \frac{1.25}{-1.667} = -0.75$
- Frontier line equation using point-slope form:
  - $y - 2.5 = -0.75(x - 6.25)$
- Simplify:
  - $y = -0.75x + 7.1875$

CALCULATING LA'S EFFICIENCY (41%)

- **Step C: Solve intersection of the two lines:**
  - $0.52x = -0.75x + 7.1875$
  - $1.2717x = 7.1875$
  - $x = 5.65$
- Then:
  - $y = 0.5217 \cdot 5.65 = 2.95$
- So the intersection point is approximately:
- **(5.65, 2.95)**

CALCULATING LA'S EFFICIENCY (41%)

- **Compute distance from origin to intersection**
- $d_{intersection} = \sqrt{5.65^2 + 2.95^2}$
- $= \sqrt{31.92 + 8.70} = \sqrt{40.62} = 6.37$
- **LA's efficiency score**
- $\text{Efficiency}_{LA} = \frac{d_{LA}}{d_{intersection}}$
- $= \frac{2.60}{6.37} = \mathbf{0.41}$



EXTEND THE BANK EXAMPLE TO 2 INPUTS AND 2 OUTPUTS

Branch	Staff (x_1)	Floor space (x_2)	Personal (y_1)	Business (y_2)
Cincinnati	20	500	125	50
Kansa city	12	400	55	45
LA	10	250	23	12

2 INPUTS AND 2 OUTPUTS CASE

- When we introduce a second input, the problem becomes four-dimensional. The frontier now lies in multi-dimensional space, so geometry is no longer possible. Instead, DEA uses linear programming to construct a convex frontier using the best performers and computes efficiency by comparing each unit to its optimal benchmark in that high-dimensional space.

GENERAL DEA OUTPUT-ORIENTED MODEL

- **Maximize proportional expansion of all outputs:**
  - $\max \theta$
- Subject to:
  - $X\lambda \leq X_o$
  - $Y\lambda \geq \theta Y_o$
  - $\lambda \geq 0$

Where:

- X is the matrix of inputs
- $Y$is the matrix of outputs
- λ forms convex combinations of reference units
- θ is the expansion factor

- Efficiency score:
  - $E_o = \frac{1}{\theta^*}$

GENERAL DEA INPUT-ORIENTED MODEL

- For a given unit o(the DMU we are evaluating), the **input-oriented** CCR model is:
- $\min_{\theta,\lambda} \theta$ subject to
  - $X\lambda \leq \theta X_o$
  - $Y\lambda \geq Y_o$
  - $\lambda \geq 0$
- Where:
  - X is the $m \times n$matrix of **inputs** (m inputs, n units)
  - Y is the $s \times n$matrix of **outputs** (s outputs, n units)
  - X_o is the input vector of the unit being evaluated (DMU o)
  - Y_o is the output vector of DMU o
  - λ is an $n \times 1$vector of intensity weights (convex combination of reference units)
  - θ is the **radial input contraction factor**
- Efficiency score:
  - Eo=θ∗ (because $\theta^* \leq 1$)
- Side by side:
- Output-oriented: $\max \theta \ \ s.t.\ X\lambda \leq X_o,\ Y\lambda \geq \theta Y_o,\ \lambda \geq 0$
- Input-oriented: $\min \theta \ \ s.t.\ X\lambda \leq \theta X_o,\ Y\lambda \geq Y_o,\ \lambda \geq 0$
- **Output-oriented: hold inputs fixed, scale outputs up by θ**
- **Input-oriented: hold outputs fixed, scale inputs down by θ**

1. OUTPUT-ORIENTED DEA IDEA

- By how much could LA proportionally increase *all* its outputs, keeping its inputs (staff and floor space) the same, if it operated as efficiently as some combination of Cincinnati and Kansas city branches?
- In output-oriented CCR DEA, for LA (our DMU_0), we:
  - Let λ_C and λ_K be weights that form a **virtual composite branch** from Cincinnati and Kansas city.
  - Let θ be the **output expansion factor** (how many times we could scale LA's outputs).
- We want the composite branch to:
  - Use **no more inputs** than LA,
  - Produce **at least θ times** LA's outputs.

2. OUTPUT-ORIENTED CCR DEA LINEAR PROGRAM FOR LA

- Decision variables:
  - $\lambda\_C \geq 0$ (weight on Cincinnati)
  - $\lambda\_K \geq 0$ (weight on Kansa city)
  - $\theta \geq 1$ (output expansion factor)
- We maximize θ subject to:
- **Input constraints (composite must use ≤ LA's inputs)**
- Staff: $20\lambda_G + 12\lambda_M \leq 10$
- Floor space: $500\lambda_G + 400\lambda_M \leq 250$
- **Output constraints (composite must produce ≥ θ × La's outputs)**
- Personal transactions:
  - $125\lambda_G + 55\lambda_M \geq \theta \cdot 23$
- Business transactions:
  - $50\lambda_G + 45\lambda_M \geq \theta \cdot 12$
- Non-negativity:
  - $\lambda_G \geq 0, \lambda_M \geq 0$

OUTPUT-ORIENTED CCR DEA LINEAR PROGRAM FOR LA

- **The LP in compact form**
- **Maximize** θ
- Subject to:

$$
\begin{aligned}
20\lambda_C + 12\lambda_K &\leq 10 \\
500\lambda_C + 400\lambda_K &\leq 250 \\
125\lambda_C + 55\lambda_K &\geq 23\theta \\
50\lambda_C + 45\lambda_K &\geq 12\theta \\
\lambda_C, \lambda_K &\geq 0
\end{aligned}
$$

3. WHAT DEA DOES WITH THIS LP

- For any chosen λ_C, λ_K that satisfy the **input constraints**, the composite branch has:
- Inputs:

$$x_1^* = 20\lambda_C + 12\lambda_K, x_2^* = 500\lambda_C + 400\lambda_K$$

- Outputs:

$$y_1^* = 125\lambda_C + 55\lambda_K, y_2^* = 50\lambda_C + 45\lambda_K$$

- The output constraints say:

$$\theta \leq \frac{125\lambda_C + 55\lambda_K}{23}, \theta \leq \frac{50\lambda_C + 45\lambda_K}{12}$$

- So for each feasible pair (λ_C, λ_K),

$$\theta(\lambda_C, \lambda_K) = \min\left(\frac{125\lambda_C + 55\lambda_K}{23}, \frac{50\lambda_C + 45\lambda_K}{12}\right)$$

- DEA (via linear programming) searches over all feasible λ_C, λ_K (respecting inputs) to **maximize θ**.
- If we solve this LP numerically (e.g., with a Excel Solver), we get approximately:
  - λ_C ≈ 0.288
  - λ_K ≈ 0.265
  - θ* ≈ 2.19
- Interpretation:
  - A composite of **28.8% Cincinnati + 26.5% Kansa city**
  - Can produce roughly **2.19 times** LA's outputs
  - Using **no more staff or floor space** than LA uses.
- So LA could, in principle, scale its outputs by ≈2.19× with the same inputs if it were as efficient as its benchmark.

4. EFFICIENCY SCORE FOR LA WITH 2 INPUTS AND 2 OUTPUTS

- For an **output-oriented** model:
- $\text{Efficiency}_{LA} = \frac{1}{\theta^*}$
- So here:
- $\text{Efficiency}_{LA} \approx \frac{1}{2.19} \approx 0.456 \;=\; 45.6\%$
- LA branch is operating at about **46%** of the efficiency of its DEA benchmark (a virtual mix of Cincinnati and Kansas city branches) given two inputs (staff and floor space) and two outputs (personal and business transactions).

