AMQ International

Strategic Asset Management

Cross Pollination!

One of the major benefits of SAM is what one reader calls 'cross pollination' - adapting ideas from another industry or discipline to your own. Here is a great example for you to use

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DOES CAPITAL SPENDING MAKE A DIFFERENCE?

An empirical assessment of the relationship between
schools capital investment and pupil performance
(but the model can be applied to any agency)

What is the relationship between more money on capital and agency outcomes?

This is a question that is increasingly being asked as agencies come to 'manage for outcomes'. It is, however, a very difficult area to examine and few good studies are available. This is one of the few.

It is worth studying both for its content and for the way in which the research was designed. The overall outcomes show that the relationship between capital spending and outcomes is small and hard to determine. What does this mean for asset management? We consider this latter question on page 118. The full report may be accessed from the website of the Department for Education and Employment in the UK at www.dfee.gov.uk/research/ Look for "Building Performance" under 'Publications'

Historically, capital expenditure in UK schools has focused on ensuring that there is a sufficient supply of places for all children to be educated, rather than on ensuring that the premises in which they are being educated are in a good condition and "fit for purpose". In the current parliament, additional funding routes for investment in schools capital have been opened up.

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The key purpose of the study was to provide an empirical analysis of the impact of capital investment on educational attainment. In particular, a key objective of the study was to establish, if possible, **the additional effect in terms of pupil attainment of every £1 invested in schools capital**

WHAT THE CAPITAL STUDY DID

In order to address these objectives, three main strands of work were undertaken:

1. Literature review

- Review covered 54 separate studies from the UK, US and elsewhere;
- Wide range of studies included, e.g. quantitative and qualitative studies; academic and non-academic studies;
- Studies from a range of disciplines, e.g. economics, sociology, architecture.

2. Qualitative analysis

- Interviews covered 5 Local Education Authorities (LEAs):
  - 27 headteachers;
  - 4 LEA officials;
  - 2 Diocesan authority representatives;

  2 former staff of Funding Agency for Schools.

3. Quantitative analysis

- Database contained information on 1,916 primary and secondary schools;
- Range of statistical/econometric techniques used, e.g. bivariate correlation coefficients, OLS, logistic regression;
- Analysis 'controlled for' effects of other factors, e.g. Free School Meals (FSM), school type, leadership.

WHAT CAN BE LEARNED FROM THIS STUDY?

Each of these strands has value for agencies wishing to examine the relationship between their own spending and outcomes, whether in education, or in other areas.

Capital has an indirect effect on outcomes

Of particular interest is the way in which capital is related to outcomes via a series of intermediate effects on teaching, learning, morale, etc. see p. 115.

1. Literature Review

In total 54 studies were reviewed, most of which had been conducted in the US. A full list of references is provided in the Bibliography of this Report which you will find on the website listed on the front page of this newsletter.

Studies were chosen which examined the relationship between capital investment in schools and pupil performance. **The focus is on whether or not, on balance, existing studies have found a positive and significant relationship to exist between capital spending and pupil performance.**

By way of summary, the key findings to emerge from this review are as follows:

- there are three broad strands of literature that examine the relationship between capital investment and pupil performance in schools: an economics literature, a school effectiveness (education/sociology) literature and an architectural building design literature;

- the economics literature is mostly concerned with school resources in general, and not specifically capital investment. Evidence for a relationship between *general resources* and performance could be described as *'far from overwhelming'*; some studies find a positive

THE CAPITAL-OUTCOMES LITERATURE CONT.

relationship, some find a negative relationship, and others find no relationship at all;

- the relatively small economics literature which focuses specifically on capital investment also draws mixed conclusions.

