

# No Organization Left Behind – “Mass Market” Data Envelopment Analysis

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## Abstract

Data Envelopment Analysis (DEA) is a powerful tool for benchmarking to identify best practices and organizational inefficiencies. However, while the approach’s profile has been raised considerably over the past decade, it has failed to capture the attention of the majority of the potential users.

The world seems to run on performance metrics, yet only a tiny proportion of these are informed by the application of DEA. The rest leave the necessary synthesis of these metrics open to the vagaries of political opinion.

This paper explores some of the barriers to “mainstream” adoption of DEA. In doing so, it draws on personal experience of applying DEA in organizations, working with DEA practitioners and, most importantly, teaching DEA in government and commercial organizations.

A project from the education sector is used to illuminate many of the points raised in the paper<sup>1</sup>. DEA is being deployed as the foundation of a best practices identification and dissemination initiative. Focus has been placed on the identification and implementation of individualized improvement projects which are *directly* informed by, but abstracted from, the technical analysis.

Initial results were used to design a successful state-wide best practices conference where efficient schools were invited to give structured, “vertical”

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<sup>1</sup> Although the work of others is referenced in this paper, the data, information and views presented are solely those of the author, Andrew Tait.

(superintendent, principal and teacher) presentations on how they ran their school(s). Peer group membership was made available to the other schools, allowing them to identify the best learning opportunities from the assembled program.

## Introduction

Performance management is everywhere. It can be seen as the driving force behind vital aspects of modern life – from the determination of individual remuneration to the competitiveness of national, or regional, economies.

However, most of the performance management mechanisms in place today are flawed – some fundamentally so. In many cases these flaws can result in pathological behavior within the system being managed. For example:

- Eye hospitals in the UK have been focusing on simple procedures while more serious cases go untreated. This is the consequence of a “number of successfully treated patients” targets being set for the hospitals. Medical staff are being pressured to suppress their professional judgment in pursuit of this target.
- A large technology company emphasized the importance of constant innovation in its product line. This resulted in a stream of “innovations” such as changes in the color of components – each of which incurred some implementation costs.
- Schools have been known to encourage weak students to stay at home during exams, allowing them to be marked as “absent”. This is motivated by the fact that students who do not sit the exam are not factored into the average grade calculations for the school<sup>2</sup>.
- A software company that introduced performance bonuses for testers based on the number of bugs they found inadvertently created a “bug economy”. Programmers would introduce bugs and tell the testers where to locate them. The programmer and the tester would then split their ill-gotten proceeds.
- National newspapers (in the US and UK) live and die by circulation. Exclusives and campaigning journalism are two of the main tools used to boost figures. Recently, there have been a number of cases (e.g. USA Today, Daily Mirror) where newspapers have compromised their integrity in pursuit of “circulation performance”. Paradoxically, this may ultimately have the opposite effect, as readers desert the paper through lack of confidence.

Where attempts have been made to alleviate these kinds of problems through increased sophistication, the result has often been performance measurement mechanisms that evoke “Frankenstein’s Monster” – ad hoc combinations of metrics and calculations that obscure the goals of the organization and result in further frustration.

Of course, designing a perfect performance management system is incredibly difficult – it would be imprudent to suggest otherwise. It may not even be possible, as performance management goals within social systems are

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<sup>2</sup> This is not true in all cases.

negotiated tradeoffs (i.e. political). However, it would seem to be far from controversial to suggest that the performance management mechanisms in place today are candidates for considerable improvement.

This article advocates Data Envelopment Analysis (DEA) as a “general purpose” performance measure mechanism. It allows a comprehensive view of performance with a single theoretical framework. In many organizations, the adoption of DEA would be a first, and relatively simple, step towards better performance management. Granted, it is far from a panacea – but, in most cases, it would be an “off the shelf” improvement.

DEA is not as widely used as it could, or even should, be. This is due, in part, to a number of barriers would-be users tend to experience when attempting to apply DEA in organizations.

In this article, some of these barriers are identified and ways of overcoming them are discussed. Some of the approaches to overcoming these barriers are illustrated through a project that is using DEA to improve the performance of schools within New York State.

## Data Envelopment Analysis

DEA (Charnes 1978) is, fundamentally, a mathematical benchmarking approach. It identifies the relative performance/efficiency of a set of decision making units. Some of the units are identified as benchmark performers and these form a frontier of best practice against which the suboptimal units are evaluated.

Performance is determined against a set of supplied “inputs” (resources) and “outputs” (targets) that apply to each of the units being evaluated. For example, a retail organization may evaluate each of its outlets based on their ability to produce profit and turnover (outputs) for a given level of investment (input).

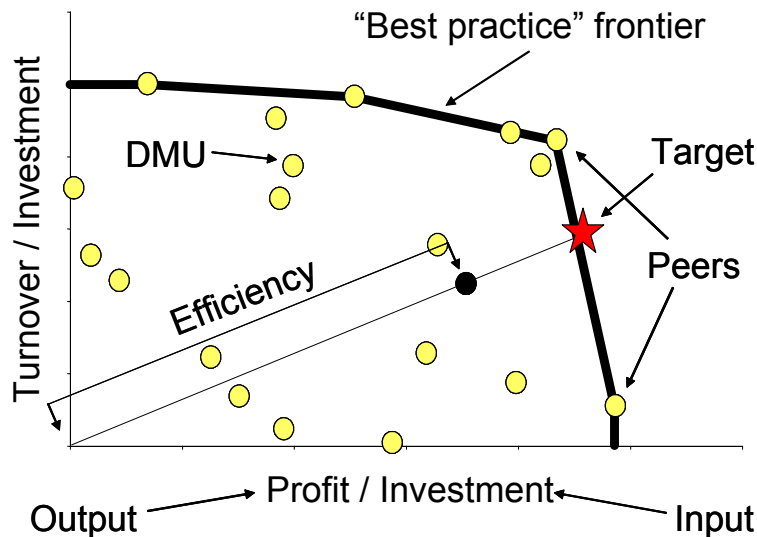


Figure 1: The “mechanics” of DEA

Figure 1 illustrates a simple analysis. First, the inputs and outputs are combined to produce all possible “performance ratios”. In this model, our two outputs and one input can be combined to produce two ratios – profit/investment and turnover/investment. Each DMU (e.g. outlet) is plotted against these two ratios, producing a scatter diagram.