- This is the **exact analogue** of the earlier geometric 41%:
- In the **1-input, 2-output** case we used **distance to the frontier along a ray**.
- In the **2-input, 2-output** case, we use a **linear program** instead, but the idea is the same: we find how far LA is from the "best practice" frontier along a proportional output expansion.

The Fundamental Idea Behind DEA

- The clever idea behind DEA lies in how it determines the importance of each input and output.
- Rather than assigning fixed weights in advance, DEA lets the data itself reveal how much each factor contributes to efficiency.
- Importantly, these weights can differ from one unit (e.g., school, banks) to another, allowing each to be evaluated based on the combination of inputs and outputs that best reflects its own strengths (and unique context).

LIMITATIONS OF TRADITIONAL DEA

- The conventional application of DEA is using easy to access, narrow measures of inputs and outputs (e.g., school funding, student/teacher ratio, standardized test scores in school DEA) without accounting for context or asset-based factors.
- Rankings / composite indices often privilege average, majority contexts and penalise heterogeneity, complexity, variation in community assets.
- They may reinforce deficit-narratives rather than celebrate unique strengths or local definitions of success.

DEA VS CRITICAL DEA

- DEA uses optimization algorithms to compare each school's inputs and outputs, finding the most efficient schools and showing how others can improve.
- Critical DEA keeps that mathematical structure but changes what counts as inputs and outputs — guided by QuantCrit and CritQuant.

DEVELOPMENT OF CRITICAL DEA

1. QuantCrit and CritQuant Principles
2. Systematic Review of DEA literature
3. Framework to inform *critical* performance indicators

QuantCrit (Gillborn et al., 2018) vs CritQuant (Diemer etl., 2023)

Similarities:

- **Both challenge traditional positivist assumptions in quantitative research**
- **Both center equity, justice, and systemic critique in data use**
- **Both use quantitative tools to surface structural inequities rather than reproduce them**
- **Both align with critical traditions (CRT, feminist, decolonial, etc.)**

Differences:

- **QuantCrit: Originated from CRT, emphasizes how *race, racism, and power* shape data and methods.**
- **CritQuant: Broader application, incorporates critical epistemologies (e.g., decolonial, Indigenous, feminist) beyond race alone.**
- **Good resource for CritQuant:**
  - **Diemer et al., (2023) https://doi.org/10.1080/19345747.2024.2391774**

QuantCrit vs CritQuant

QuantCrit (Gillborn et al., 2018)

(i) The centrality of racism: Reveals racism as a complex, sometimes subtle, aspect of social relations that frequently permeates the entire fabric of institutions. Positionality statement.

(ii) Numbers are not neutral: Model selection: Think about why you are choosing certain variables to include in your model

(iii) Categories are neither 'natural' nor given: for 'race' read 'racism' . When researchers are collecting and analyzing data, they should ensure their categorization is informed and resonates with the communities of interest.

(iv) Data cannot speak for itself: voice and insight. How have the perspectives and understandings of traditionally marginalized communities informed the research process? What steps have you taken to ensure that the research does not simply encode majority beliefs

(v) A social justice/equity orientation. Go beyond the existing and over-used metrics.

CritQuant (Diemer etl., 2023)

(i) Foundation: CritQuant scholarship should be thoroughly grounded in both critical theories and quantitative methods, throughout the research process

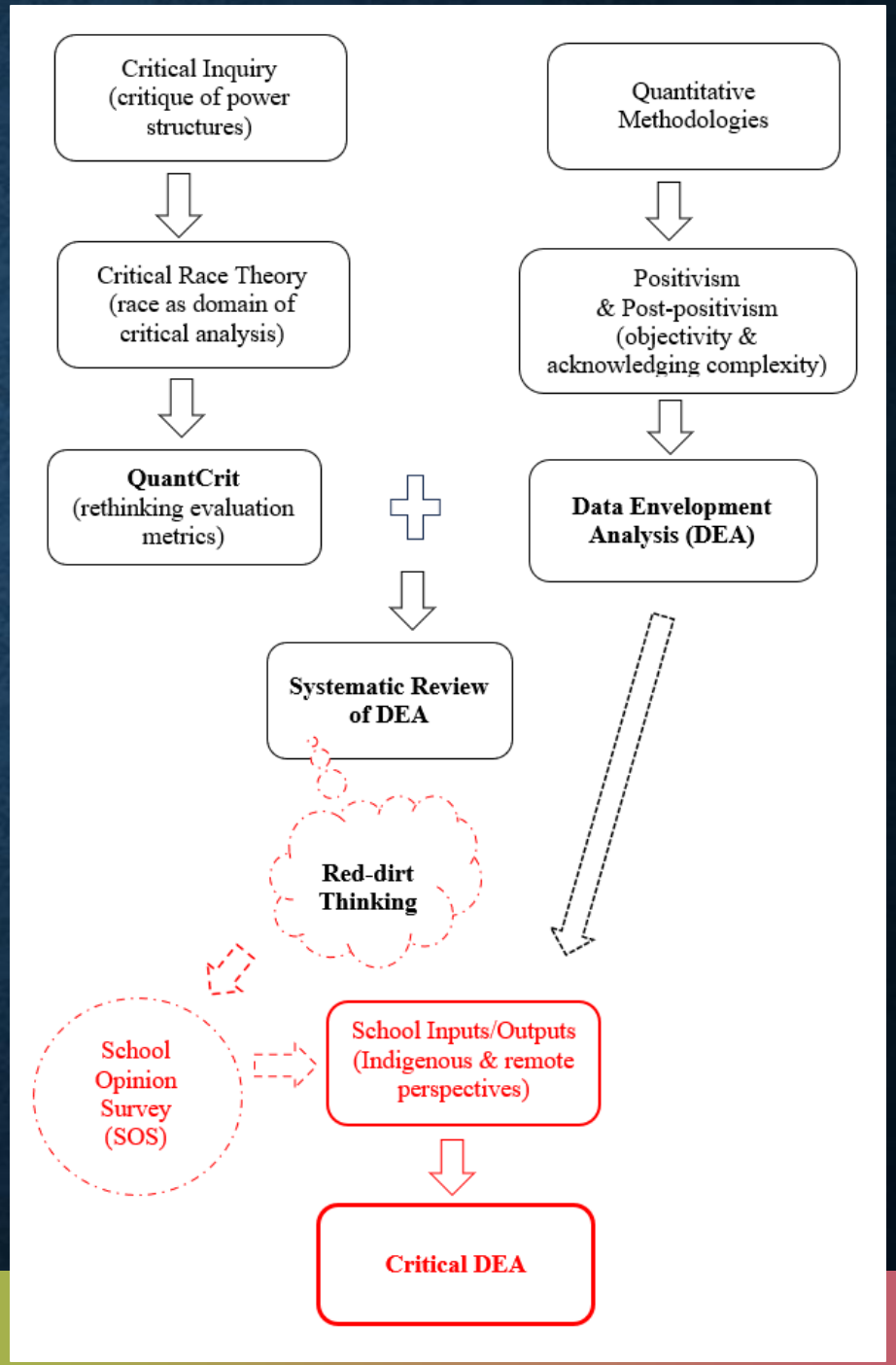
(ii) (ii) Goals: CritQuant scholarship aims to advance and reformulate critical theories and quantitative methodologies **Good resource for CritQuant:**

(iii) Parity: quantitative methods do not have more inherent truth or rigor than qualitative methods

(iv) (iv) Subjectivity: the research enterprise and quantitative methods are political and subjective; there is "no such thing" as value-free or objective inquiry

(v) (v) Self-reflexivity: structured researcher self-reflexivity, such as in positionality statements, is necessary across the research enterprise.