The boundary<sup>3</sup> of this scatter plot identifies the best-practice frontier<sup>4</sup>. All DMUs below this frontier are inefficient – to a degree determined by their proximity (projected through the origin) to the frontier. For example, the star on the diagram shows the projection of the highlighted point onto the frontier. As this point is about 80% of the way along the projection line, the corresponding DMU is about 80% efficient.

Best-practice benchmarks (or peers) for a given inefficient DMU are the DMUs that border the area of the frontier onto which the inefficient unit is projected. These are shown in Figure 1 for the highlighted unit.

DEA has a number of benefits over more familiar performance measurement approaches, such as ratios, statistical summaries and multi-criteria analysis. For example:

- DEA provides a comprehensive evaluation of performance, taking into account multiple inputs and outputs to produce a single metric.
- DEA is “objective” in the sense that it does not require any *a priori* weights to be assigned to the inputs and outputs. These are determined as part of the analysis. In DEA, as in many similar approaches, the weights assigned represent tradeoffs between the various inputs and outputs. For example, in Figure 1, the optimal performance for the highlighted unit is achieved when profit is weighted higher than turnover (as slope of the projection line is less than 45°).
- DMUs are evaluated in the “best possible light”. DEA assigns weights to inputs and outputs in a way that maximizes a DMU’s performance – subject to the proviso that no DMU can have a performance level in excess of 100%.

It should be noted that DEA is a performance *measurement* approach – it is not a performance *management* or performance *improvement* approach. While the results identify improvement targets, they do not provide any direct guidance as to how these targets might be achieved.

However, DEA can form the foundation of a more complete performance management system. This is discussed later in the article.

## Improving organizational performance

Organizations are complicated and complex – clichéd, but true. They emerge from the interplay of thousands of goals and, consequently, are ultimately

<sup>3</sup> The boundary is delimited by the axes.

<sup>4</sup> Technically, the best-practice frontier is identified by taking the convex hull of the data points.

political entities. This is no less true for companies than it is for government organizations.

The dynamic, highly politicized nature of organizations presents particular challenges for performance improvement initiatives. Initiatives often need fine tuning *in situ* and outcomes can be difficult to predict.

A range of philosophers (Bergson 1946) and organizational development researchers (Land 1998) and scientists (Kelly 1955, Brooks 2002), from multiple disciplines, have argued persuasively that true understanding and creativity must be situated – i.e. embedded within the environment to which that understanding and creativity relates. Only those directly involved in an organization have the ability to truly understand it and alter its behavior in pursuit of chosen goals.

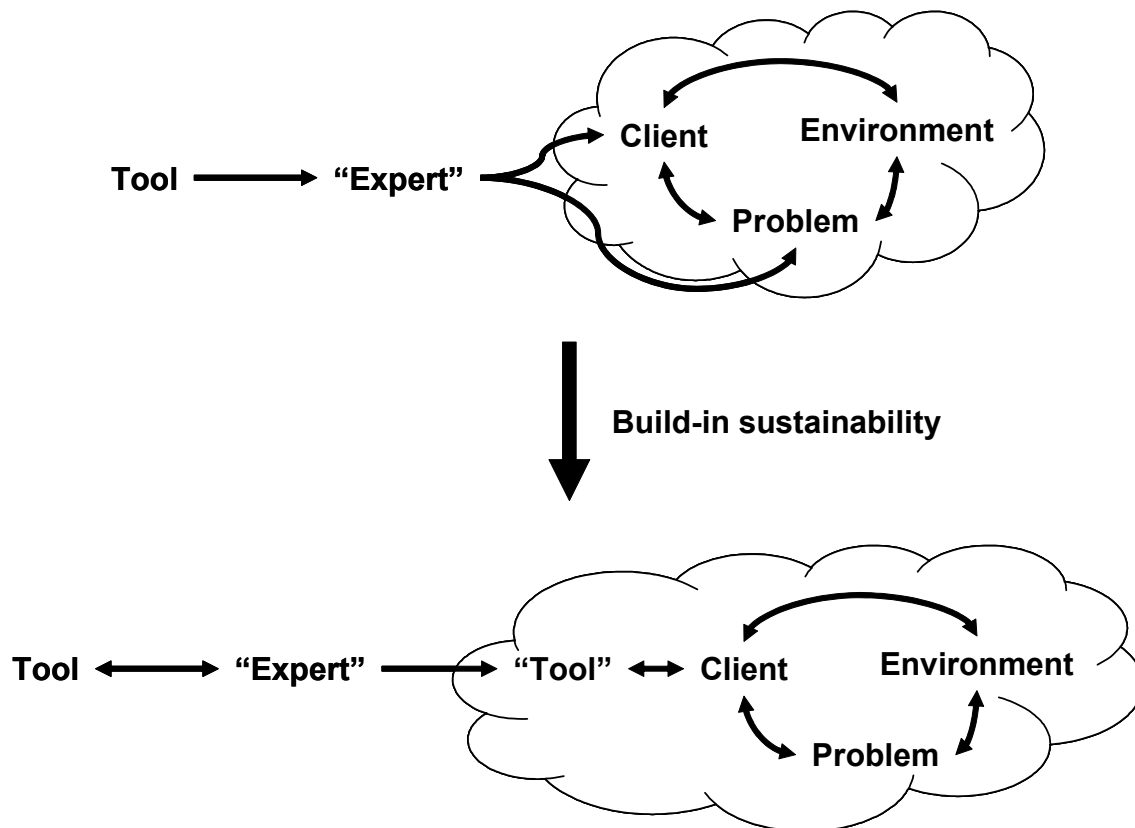
In addition, a growing body of research suggests that organizations are smarter than individuals. Again, this concept (indirectly) argues situated understanding – it is difficult to imagine how the “wisdom of crowds” (Surowieckis 2004) could be effectively applied from outside an organization.

What does this mean for DEA and its practitioners? There is a tendency to think that DEA, as a consequence of its formality and objective assignment of weights, stands above the political fray. Far from it. In fact, it is this very formality and objectivity that can place it at the center of politics.

When faced with an approach that appears to leave no avenue for political debate, a political organization (i.e. any organization) will have no alternative but to reject the approach itself.

Fortunately, DEA can provide an avenue for discussion and debate – and any successful DEA implementation must ensure that this is the case.

To succeed in improving performance – as opposed to merely measuring it – DEA must be embedded in the very fabric of the organization. It must “fake the immune” system and be transferred into the hands of those who can use it to change the future of the organization. If this is not achieved, any DEA project is likely to be a “one-off” experience.



**Figure 2: Building sustainable improvement initiatives**

Figure 2 illustrates the change in thinking that needs to occur. At present, most DEA initiatives involve an “expert” who conducts an analysis, advises the client and directly addresses aspects of the problem (e.g. develops strategy). This will tend to result in the gradual decay in the use of the approach after completion of the initial project.

To ensure the long term viability of a DEA-based performance improvement initiative, the capability (which may be a tool or expertise) to continue the initiative must be transferred to the client. Note that continued involvement of the “expert” is not a substitute for this capability transfer.

It may not be necessary to transfer a full capability to the client – especially where the necessary expertise (as is the case with DEA) is of a technical nature. A simplified capability can be transferred that meets the client’s needs. However, a *complete* capability must be transferred – i.e. one that allows the client to continue the development of the improvement initiative. Clients need complete, self-contained, renewable solutions – not models.

For example, it would be pointless to transfer software to a client without the capability to utilize that software. In such a case, it would be far more advantageous to produce a simplified software application for the client that, while more limited than the “expert” application, could be successfully used by the client without the need for advanced skills. In performance improvement

initiatives it is better to do one simple thing continuously than sporadically address ten sophisticated things.

So, to support successful performance improvement, DEA must be:

- accepted as a valuable tool for improving performance;
- placed in the hands of organizational “insiders” who are willing, and able, to utilize it; and
- packaged to support *sustainable* performance improvement initiatives.

Experience shows that there are numerous barriers to the successful implementation of DEA within organizations. When DEA is applied by “experts” many of these barriers are overcome as a natural part of the consulting process – i.e. the expert is able to “hide” irrelevant parts of the analysis and interpret the results in the context of the client’s problem. However, it has been argued that continued reliance on experts is incompatible with the long-term sustainability required for successful performance improvement initiatives.

If these barriers cannot be overcome, it is unlikely that DEA will ever achieve mainstream success as the basis of organizational performance improvement programs.

## **Barriers to adoption of Data Envelopment Analysis**

What are the barriers inhibiting the wider adoption of DEA?

Unfortunately, there is no objective answer to this question. It depends on individual perspectives, organizational biases and the current environment facing organizations. This latter point also means that the answer to the question shifts over time. For example, the recent Sarbanes-Oxley Act<sup>5</sup> is already having repercussions for performance measurement initiatives.

General contemporary trends can, however, be determined – and experience suggests that these tend to remain accurate over a number of years.

This section describes ten such trends uncovered during three years of conducting performance improvement and organizational development projects with large organizations.

### ***Data collection and analysis approach***

The trends identified below are the result of detailed discussions with people involved in implementing, or planning to implement, performance improvement initiatives within organizations.

Although a comprehensive cross section of people were included in these discussions, the trends are based only on the views and experiences of those who were able (either directly or indirectly) to *implement* improvement strategies.

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<sup>5</sup> [www.usdoj.gov/ag/readingroom/sarox.htm](http://www.usdoj.gov/ag/readingroom/sarox.htm).



This excluded people researching DEA and those using DEA to study third-party problems.

Such a distinction was necessary to identify barriers to the *long-term adoption* of DEA. Researchers have their own ranges of challenges in the application of DEA, but these tend to be quite different from those faced by people responsible for improving organizational performance.

Approximately 60 people were interviewed for this research.

### **“Top 10” barriers to adoption of Data Envelopment Analysis**

The ten most important issues were distilled from the interviews. This suspiciously round number does not reflect a natural break in the data. Rather, it reflects the goal of this research – a call to arms for those “experts” applying DEA in organizations. Ten items is a tidy, manageable, *marketable* number.

As such, the results are presented as much as a “manifesto” as a report on research. Nonetheless, these barriers do represent the major, real-world barriers preventing the adoption of DEA in organizations today.

#### **Barrier 1: “Already have an established method - or don't need one”**

Those who highlighted this as a problem tend to come from one of two types of organization. Either their organizations employed some historical, *ad hoc* approach, or they were implementing a form of Balanced Scorecard (occasionally it was an unholy combination of both).

Usually this barrier was reported as an objection of senior management. On occasion, it was reported as a personal philosophy of “If it ain't broke, don't fix it”. Unfortunately, a lot of these systems tend to be very much “broke”.

A problem with ad hoc systems that was reported numerous times was the inability of management to defend performance evaluations – leading to general inaction.

#### **Barrier 2: “Disagreement over appropriate metrics”**

This barrier refers to the difficulty in selecting input and output metrics that are acceptable to all the stakeholders. One of two outcomes tends to result from these disagreements. Either the model includes every possible variable and becomes unworkable, or the whole approach is abandoned.

#### **Barrier 3: “Don't have the necessary data”**

DEA is a data intensive approach. Many organizations are concerned that they do not have the necessary data to conduct an analysis – or that the quality of their data is inadequate for the task.