CRITICAL DEA FOR SCHOOL PERFORMANCE EVALUATION IN QUEENSLAND, AUSTRALIA



SYSTEMATIC REVIEW OF DEA (1978 – 2022)

- Elementary or primary schools context
- Databases: ERIC, BSC and EconLit.
- 16 papers reviewed, none applied QuantCrit and CritiQuant principles.
- One paper included ‘equity’ in the title, but the notion of equity did not play any significant role in how it planned and performed DEA (Kantabutra & Tang, 2006).
- All 16 studies in education were designed and performed by researchers from economics and business, whose interests are often restricted to pure quantitative analysis (positivist).

LIMITATIONS OF TRADITIONAL DEA IN SCHOOLS CONTEXT

1. Efficiency = Performance Relative Only to the "Best"

DEA constructs its frontier from the highest performers, regardless of **advantage, privilege, or context**.
→ Schools with systemic disadvantages appear "inefficient," not because they underperform, but because the model is blind to context.

2. No Incorporation of Equity or Fairness

Traditional DEA assumes inputs and outputs are neutral.
→ It cannot detect when metrics reward already advantaged schools or when outputs reflect opportunity gaps rather than efficiency.

…CON'T

3. Ignores Community Knowledge, Culture, and Strengths

The model values only quantifiable, Western-defined outputs.
→ Red Dirt Thinking and QuantCrit highlight that community-derived strengths are invisible in traditional DEA.

Traditional DEA offers mathematical elegance, but without a critical, equity-centered perspective, it reproduces systemic inequities rather than revealing true school strengths.

FRAMEWORK TO INFORM CRITICAL PERFORMANCE INDICATORS: AUSTRALIAN CONTEXT

3. Red-dirt Thinking of Educational Success (Guenther et al., 2013, 2015, 2016)

- Offers a critical reimagining of educational assessment, particularly within the sociocultural and geographic contexts of very remote Aboriginal and Torres Strait Islander communities in Australia.
- It challenges the dominance of metrocentric, standardised evaluation frameworks, such as NAPLAN, which reduce complex educational experiences into narrow input–output models.
- The language in discussions about remote schools is rife with messages of failure, deficit, disparity and problems and that this negative discourse is often supported by official statistics that appear unambiguous and objective on the surface.

MOTIVATIONS FOR CRITICAL DEA IN EDUCATION

"If the system is really interested in measuring progress, it is clear that NAPLAN is too blunt an instrument to do the job (at least on its own) in remote communities. Can we dare to be creative enough to begin measuring other indicators of progress or success?" (Guenther, 2013)

"In the absence of sophisticated ways of measuring and reporting achievement, we fall back on old failed methods. All NAPLAN has done is reinforce a social gradient of advantage and disadvantage, and seemingly legitimise unequal outcomes." (Roberts, 2017)

MOTIVATIONS FOR CRITICAL DEA IN AUSTRALIAN EDUCATION CONTEXT

NAPLAN is a "dumb" test administered to all students, regardless of contextual factors such as location and culture. Shutterstock

Beyond 'dumb' tests: NAPLAN needs to value regional, rural and remote students

Published: May 18, 2018 2.53pm AEST

Philip Roberts
Associate professor, University of Canberra

NAPLAN testing starts this week. With calls for a review, many education experts are calling the Future of NAPLAN into question. In this series, the experts look at options for removing, replacing, rethinking or resuming NAPLAN.

The recently released Independent Review into Rural, Regional and Remote Education again noted students in non-metropolitan areas perform, on average, below those in metropolitan areas. One such measure commonly used to make this claim is students' NAPLAN results.

But the problem with NAPLAN is that it's a "dumb" test: administered to all students, regardless of contextual factors such as location and culture. This is said to be a benefit, as it provides a measure comparable across all students.

Monitoring the performance of a system is an important and necessary public policy process. But in practice, no tool is able to neutralise the influence of contextual factors.

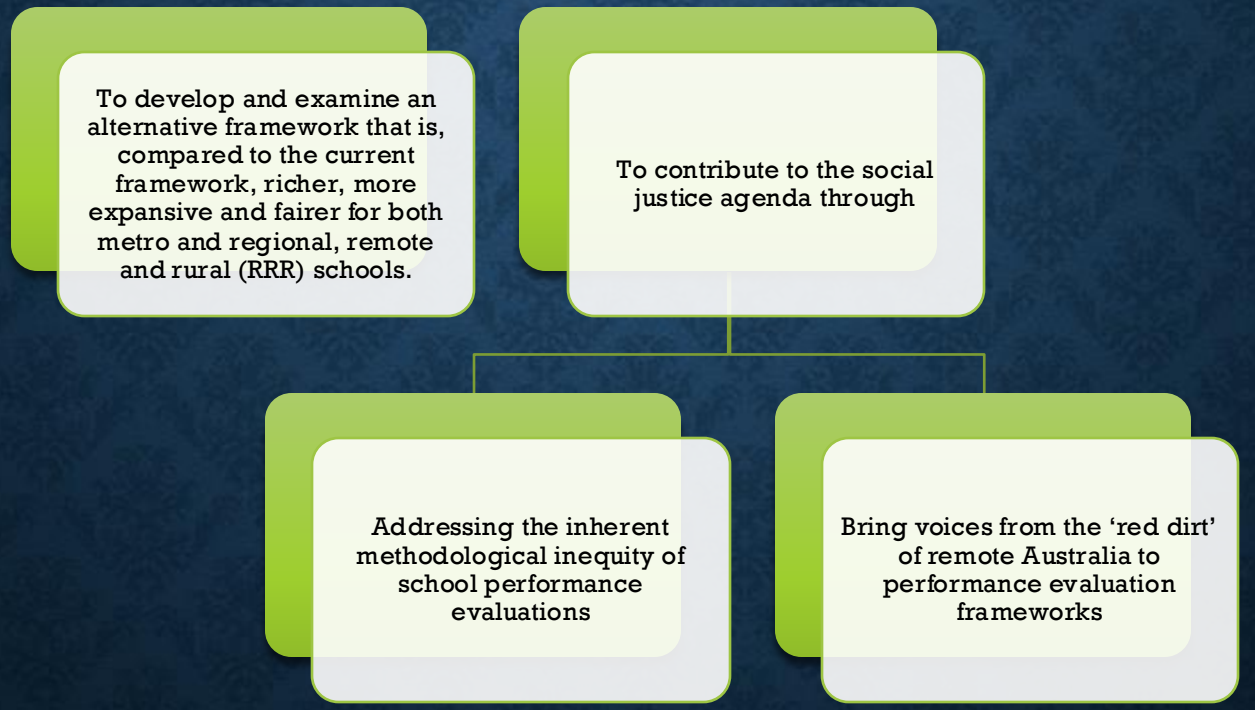
Education Queensland

Education academic says sample-based assessment better than NAPLAN

As NAPLAN testing gets under way around Queensland again this week, an education academic has suggested an alternative that might win over scared students and stressed teachers. VOTE IN OUR POLL.