#### **Barrier 4: “Technique (DEA) is too complex”**

This objection tended to refer to the difficulty in selling DEA within the organization. One interviewee asked, “How can I sell a concept that no-one can understand?”

Quite.

#### **Barrier 5: “Difficulty in interpreting results of the analysis”**

Even if one overcomes Barrier 4, there is still the challenge of interpreting the results in the context of the problem to be addressed. “OK, we can build a DEA model,” mentioned one interviewee, “but what do we do with the results?”

This is partially a technical education problem, but also reflects political realities within many organizations. A number of interviewees had a firm grasp of what their models were telling them, but didn’t feel they could translate that into action within their current organizational climate.

#### **Barrier 6: “Need to improve, not just benchmark”**

This was the ubiquitous “So what?” question. Measuring performance is one thing, but *improving* it is quite another. DEA, it was argued, has nothing to say about the latter, and more important, problem.

#### **Barrier 7: “Benchmark units could be inundated with inquiries”**

In benchmarking, lower performing entities (e.g. DMUs) are encouraged to visit higher performing entities to learn how they manage to achieve better results.

While this is a powerful tool for transferring expertise throughout the organization, many interviewees expressed a concern that high performing DMUs would be inundated with requests from weaker DMUs, eating into their time and lowering their performance.

While there is obviously a balance to be struck between individual performance and the good of the organization, this represents a valid concern. Rewarding strong performance with the responsibility for helping others improve may have the effect of lowering performance as DMUs try to keep themselves just below the frontier. At the very least, the performance measurement approach will have to include knowledge sharing as part of the overall evaluation.

#### **Barrier 8: “Approach (DEA) is politically unacceptable”**

DEA addressed a sensitive issue – comparative performance. In effect, it provides a single metric showing who is “failing” and by how much. The DEA performance “league table” (i.e. the list of efficiency scores) is a powerful, and emotional, product.

In some cases, the mere existence of such an analysis could precipitate a political crisis. For example, heavily unionized industries could see it as an attempt to identify areas for cutbacks.

In some cases, it is the *simplicity* of DEA (cf. Barrier 4) that results in a political objection. Some managers are unwilling to accept that their performance can be encapsulated in a finite number of tangible variables (i.e. inputs and outputs).

**Barrier 9: “Technique (DEA) cannot compare ‘apples’ and ‘oranges’”**

Some of the interviewees had difficulty in identifying comparable DMUs in their organizations. Every potential DMU seemed to have some quirk that rendered it incompatible with the other units.

Even more common was the view that there were at least a few different types of DMU within the organization, making a comprehensive analysis impossible and, thus, significantly limiting the value of the DEA approach.

**Barrier 10: “What's DEA?”**

Some of the interviewees had never heard of DEA. As discussions were held with those involved in wider performance improvement initiatives and other organizational development activities, not all of them had come across DEA. In fact, unless the initial contact had been made with respect to DEA, about half the people interviewed had not come across the technique – even though it could be of some value in their work.

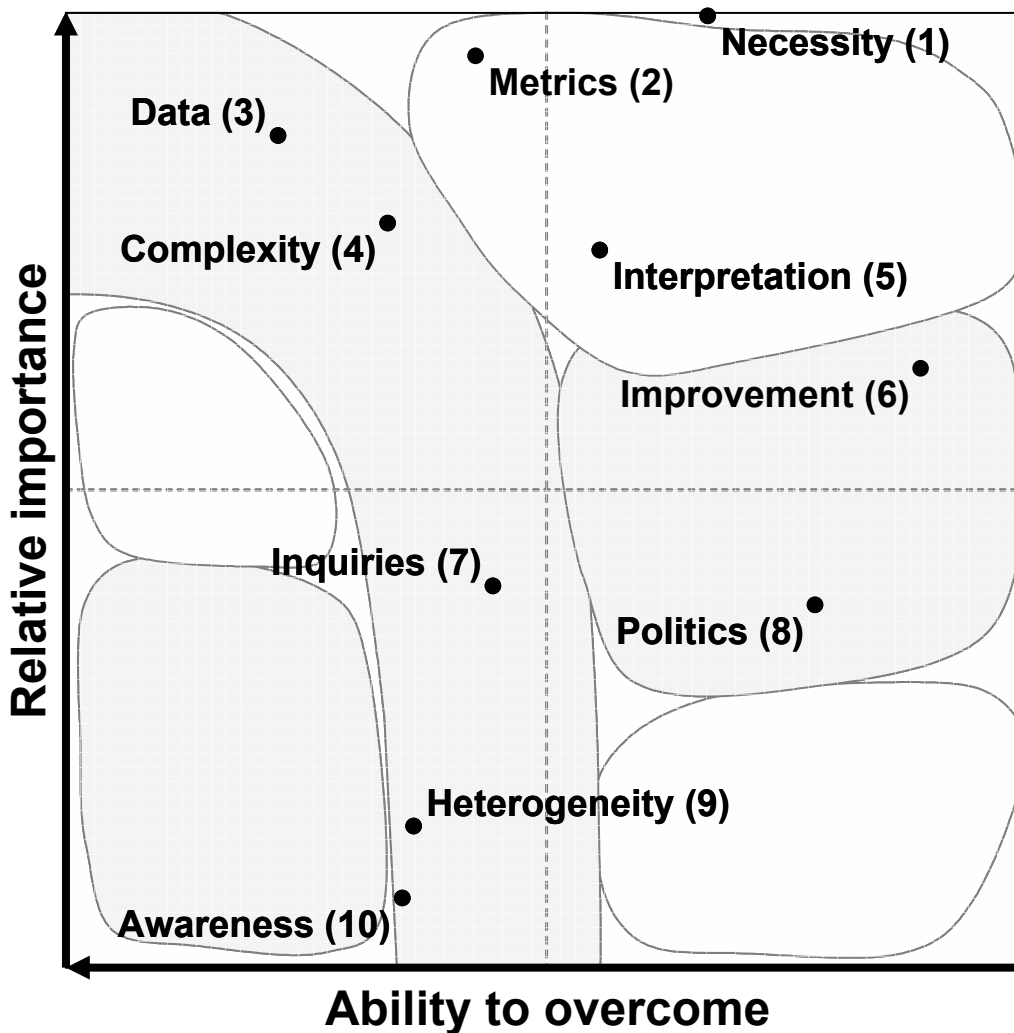
**CoNexus<sup>®</sup> strategic profile**

After distilling the discussion into the ten most significant barriers to adoption, the interviewers (of whom there were five) went through a further, more detailed, round of prioritization. The goal of this activity was to determine the most critical barriers. Although ten items is a manageable number, it still represents too many initiatives to be addressed at once – due to resource and attention constraints.

The CoNexus<sup>®</sup> strategic profiling process was used to evaluate the barriers across two dimensions – “importance” and “ability to overcome”. Importance was evaluated using a pairwise comparison process. As all of these barriers were important (or they would not have been in “Top 10”), it was necessary to *force* the interviewers to distinguish between them.

The “ability to overcome” dimension was an assessment of how effectively this barrier was currently being addressed by existing work – of which the interviewers were aware.

Obviously, it would have been more appropriate for the *interviewees* to have conducted this assessment directly, but this was not practical. In addition, the interviewers felt they had a significant grasp of the issues to act as proxies for the wider group.



**Figure 3: Further prioritization of barriers to adoption of DEA**

Figure 3 shows the profile that resulted from this process. The labels provide a shortened description of the barrier, with the relevant number.

One thing to note about this diagram is that the “Ability to overcome” axis is reversed – i.e. it runs from right to left. This results in the critical items (important, but difficult to overcome) appearing in the top right of the diagram – the area to which the eye is naturally drawn.

The graph is partitioned into six, oddly-shaped areas. Going anti-clockwise, from the bottom right, these represent: “long-term issues”, “medium-term issues”, “immediate issues”, “currently satisfied”, “outdated issue” and “overkill”.

Three of these sections are relevant to an interpretation of Figure 3. “Medium-term” issues are issues that are likely to become immediate issues in the future if not addressed now. However, solving “immediate issues” represents the “biggest bang for the buck” – this is where initial attention needs to be focused.

“Currently satisfied” issues do not indicate the lack of a problem – they indicate an appropriate balance between the extent of the problem and one’s ability to

address it. For example, there is little point investing significant resources overcoming the “Data” barrier while progress is still to be made on the “Necessity” barrier.

In a strategic profile, there is a temporal flow in an anti-clockwise direction from the bottom right of the diagram. Issues become increasingly pressing until they represent immediate problems and have resources allocated to them. This shifts them right as they are addressed. Over time, effort continues to be spent on them, even though they have long passed from being issues to becoming part of the organization’s infrastructure. This effort could be deployed elsewhere and is indicated by issues dropping into the bottom left of the profile.

Applying this interpretation to the profile in Figure 3 is illuminating. The bottom right is dominated by fundamental implementation issues – apply DEA to produce improved performance. At the top right (and into the top left) of the profile, the issues are focused more on the conceptual aspects of the analysis itself. Continuing to the top left, the focus is more on practical, tangible aspects (i.e. do we have the data and will people have the time to support the benchmarking visits). Finally, there is basic awareness of the concept itself.

The timeline represented by the profile seems to suggest a gradual shift from tangible, easily grasped issues to higher level conceptual tasks. It also represents the stages of knowing DEA exists; supporting an “expert” who is conducting the analysis (through data gathering and arranging benchmarking visits); understanding how to apply and interpret the analysis in the context of real problems; and implementing performance improvement initiatives.

This suggests clear ambitions for the adoption of DEA in organizations.

## **Making Data Envelopment Analysis work in organizations**

Although there are many barriers to the adoption of DEA by organizations, there are no showstoppers. Many of the barriers are a result of misperceptions or lack of training/experience. For the remaining barriers that represent fundamental challenges, there are approaches that can be used to allow DEA to “fake the organization’s immune system”.

In this section, techniques for demolishing each of the barriers are presented.

### **Demolishing Barrier 1 (“Already have an established method - or don’t need one”)**

It is rarely the case that the effective implementation of DEA would require the replacement of an existing performance management system. DEA can often be employed to enhance an existing system. For example, DEA can be added to an existing “organizational dashboard” to provide another perspective on performance. This allows managers to develop a level of comfort with the results before DEA is promoted to become the primary measurement approach.

Where an existing system is woefully inadequate and must be replaced, approaching this issue directly is often ill-advised. Changing the performance management model in an organization can be a major undertaking, given the aforementioned importance of these metrics in organizational life. A far better approach is often to implement a parallel DEA approach and allow the organization to discover its value.

Where these strategies cannot be applied, there are occasionally stakeholders within the organization who are disenfranchised by the current system. They can often be persuaded to sponsor a pilot study which they can then use to lobby for change.

### **Demolishing Barrier 2 (“Disagreement over appropriate metrics”)**

This is largely a conflict management issue. Stakeholders are attempting to ensure that the system works to their advantage. Techniques such as Confrontation and Collaboration Analysis (Howard 1998) can be used to find common ground on which an analysis can be developed.

In many cases these disagreements result from a misunderstanding of the DEA approach. As DMUs are seen in their best possible light, “gaming” the system is often unnecessary. Strong DMUs will come to the fore regardless of the model used. Getting agreement to develop a simple “proof of concept” model can often alleviate concerns.

The DEA process itself can also be used to resolve disagreements over metrics. There are usually a few inputs and outputs that everyone can agree on (e.g. profit and staff costs). A model can be constructed using these variables and criticized by stakeholders, based on the ranking of DMUs – an area in which the stakeholders will have expertise. This critique will identify missing inputs and outputs which can be included to produce a new model. By cycling through this “construct-critique-construct” loop, a model gradually develops that is acceptable to all stakeholders.