Stephanie Bennett
2 min read May 10, 2021 - 8:41AM The Courier Mail 109 comments

OBJECTIVES OF CRITICAL DEA IN QUEENSLAND SCHOOLS CONTEXT



RED-DIRT THINKING OF SCHOOL PERFORMANCE INDICATORS

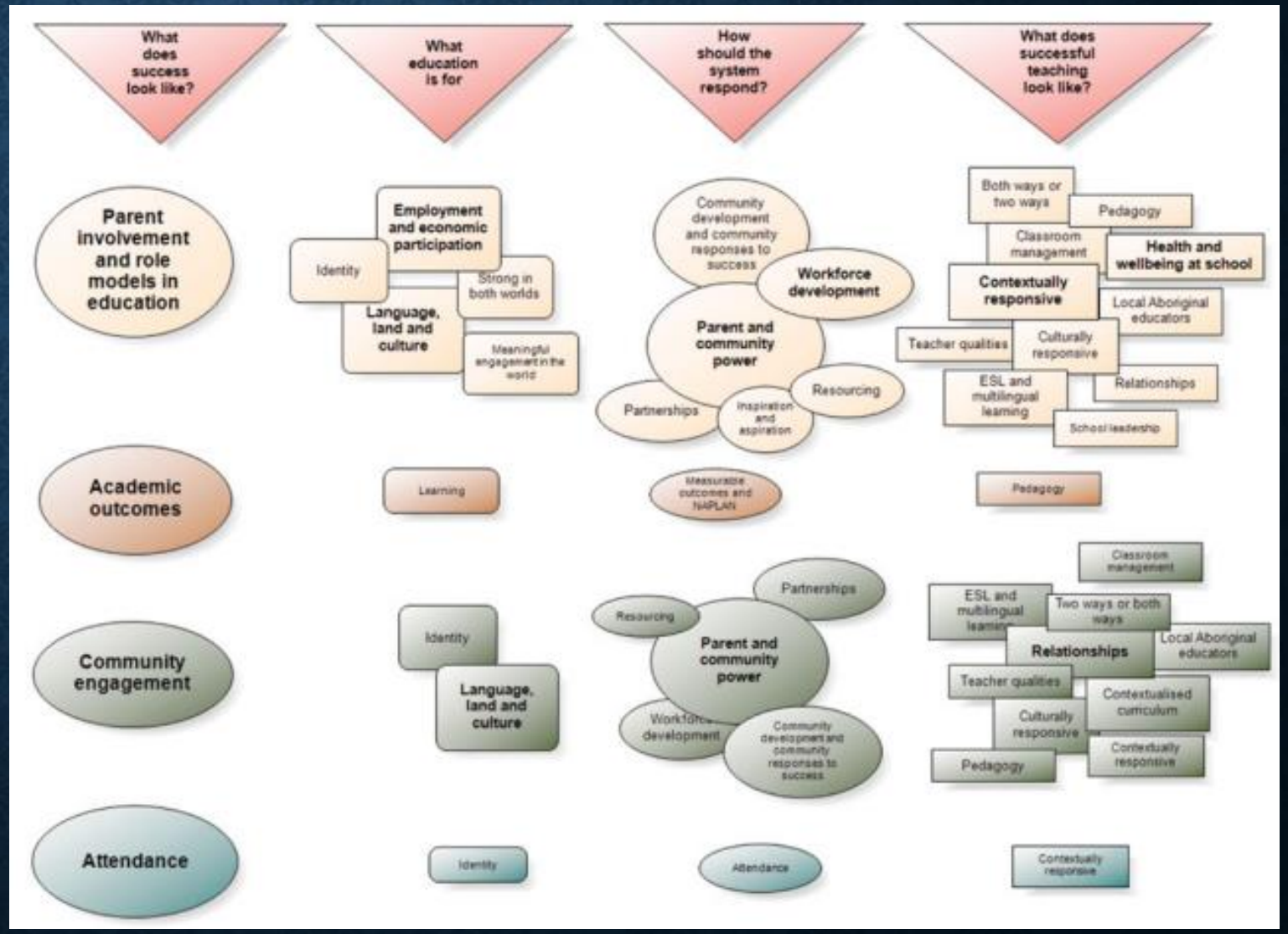
- Guenther et al. (2013) asserted that the language in discussions about remote schools is rife with messages of failure, deficit, disparity and problems and that this negative discourse is often supported by official statistics that appear unambiguous and objective on the surface.
- These data and the underlying quantitative methods are leaving us with poor outcomes, failures and disadvantages of remote schools and often fail to acknowledge the diversity, richness and worldview of remote communities.
- Guenther et al., (2013) introduced the concept of 'red dirt thinking' to explore ways to quantify educational success for remote schools and communities. Red-dirt symbolize the ubiquitous nature of red dirt in the remote parts of Australia. To ensure that success is defined, not just in generalised way, but in a way that reflects the 'red dirt' context in which education is delivered. (2015, p. 194)

CRITICAL PERFORMANCE INDICATORS FROM AUSTRALIAN OUTBACK SCHOOLS' PERSPECTIVE

2012 - 2015. A wide range of qualitative data were collected: 45 focus groups and individual interviews with 230 remote education stakeholders.

Interviewed teachers, assistant teachers, school leaders, community members, policymakers, bureaucrats, university lecturers and researchers, Vocational Education and Training and higher education students, youth workers, childcare workers, education union members and non-government organisation representatives

(Image from Guenther et al., 2015, p. 202)



1. DEFINE PURPOSE AND VALUES

- Clarify **why** evaluation is being done and **whose values** define "performance", "success", or "efficiency."
- Adopt a **QuantCrit, CritQuant or equity-focused stance**: evaluation must reflect justice, context, and community priorities, not productivity.

2. ENGAGE COMMUNITIES TO IDENTIFY CRITICAL PERFORMANCE INDICATORS

- Use qualitative or participatory methods (focus groups, interviews, Delphi survey) to surface what matters locally.
- If it is not feasible, use existing study that is robust enough to capture the voices and experiences of the subjects being evaluated.
  - Example in our study: Red-dirt Thinking Study.

3. BUILD THE DATA STRUCTURE

- In a traditional DEA, common school input/output indicators, such as socioeconomic status, income per student, and Math and English proficiency scores, are typically selected. In contrast, a Critical DEA expands the selection to include ‘critical’ indicators, such as community engagement, DEI, and local voices (parent voice and student voice) and efforts to ensure.
- Ensure a complete dataset — DEA requires no missing data for inputs and outputs.

QUEENSLAND SCHOOL OPINION SURVEY

- Many education systems already have data collection programs that gather qualitative information.
- The school opinion survey, which collects data annually from students, teachers, school leaders, non-teaching staff and parents across all state schools in Queensland.
- Closest available proxies for ‘red dirt’ indicators
- 90 survey items distributed across themes such as fairness, school culture, safety, staff wellbeing and departmental support.

RED-DIRT INDICATORS

Red Dirt Thinking proposes:

- Five qualitative *output* indicators: community engagement, DEI, student's voice, teacher's voice, parent's voice, and staff's voice and
- Four qualitative *input* indicators: school's effort, teacher's effort, non-teaching staff's effort, teaching/learning resources.

Quantifying these indicators is a challenge.

- We used Queensland Annual School Opinion Survey as proxies for these indicators.

EXAMPLE OF SCHOOL OPINION SURVEY ITEMS USED FOR CRITICAL PERFORMANCE INDICATORS

- 19 items are used to quantify DEI
- These items reflect key dimensions, such as the fair treatment of students, support for students with disabilities, cultural inclusion and staff engagement with Aboriginal and Torres Strait Islander perspectives. For instance, items such as *'My school has an inclusive culture where diversity is valued and respected'* and *'I feel confident embedding Aboriginal and Torres Strait Islander perspectives across the learning areas'* are pivotal in evaluating DEI in remote schools.

SOME EXAMPLES OF CRITICAL INDICATORS

Teacher Voice
I feel confident in my ability to work autonomously.
I am able to speak up and share a different view to my colleagues and the school leadership team.
I get the opportunity to develop new and better ways of doing my job.

Teachers' effort
My teachers motivate me to learn.
My teachers expect me to do my best.
My teachers provide me with useful feedback about my school work.
I can talk to my teachers about my concerns.
I understand how I am assessed at my school.
My schoolwork challenges me to think.
My teachers challenge me to think.