The key to understanding the value of this approach to identification of metrics is to realize that people often argue over things that have no bearing on the eventual results. By focusing attention on things that *matter* (i.e. impact the results), it is possible to sidestep unnecessary debates.

### **Demolishing Barrier 3 (“Don't have the necessary data”)**

The first tactic for demolishing this barrier is to realize that the critical dimensions of performance often come down to a few key parameters. Organizations do not need to have detailed data on all aspects of their operations to derive value from DEA.

Even when organizations do not have data that is essential to accurately determining performance, DEA can help to prioritize the data gathering process. Developing models based on existing data and examining the results will often highlight missing performance parameters. For example, if a DMU that is acknowledged to be a strong performer has a low performance score, the

question immediately arises of what would need to be included in the model to rectify that contradiction.

Finally, organizations often do not realize that proxy measures can be substituted for primary measures and that this data is often available from government databases. For example, one of the author's clients believed that his organization could not use DEA to compare the performance of retail stores as they did not have comprehensive data on customer incomes. By simply substituting this missing data with average wealth statistics for the stores' catchment areas, an effective analysis was conducted.

#### **Demolishing Barrier 4 (“Technique (DEA) is too complex”)**

This objection often results from a misplaced desire to explain the tool rather than the results. The object of explaining the analysis should be to give the stakeholders confidence in the results. In the case of a benchmarking study, an explanation of DEA is almost always superfluous. By definition, the client organization will have a high level of comfort concerning the interpretation of DMUs. Appealing to comparisons between DMUs to explain performance scores, which, after all, is what DEA is doing, provides all the information stakeholders require.

The key here is to understand that DEA is a tool for understanding a problem - and its solution. Once the problem and solution are fully understood, the DEA results are no longer of any interest. For example, DEA may show that one DMU is operating at 50% of the performance of another DMU. When examining the efficient DMU, it may become clear that its enhanced performance is due to its ability to retain skilled staff. At this point, the DEA results cease to have value.

Barrier 4 is generally overcome by describing problems and solutions in their own domain language – not the language of DEA.

#### **Demolishing Barrier 5 (“Difficulty in interpreting results of the analysis”)**

Overcoming Barrier 5 requires similar approaches to those used in overcoming Barrier 4 – keep to the problem domain. By constantly referring back to peer group comparisons, the intricacies of DEA can be avoided.

It has to be conceded, however, that this is an area that has been largely ignored by the DEA research community. Basic visualization techniques and interactive tools to support exploration of the data help, but this area is one of the richest seams for future DEA research.

#### **Demolishing Barrier 6 (“Need to improve, not just benchmark”)**

The leap from performance measurement, and identification of benchmarks, to performance management/performance improvement is a significant one. It is also essential.

In practice there is little generic advice, from a DEA perspective, that can be given with respect to overcoming this barrier. The performance improvement, as

opposed to the performance measurement, process, sits beyond the realm of DEA.

Of course, the very idea of “the performance improvement, as opposed to the performance measurement, process” is ridiculous – these are parts of the same process. DEA is a *part* of performance improvement – it is not a performance improvement approach in itself. Consequently, rejecting DEA on these grounds is the result of misunderstanding its role.

### **Demolishing Barrier 7 (“Benchmark units could be inundated with inquiries”)**

Before determining how to prevent benchmark units being inundated with inquiries, the relative values of encouraging and discouraging this behavior have to be weighed – from an organizational perspective. While a single manager may object to the demands on his time, it may be worth considering relieving that manager from his current duties for a set period and sending him to mentor other managers.

One alternative approach can be to run a single seminar, where managers of high performing DMUs lecture managers of weaker DMUs and participate in a “Question and Answer”. This may take the form of a multiple day offsite retreat – if the amount of expertise to be transferred dictates it.

The manager of the high performance unit could be interviewed by a performance improvement specialist and a video briefing or report developed to distribute to other managers. This could be conducted at regular intervals (e.g. every three months) to present questions from other managers and provide new updates.

### **Demolishing Barrier 8 (“Approach (DEA) is politically unacceptable”)**

In the majority of cases, this concern is a direct result of a focus on the “league table” (rank ordering of DMUs according to their efficiency). This is a rare case of an organizational development issue where absolute advice can be given – *never focus attention on the “league table”*.

The numerical efficiency ratings and a ranking amongst one’s peers that the table implies are dangerous – pure and simple. Focusing on individual improvement, and aggregate problems, is a much safer approach – and is less likely to result in wounded, and potentially vindictive, parties.

### **Demolishing Barrier 9 (“Technique (DEA) cannot compare ‘apples’ and ‘oranges’”)**

While this objection is technically true, it is often a result of someone having misunderstood how DEA can be applied to problems.

This barrier commonly arises when there are units which are mostly similar but have certain differences that impact their performance. For example, some supermarkets may have a petrol station that results in more customers entering the site than would otherwise be the case.



One way of demolishing this barrier is to conduct two or more analyses – e.g. one for supermarkets *with* petrol stations and one for those *without* petrol stations. Another approach would be to utilize categorical variables.

What is often missed is that these cases represent an opportunity to carefully think through the dynamics of performance in an organization. Take the supermarket example. What is it about the existence of a petrol station at the supermarket that gives it an advantage? It is probably that there is an increase in passing trade. Would this only differ according to the presence of a petrol station? Probably not – a store in a city center would also have higher passing trade.

By thinking through the ramifications of differences, a more sophisticated understanding of the problem can be developed – which can be reflected in more sophisticated models. Increasing passing trade has much more scope for developing innovative improvement strategies than the development of petrol stations.

### **Demolishing Barrier 10 (“What's DEA?”)**

Short of commissioning an advert during next year's SuperBowl, the most practical approach for improving awareness about DEA is to demolish barriers 1-9! If organizations start to improve their performance using DEA, the word will get out...

## **Improving school performance in New York State – a case study**

This section demonstrates the demolition of Barriers 1-10 via a case study. The description of the case study is limited to the information needed to illustrate the key points.

### ***Project background***

As part of the federal “No Child Left Behind” legislation, New York State has been attempting to revamp its “Sharing Success” program – a program designed to promote the sharing of best practices within its public schools.

DEA is being used as the foundation of this revamping. Using Frontier Analyst Professional<sup>®6</sup>, researchers have studied the performance of all elementary and middle schools in order to determine the benchmark performers in all demographic profiles. All lower performing schools are able to see their discrete set of benchmark peers, including the gap between their performance and that of their benchmark peers.

Researchers are also studying the benchmark performers to determine their best practices. Lower performing schools are then able to identify the best practices contributing to the benchmark performance of their peer schools. As appropriate, the lower performing schools will transfer those best practices as they aspire to

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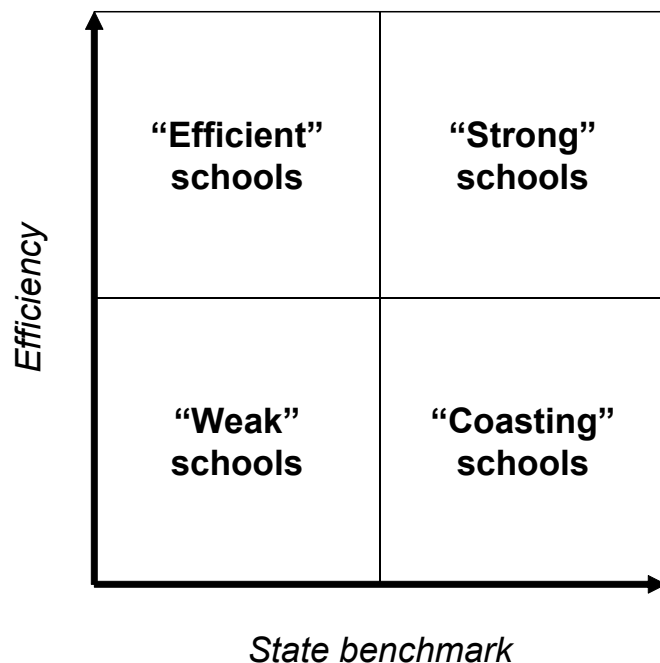
<sup>6</sup> Trademark registered to Banxia Software Ltd. ([www.banxia.com](http://www.banxia.com))

improve their own performance and achieve parity with their benchmark peers. Lower performing schools will access best practices through site visits, phone interviews, statewide best practice conferences<sup>7</sup>, and eventually a web based dissemination service.

### **Addressing Barrier 1 (“Already have an established method - or don't need one”)**

New York State has an existing school accountability system. The accountability system reports "performance index scores", an involved calculation that measures school performance on state assessments in English language arts and math. The state also reports data on student poverty, community wealth, expenditure per pupil and percent of students who are English language learners.

The DEA model referenced above was developed to run in parallel with the state accountability system and the demographic data collected. This had the dual value of reducing the costs of the initial DEA study and keeping the project under the “political radar”. Trying to measure something new could have resulted in the approach being culled in a disagreement over the goals of the organization.



**Figure 4: Combining DEA with the "State Benchmark"**

Running a parallel model also has the potential benefit of allowing the two approaches to be combined, resulting in the refined classifications shown in Figure 4. Identifying schools that are below the minimum state performance benchmark as “efficient schools” means that they could be given improvement support tailored to their status.

<sup>7</sup> Designed and organized by Brenda Myers, Deputy Superintendent, Broome-Tioga BOCES, NY.

### **Addressing Barrier 2 (“Disagreement over appropriate metrics”)**

This barrier was sidestepped by using metrics already collected by the state. By adopting “politically approved” metrics, the DEA approach was evaluated solely on its own merits.

### **Addressing Barrier 3 (“Don't have the necessary data”)**

The analysis was conducted using existing data, with the goal of identifying additional data that could be used to refine the analysis. The existing dataset was rich enough to produce valuable results, so it would have been imprudent to start by collecting additional data.

### **Addressing Barrier 4 (“Technique (DEA) is too complex”)**

The DEA approach was only explained when absolutely essential. For example, it was necessary to brief the Education Department’s statistical team on the study design before the project could be authorized.

It was unnecessary to introduce the end-users to DEA as the results were presented to them using comparisons between schools – an area where they have expert knowledge. When end-users inquired as to the nature of the approach, it was described as a “mathematical benchmarking approach that is designed to produce more appropriate benchmarks than alternative approaches”. Non-technical descriptions of its use in other fields were given to provide reassurance that this is a “tried and tested” approach.