Parent voice
I can talk to my child's teachers about my concerns.
This school works with me to support my child's learning.
This school takes parents'/caregivers' opinions seriously.
This school asks for my input.
This school keeps me well informed.

Community engagement
This school has a strong sense of community.
My work has a direct positive impact on the community.
My school encourages me to be a good community member.

USE DISAGGREGATED DATA

Disaggregate both input and output variables as possible.

Variable options

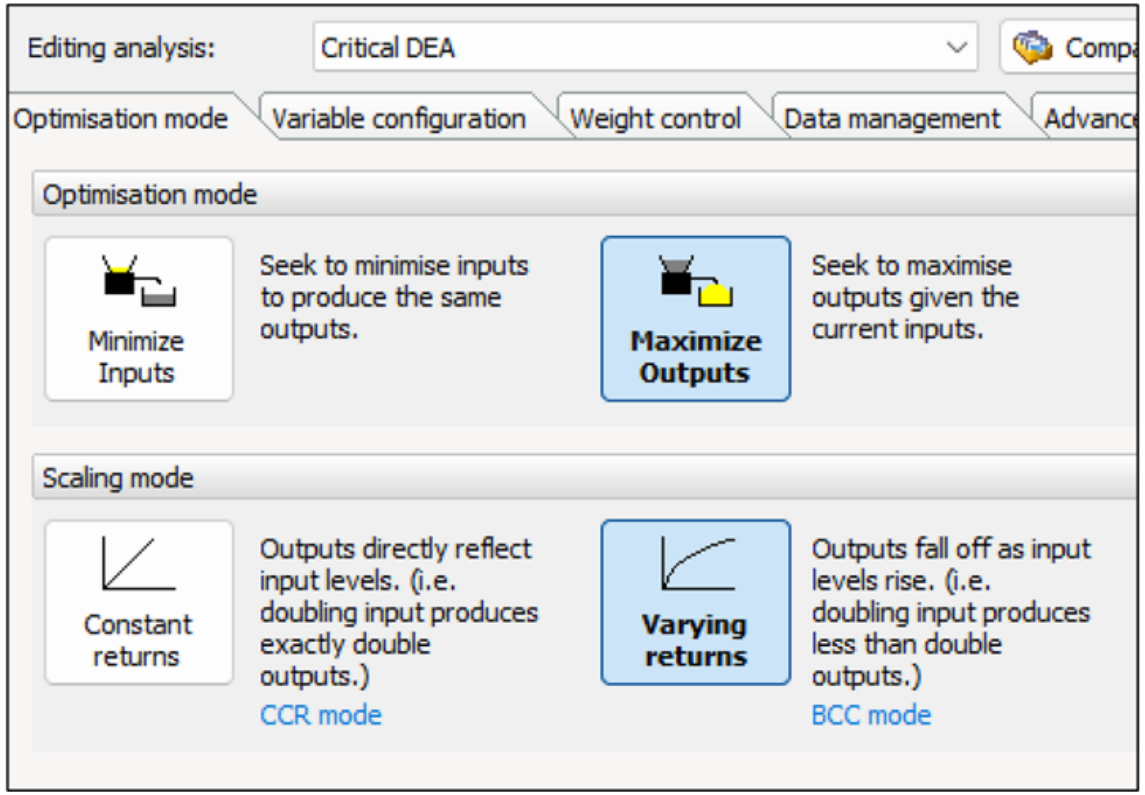
Active	Variable	Type
☑	Geolocation	Non-numeric data
☐	Sch_effort	Controlled input
☐	Teach_effort	Controlled input
☐	Staf_effort	Controlled input
☑	Resources	Controlled input
☑	ICSEA	Uncontrolled input
☐	Geolocation.3	Uncontrolled input
☑	Girls.perc	Uncontrolled input
☑	Indige.perc	Uncontrolled input
☑	Eng.sec.perc	Uncontrolled input
☑	Teach.Staf.per.Std	Controlled input
☑	NonTeachStaf.per.Std	Controlled input
☑	Income.per.std	Controlled input
☐	DEI	Output
☐	Std_voice	Output
☐	Pare_voice	Output
☐	Teach_voice	Output
☐	Staf_voice	Output
☐	Commu_Engage	Output
☑	yr3and5mean	Output
☐	yr3mean	Output
☐	yr5mean	Output
☐	Yr3_Numeracy	Output
☐	Yr3_Reading	Output
☐	Yr3_Writing	Output
☐	Yr3_Spelling	Output
☐	Yr3_Grammar	Output
☐	Yr5_Numeracy	Output
☐	Yr5_Reading	Output
☐	Yr5_Writing	Output
☐	Yr5_Spelling	Output
☐	Yr5_Grammar	Output

4. SPECIFY THE DEA MODEL

- Constant Returns to Scale (CRS) vs. Variable Returns to Scale (VRS) assumptions. Choose VRS at the minimum.
- Choose output-oriented DEA, not input-oriented. "How much can we *increase outputs* using the same inputs?"

Figure 6.1

Critical DEA Setup in Frontier Analyst Software



5. INTERPRET THROUGH A CRITICAL LENS

- Do not rank schools; interpret efficiency scores contextually.
- Examine who appears efficient and why:
  - Are remote schools still “inefficient”?
  - What community assets or structural constraints explain differences?

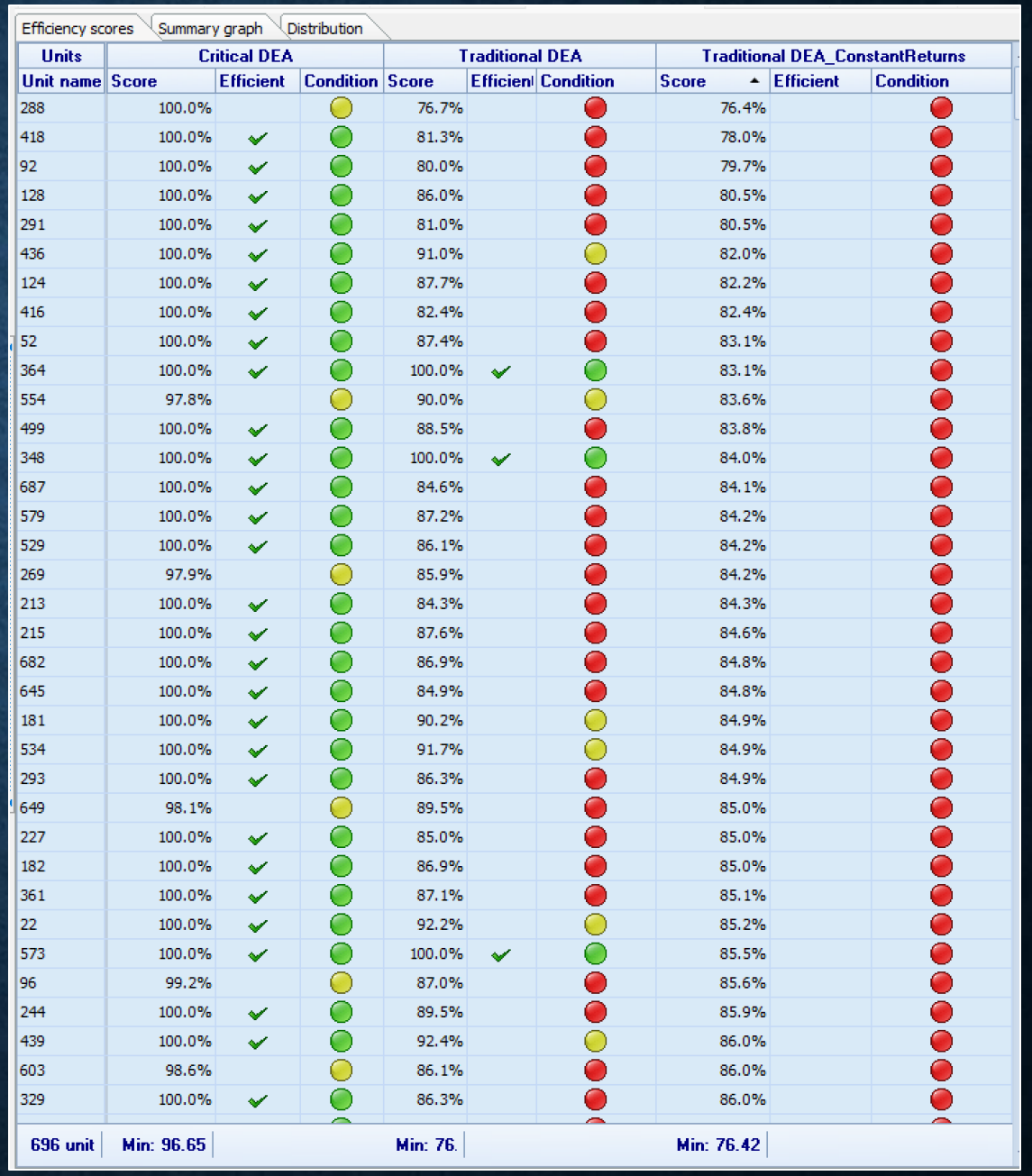
6. GENERATE “CRITICAL DEA REPORT CARDS”

Replace league tables with **constructive benchmarking**:

- Identify peer schools with similar contexts.
- Highlight red-dirt indicators driving efficiency (e.g., community engagement).
- Suggest feasible, equity-aligned improvement targets.

CRITICAL DEA AND TRADITIONAL DEA RESULTS

- League table ranking: Not the goal of Critical DEA. Here from illustration only.
- The goal is detailed Report Cards for each school



Efficiency scores | Summary graph | Distribution

Units	Critical DEA			Traditional DEA			Traditional DEA_ConstantReturns		
Unit name	Score	Efficient	Condition	Score	Efficient	Condition	Score	Efficient	Condition
288	100.0%			76.7%			76.4%		
418	100.0%	✓		81.3%			78.0%		
92	100.0%	✓		80.0%			79.7%		
128	100.0%	✓		86.0%			80.5%		
291	100.0%	✓		81.0%			80.5%		
436	100.0%	✓		91.0%			82.0%		
124	100.0%	✓		87.7%			82.2%		
416	100.0%	✓		82.4%			82.4%		
52	100.0%	✓		87.4%			83.1%		
364	100.0%	✓		100.0%	✓		83.1%		
554	97.8%			90.0%			83.6%		
499	100.0%	✓		88.5%			83.8%		
348	100.0%	✓		100.0%	✓		84.0%		
687	100.0%	✓		84.6%			84.1%		
579	100.0%	✓		87.2%			84.2%		
529	100.0%	✓		86.1%			84.2%		
269	97.9%			85.9%			84.2%		
213	100.0%	✓		84.3%			84.3%		
215	100.0%	✓		87.6%			84.6%		
682	100.0%	✓		86.9%			84.8%		
645	100.0%	✓		84.9%			84.8%		
181	100.0%	✓		90.2%			84.9%		
534	100.0%	✓		91.7%			84.9%		
293	100.0%	✓		86.3%			84.9%		
649	98.1%			89.5%			85.0%		
227	100.0%	✓		85.0%			85.0%		
182	100.0%	✓		86.9%			85.0%		
361	100.0%	✓		87.1%			85.1%		
22	100.0%	✓		92.2%			85.2%		
573	100.0%	✓		100.0%	✓		85.5%		
96	99.2%			87.0%			85.6%		
244	100.0%	✓		89.5%			85.9%		
439	100.0%	✓		92.4%			86.0%		
603	98.6%			86.1%			86.0%		
329	100.0%	✓		86.3%			86.0%		
696 unit	Min: 96.65			Min: 76.			Min: 76.42		

COMPARING CRITICAL DEA VS. TRADITIONAL DEA

School ID	Location	Critical DEA	Traditional DEA (VRS)
288	Inner Regional	100 %	76.7 %
92	Inner Regional	100 %	80.0 %
128	Very Remote	100 %	86.0 %
96	Inner Regional	99.2 %	87.0 %

SCHOOL288 REPORT CARD UNDER TRADITIONAL DEA

- Its efficiency was benchmarked against four schools (Schools 261, 451, 659, and 690) in its Reference Set
- To be considered fully efficient under CRS model, School 288 would be required to improve its average Year 3 and 5 NAPLAN score from 374.0 to 487.7 (a 30.4% increase), reduce teacher staffing from 0.08 to 0.07 (−9.5%), and decrease income per student by 13.6%.

Table 7.5

School Report Card for School 288 Under Traditional DEA (CRS)

School 288 Traditional DEA Report Card (CRS). References: 0
Efficiency Score **76.69%**
Peers: **261, 451, 659, 690**

Potential Improvements

Variable	Actual	Target	Potential Improvement
Eng.sec.perc	0.08	0.06	-27.14 %
Girls.perc	0.47	0.47	0.00 %
ICSEA	952.00	952.00	0.00 %
Income.per.std	18601.00	16067.53	-13.62 %
Indige.perc	0.08	0.08	-4.22 %
NonTeachStaf.per.Std	0.05	0.04	-6.30 %
Resources	92.47	92.47	0.00 %
Teach.Staf.per.Std	0.08	0.07	-9.54 %
yr3and5mean	374.00	487.66	30.39 %

Peer Contributions

261	Eng.sec.perc	51.40 %
261	Girls.perc	40.92 %
261	ICSEA	36.68 %
261	Income.per.std	33.48 %
261	Indige.perc	30.41 %
261	NonTeachStaf.per.Std	32.95 %
261	Resources	35.70 %
261	Teach.Staf.per.Std	34.04 %
261	yr3and5mean	36.86 %
451	Eng.sec.perc	17.86 %
451	Girls.perc	33.07 %
451	ICSEA	40.54 %

SCHOOL288 UNDER CRITICAL DEA

- School288 is efficient
- Different Reference Set: School **125, 196, 284, 516,614, 641**
- **More input and output indicators to look at**

School 288 Critical DEA Full Results References: 0
Efficiency Score **100%**
Peers: **125, 196, 284, 516,614, 641**

Potential Improvements

Variable	Actual	Target	Potential Improvement
Commu_Engage	93.87	94.25	0.40 %
DEI	94.66	94.79	0.14 %
Eng.sec.perc	0.08	0.05	-41.08 %
Geolocation.3	2.00	1.12	-44.14 %
Girls.perc	0.47	0.47	0.00 %
ICSEA	952.00	948.73	-0.34 %
Income.per.std	18601.00	13485.24	-27.50 %
Indige.perc	0.08	0.03	-57.87 %
NonTeachStaf.per.Std	0.05	0.04	-16.25 %
Pare_voice	88.67	88.67	0.00 %
Resources	92.47	92.47	0.00 %
Sch_effort	94.33	94.23	-0.11 %
Staf_effort	100.00	92.24	-7.76 %
Staf_voice	94.17	97.41	3.45 %
Std_voice	94.12	94.12	0.00 %
Teach.Staf.per.Std	0.08	0.07	-16.75 %
Teach_effort	95.94	95.94	0.00 %
Teach_voice	100.00	100.00	0.00 %
yr3mean	293.40	391.96	33.59 %
yr5mean	454.60	470.19	3.43 %

Peer Contributions

125	Commu_Engage	4.83 %
125	DEI	5.08 %
125	Eng.sec.perc	6.19 %
125	Geolocation.3	9.01 %
125	Girls.perc	4.01 %
125	ICSEA	5.12 %

SCHOOL 288 REPORT CARD UNDER TRADITIONAL DEA

- The primary output driving efficiency under the Critical model was teacher voice, contributing 100% to the output weight.
- Among inputs, the most influential was teacher effort (59.2%), followed by resources (15.4%).
- In effect, the model framed School 288's success as rooted not in standardised test performance or wealth, but in the commitment of its staff, their relationships with the community, and how empowered they feel in their roles.