### **Addressing Barrier 5 (“Difficulty in interpreting results of the analysis”)**

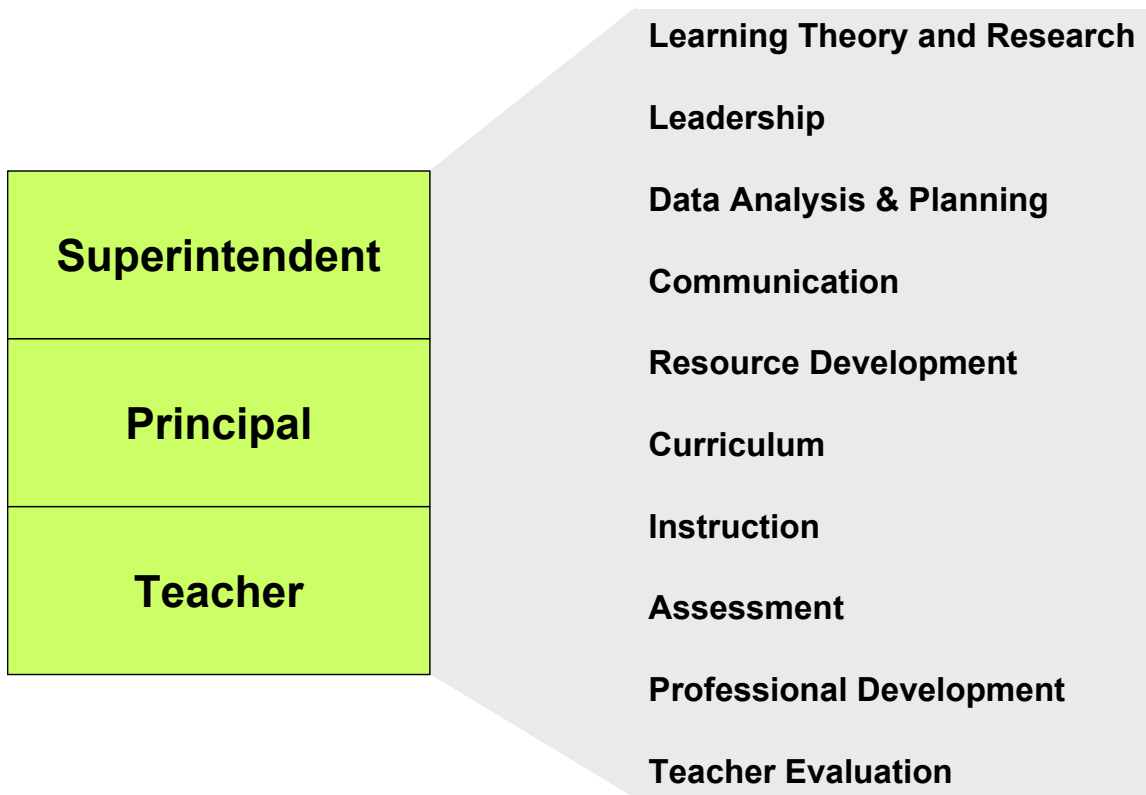
When presenting the findings to end-users (e.g. superintendents, education department staff, principals) schools were contrasted with each of their *compelling* benchmarks – using the original, unmodified data in the comparison. Benchmarks which required a technical explanation (i.e. were not immediately obvious) were removed from the presentation.

After a DMU had been compared against its compelling benchmarks, its targets were discussed. Where necessary, these were presented as improvements over a number of years, resulting in realistic annual targets. Improvements of 50% tend to be too shocking.

As the targets were already clear from the previous comparisons, there were no requests to explain how they were derived – it was “obvious”.

### **Addressing Barrier 6 (“Need to improve, not just benchmark”)**

This barrier was tackled from two directions. First, a best practices conference was held with attendees from across the state. High performing (efficient) schools were invited to present on their local initiatives, and lower performing schools were provided with a list of their benchmarks so they could plan their conference schedule accordingly.



**Figure 5: Mandated presentation format for best practices conference**

Templates were provided for presenters to ensure a consistent format throughout the conference. “Vertical” descriptions of the school’s initiatives were provided – i.e. from the perspective of the superintendent, the principal and a teacher. Each had to address a range of predefined issues. Figure 5 gives an overview of the mandated format.

In addition to the best practices conference, a web application has been designed that will index best practices research, and specific implementation examples, using the results of the DEA analysis. Using this application, schools will be directed only to the information that will assist them in meeting their targets. This starts to alleviate the “data smog” that threatens to overwhelm busy principals.

### **Addressing Barrier 7 (“Benchmark units could be inundated with inquiries”)**

As part of the current project, education researchers will interview principals and teachers from high performing schools to produce a 3-5 page “strategy” summary based on a set template. This will then be made available to all schools in the state. Annual best practices conferences will allow an opportunity for principals and teachers to pose specific questions.

There is some interest in enhancing the summaries through the use of streaming video technology. The principal of an efficient school will conduct a short

“Question and Answer” session with a researcher and this will be made available, via the web, to other schools in the state.

### **Addressing Barrier 8 (“Approach (DEA) is politically unacceptable”)**

This research was started at a time of political upheaval within the US education system. The “No Child Left Behind” legislation meant school districts found themselves facing a whole new range of challenges – almost overnight.

The extra workload this created resulted in a reluctance to adopt new ideas. However, key stakeholders also found themselves requiring solutions to new problems, and this turned out to provide a temporary vehicle for the ongoing development of DEA initiatives.

The ebb and flow of organizational politics can create opportunities as well as barriers. Anticipating the timing of any changes, and riding the subsequent waves is critical to the success of most novel initiatives.

### **Addressing Barrier 9 (“Technique (DEA) cannot compare ‘apples’ and ‘oranges’”)**

In New York State there is a prevailing view that urban and rural schools face fundamentally different challenges and are incomparable. As there are thousands of schools, it would be feasible to separate the schools into two distinct models.

It is not, however, obvious that there is no value to be drawn from a comparison between urban and rural schools. Therefore, the decision was made to produce a single model and segregate the results for presentation. In general, urban schools were only shown urban benchmarks and rural schools were only shown rural benchmarks – unless there were compelling insights to be drawn from a specific cross comparison. This was the case with a number of examples, and the comparisons were well received.

It may be possible to identify the aspects of performance that result in a distinction between urban and rural schools and make them part of the model – improving the comparability of the two types of school. As this would have butted against accepted organizational wisdom, it would have to have been supported by a technical justification – an unnecessary, and dangerous, complication in the early phases of the study.

### **Addressing Barrier 10 (“What's DEA?”)**

Interest in conducting a DEA study within New York State was developed through a series of presentations at Education Department forums (e.g. workshops, conferences). A gradual increase in awareness resulted in support for the pilot study.

## “Your technique needs you...”

If DEA is to have a positive impact on our lives, through improving the performance of our institutions, we must overcome the ten barriers to its adoption that are presented in this article.

For researchers, the task is to develop tools and approaches that demolish these barriers. In addition, the barriers must be continuously reviewed as they will alter over time.

For practitioners, the task is to ensure that these barriers are considered early in the implementation of any DEA study. Failure to do so may ultimately result in the collapse of the entire study – raising the barriers that little bit higher the next time around.

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