Input / Output Contributions

Eng.sec.perc	0.22 %	Input
Geolocation.3	1.81 %	Input
Girls.perc	4.91 %	Input
ICSEA	3.52 %	Input
Income.per.std	2.47 %	Input
Indige.perc	0.17 %	Input
NonTeachStaf.per.Std	1.21 %	Input
Resources	15.43 %	Input
Sch_effort	4.28 %	Input
Staf_effort	4.53 %	Input
Teach.Staf.per.Std	2.24 %	Input
Teach_effort	59.19 %	Input
Commu_Engage	0.00 %	Output
DEI	0.00 %	Output
Pare_voice	0.00 %	Output
Staf_voice	0.00 %	Output
Std_voice	0.00 %	Output
Teach_voice	100.00 %	Output
yr3mean	0.00 %	Output
yr5mean	0.00 %	Output

CASE STUDY: SCHOOL 288 REPORT CARD

Under Traditional DEA (CRS):

- Efficiency = 76.7 %.
- Benchmarked against urban schools.
- Expected +30 % test scores improvement to be "efficient."

Under Critical DEA (VRS):

- Efficiency = 100 %.
- Reference Set = regional schools with similar context.
- Main outputs = teacher voice (100 %), teacher effort (59 %), resources (15 %).
- 🟢 Critical DEA centres the real labour of teachers and communities, not just scores.

CONCLUSION

- The study's emphasis on incorporating non-traditional (critical) inputs & outputs to further contextualize efficiency scores.
- This study broadens the field of both critical inquiry and quantitative methodologies. While critical research has traditionally relied on qualitative methods to explore issues of equity, race and systemic barriers, this study demonstrates how quantitative tools can also be leveraged for critical and equity-oriented data analysis.

RESOURCES

- https://banxia.com/frontier/
- R Packages:
- install.packages("Benchmarking")
- install.packages("deaR")
- install.packages("FEAR")
- install.packages("productivity")
- Python:
- pip install pyDEA

Foundational Books:

Charnes, Cooper, & Rhodes (1978) — CCR model

Banker, Charnes, & Cooper (1984) — BCC model

SCHOOL 96 VS. SCHOOL 133 INTERPRETING THROUGH A QUANTCRIT LENS

This case underscores key QuantCrit insights:

Reframing of disadvantage: Traditional DEA might view School 133's higher Indigenous and EAL/D enrolment as a liability; Critical DEA treats these as critical equity considerations (Gillborn et al., 2018).

Strategic investment in equity: Higher income and staff allocations are not inefficiencies but context-sensitive investments (Guenther et al., 2013).

Temporal priorities: School 133's focus on inclusion and cultural support may be a **precursor to long-term academic gains**, whereas School 96's emphasis on test scores may reflect short-term performance pressures.

Asset-oriented benchmarking: Rather than a deficit view, School 96 can learn from School 133's equity strategies, just as School 133 might benchmark against School 96 for academic improvements.

CASE STUDY 2: SCHOOL 96 VS. SCHOOL 133

- Both highly efficient (99–100 %), but for different reasons.
- School 133 serves 581 % more Indigenous students and 866 % more EAL/D students.
- Critical DEA recognises equity investment as efficiency, not cost.
- 🟢 Multiple pathways to excellence—*context defines success.*

RED-DIRT THINKING OF SCHOOL PERFORMANCE INDICATORS

- Lingard and Sellar (2013) cautioned that the overreliance on standardised data—what they term 'catalyst data'—can have perverse systemic effects and distort both pedagogy and policy.
- Bishop et al. (2009) demonstrated that culturally responsive schooling requires locally grounded measures of student success, engagement and wellbeing that are not captured by conventional assessment tools.
- Standardised testing not only risks misrepresenting the efforts of educators and students in remote settings, but also perpetuates deficit discourses that frame Indigenous education through a lens of failure, rather than one of resilience and locally defined success (Lingard et al., 2013).

MOTIVATIONS: DIFFERENCE IN PHILOSOPHICAL FOUNDATIONS

- **Positivist paradigm**
- Ontology: there is a 'cause' that determines an 'effect', and that the truth is "understandable, identifiable, and measurable" (Ponterotto, 2005, p. 130)
- Epistemology: the researcher and the research subjects are independent, distant, and impartial to each other—therefore the "researcher sees him/herself as completely objective and without bias" (Lynn & Dixson, 2013, p. 250)
- Line of inquiry: Quantitative methods

- **Critical Theory paradigm**
- Ontology: multi-layered reality that changes over time because of the changes in social, political, cultural, economic, ethnic and gender structures (Lynn & Dixson, 2013)
- Epistemology: the "researcher and the researched are impossible to separate" (Lynn & Dixson, 2013, p. 251)
- Line of inquiry: Qualitative methods and Critical Quantitative (QuantCrit) methods

GAP IN THE LITERATURE – DIFFERENCE IN PHILOSOPHICAL FOUNDATIONS

- Positivist paradigm
  - Ontology: there is a 'cause' that determines an 'effect', and that the truth is "understandable, identifiable, and measurable" (Ponterotto, 2005, p. 130)
  - Epistemology: the researcher and the research subjects are independent, distant, and impartial to each other—therefore the "researcher sees him/herself as completely objective and without bias" (Lynn & Dixson, 2013, p. 250)
  - Line of inquiry: Quantitative methods

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  - Ontology: multi-layered reality that changes over time because of the changes in social, political, cultural, economic, ethnic and gender structures (Lynn & Dixson, 2013)
  - Epistemology: the "researcher and the researched are impossible to separate" (Lynn & Dixson, 2013, p. 251)
  - Line of inquiry: Qualitative methods and Critical Quantitative (QuantCrit) methods

. POLICY & PRACTICE IMPLICATIONS

- Traditional DEA and league tables → deficit framing.
- Critical DEA → equity framing.
- Supports funding decisions and school improvement through **context-aware report cards**, not rankings.
- Encourages dialogue around what counts as "success."

TAKE-HOME MESSAGE

- “Efficiency according to whom, and by what values?”
- Critical DEA reframes evaluation from a **deficit narrative** to an **asset-oriented story** of community effort, inclusion, and context.

  It doesn’t erase data—it **reclaims it for equity.**

WHY CRITICAL DEA? – EVIDENCE FROM OUR WORK

- In our research, we found that schools labelled as "inefficient" under traditional DEA were recast as **efficient** under Critical DEA when red-dirt indicators were included.
- Example narratives: strong community engagement, culturally relevant pedagogy, high staff morale — not captured in test-score-only models.
- This reframing matters for equity: it challenges binary "good/bad" labels and invites nuanced evaluation.

CONCEPTUALIZING CRITICAL DEA

- Critical theoretical perspectives have recently begun to engage more constructively with quantitative methodologies (Gillborn et al., 2018; Viano & Baker, 2020).
- The current study is situated in this emerging effort to reconcile Critical Theory with traditional quantitative methods.
- Explores the potential to repurpose and reconfigure a traditional quantitative tool, DEA, as a Critical evaluation framework for school performance.
- Through this reimagining, the study **aims** to create a more socially just, context-sensitive evaluation method by applying transformative-oriented methodologies, such as QuantCRiT (Gillborn et al., 2018).
- 'The goal of these efforts is to create a space for quantitative research that engages with critical race theory authentically' (Viano & Baker, 2020, p. 305).

IMPLEMENTING CRITICAL DEA

1. Direct consultation with school principals, teachers, and students, for example, is an ideal strategy for articulating relevant input and output indicators for Critical DEA of school performance. In cases where direct input or voice from such participants is not feasible, two key steps must be taken:
    - *Engagement with Robust and Relevant Literature.* Researchers should first identify significant, high-quality empirical studies that have demonstrably and rigorously captured the voices, insights, and priorities of the communities being evaluated. The **Red-dirt study** (Guenther et al., 2016), in the context of Australian schools is a good example.
    - *Locating Best Representative Data.* The preferred approach is to collect such data directly from participants. However, if primary data collection is not feasible, evaluators should seek high-quality secondary sources—preferably established administrative datasets—that can serve as credible proxies for the identified indicators. The School Opinion Survey administered by the Queensland Department of Education was used as a primary data source.
    - *Disaggregation of Input and Output Indicators.* Once input and output indicators are selected, Critical DEA requires these variables to be disaggregated to the extent possible.
    - *Re-Categorisation of Indicators into Contextually Relevant Constructs.* If the themes/categories in a secondary dataset that is used are not aligned with the equity goals of the research, it is recommended that the researcher re-categorise survey items into meaningful constructs that reflect the opinions and priorities of those being evaluated.

Variables	Value for School 96	Benchmark Value from School 133
School effort	94	100
Teacher effort	101	100
Staff effort	87	100
Resource availability	96	100
ICSEA	63	100
Geolocation	100	100
Female students %	102	100
Indigenous students %	681	100
students with English as a second language %	966	100
Teaching staff per 100 students	153	100
Non-teaching staff per 100 students	369	100
Parental income per student	163	100
DEI	100	100
Student voice	101	100
Parent voice	102	100
Teacher voice	105	100
Staff voice	88	100
Community engagement	101	100
Average NAPLAN score across Year 3 and Year 5	75	100
NAPLAN score average in Year 3	68	100
NAPLAN score average in Year 5	81	100

CASE STUDY 2: SCHOOL 96 VS. SCHOOL 133

- Although School 96 outperforms School 133 on academic metrics, it was rated slightly less efficient. A deeper examination reveals that:
- **Indigenous students**: School 133 serves a population with 581% more Indigenous students than School 96.
- **EAL/D students**: School 133 has 866% more EAL/D students.
- **Non-teaching staff per student**: 269% higher in School 133, reflecting investment in holistic support.
- **Income per student**: 63% higher in School 133, likely reflecting compensatory funding needs.
- **Red-dirt indicators**: School 133 scores slightly higher on parent, teacher, student, and community voice.

CONCEPTUALISING CRITICAL DEA

- We propose Critical DEA: an evaluation framework that retains the mathematical rigour of DEA but reframes what counts as inputs/outputs.Key features:
  - Incorporates "red-dirt" indicators: locally meaningful, contextually grounded measures (e.g., student & staff voice, community engagement, culturally responsive teaching, diversity/equity/inclusion, school effort)
  - Grounded in principles of Quantitative Critical Race Theory (QuantCrit) and asset-based evaluation.
  - Co-constructed with communities: what "success" means is defined collaboratively, not imposed from above.
- The result: schools in underserved or marginised contexts are evaluated in ways that better reflect their strengths and contributions.

CHOOSING THE DEA MODELS

- It is strongly recommended that, at a minimum, a VRS DEA model be used instead of a CRS one.
- An output-oriented DEA model is used instead of an input-oriented model:
  - In educational contexts, typically, the goal is to maximise positive student and school outcomes rather than to minimise resource use.
  - This approach aligns with asset-based frameworks, which emphasise growth, achievement and improvement, rather than deficit-based efficiency models.

MOTIVATIONS

1. Schools in most countries continue to be labelled as "good vs bad", "top vs bottom", "efficient vs inefficient" based on narrow metrics (test scores league tables).
2. These labels carry major consequences: reputational, funding, policy, community trust, and importantly, legitimizing certain groups (e.g., Indigenous groups) as "disadvantage".
3. But do these narrow metrics capture the full story of a school's value, teachers' work, effort and voice, especially in high-need or/and remote schools contexts?

CASE STUDY: QUEENSLAND STATE PRIMARY SCHOOLS, AUSTRALIA

Input/Output Indicators used:

- We demonstrate how users—whether policymakers, educators, or researchers—can engage more critically with the concept of "performance" and its embedded assumptions.

- This aligns with Ball's (2003) argument that *"performativity is a technology, a culture and a mode of regulation that employs judgements, comparisons and displays as means of incentive, control, attrition and change"* (p. 216).

- Through the lens of Critical DEA, we seek to decouple these performative pressures from deeper, contextually meaningful accounts of how schools serve their communities

Seek feedback

Reflect on performance

Explore new techniques

Set personal goals

Iterate and adapt

WHY THIS MATTERS (THE STAKES)

1. When schools are labelled “inefficient”, “bottom”, “least performing”, or “underperforming” they may:
    a. face reduced resources (or over-resourced), school closures, staff turnover
    b. lose community trust, morale, teacher retention
    c. divert attention away from strengths (e.g., community engagement, culturally responsive pedagogy)
2. Especially for schools in underserved, remote, Indigenous or historically marginalised communities: narrow evaluations amplify inequity rather than help ameliorate it.

Red-dirt thinking (Guenther et al., 2016)

Learn to infuse energy into your delivery to leave a lasting impression

One of the goals of effective communication is to motivate your audience

METRIC	MEASUREMENT	TARGET	ACTUAL
Audience attendance	# of attendees	150	120
Engagement duration	Minutes	60	75
Q&A interaction	# of questions	10	15
Positive feedback	Percentage (%)	90	95
Rate of information retention	Percentage (%)	80	85

DEA VS. CRITICAL DEA

Critical DEA builds on traditional DEA but reframes it through a **critical, equity-oriented, and contextually grounded lens**.

Whereas **traditional DEA** focuses narrowly on *technical efficiency*—how well units convert inputs into outputs—**Critical DEA** asks deeper questions about **whose values, contexts, and resources** define "efficiency" and/or "performance".

SPEAKING ENGAGEMENT METRICS

IMPACT FACTOR	MEASUREMENT	TARGET	ACHIEVED
Audience interaction	Percentage (%)	85	88
Knowledge retention	Percentage (%)	75	80
Post-presentation surveys	Average rating	4.2	4.5
Referral rate	Percentage (%)	10	12
Collaboration opportunities	# of opportunities	8	10

In this light, ‘red dirt thinking’ and related critical frameworks advocate for alternative metrics that are place-based, culturally responsive and co-developed with communities, thereby aligning measurement tools with the aspirations and realities of remote schooling environments.

THANK YOU

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CRITICAL DEA (Data Envelopment Analysis)

Amota Ataneka

MOTIVATIONS

1. Economist's Perspective

2. Coleman Report (1966): viewing education as a production process "Equality of Educational Opportunity" for the U.S. Department of Education. provided evidence that socioeconomic factors (student socioeconomic status) are the most important factors in determining educational outcome.

3. Hanushek (1989) summarized approximately 20 years of educational production studies and concluded that differences in school spending do not explain variations in student performance. Family background, however, does explain the differences in outcomes. Hanushek further finds that students with wealthier and more educated parents perform better. Hanushek (1979, 1986) provides a useful foundation to analyze education as a production process whereby outcomes are function of school inputs and socioeconomic variables.

4. Critical Perspectives