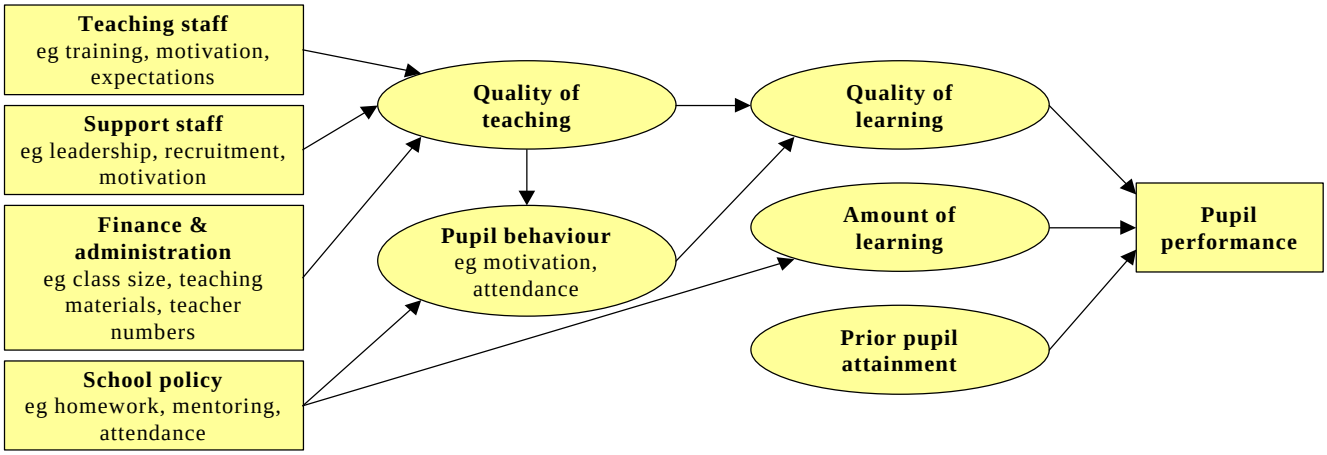
- the school effectiveness / improvement literature provides some evidence of a positive relationship, although this has to be seen within the context of a wide range of other factors which impact on performance (e.g. leadership, teaching quality etc); *'necessary but not sufficient'* is perhaps the best way of describing the findings of this literature in relation to capital spend. In fact, the strongest evidence from this literature is in relation to the impact of capital variables on intermediate factors such as teacher morale. The results suggested that performance improved after renovations, although the effects were not always statistically significant. Unsurprisingly, performance dropped *during* renovations. Some studies also find evidence of a positive link between building condition and the more intermediate outcome of pupil behaviour

- the architecture literature on school building condition and design generally finds a *positive relationship* between the quality of the physical school environment and pupil performance. However, much of this literature is open to methodological criticism from applied economists, particularly with regard to omitted variables.

Generally speaking, therefore, the estimated impact of capital spending on pupil performance varies according to the broad type of study under consideration. There is, effectively, a spectrum of studies. At one end, there are those studies which find a broadly positive relationship. These tend to be in the architecture literature, and relate to specific design features of schools and the overall quality of school buildings, as opposed to capital spending *per se*. At the other end of the spectrum there are a range of economic studies, the results of which are rather ambiguous with respect to the impact of capital spend on performance.

QUALITATIVE STUDIES

An overview of the conceptual model



Capital investment and teacher motivation

All of the headteachers reported that the building work undertaken at their school had had a major impact on teacher motivation. In some cases, capital investment had been aimed at reducing overcrowding, which had usually been coped with by the use of 'mobile' classrooms. Although these provided basic accommodation, they quickly affected teacher morale and effectiveness adversely. The factors behind this included poor quality teaching environment as the classrooms rotted and leaked, inability to work close to colleagues and to access common materials and equipment, and vulnerability to external vandalism and break-ins.

Voluntary Aided Primary

"The old 19th century building was insecure. This led to vandalism and break-ins. No work or equipment could safely be left out at night. The roof leaked and classrooms had to have standing buckets in them. There was no storage. The rooms were too small and restricted teaching methods. The stone stairs in part of the building had to be constantly monitored to ensure the safety of younger pupils. The new school is warmer and quieter with no stone corridors and stairs. No wonder morale is better!"

Community Primary

Teachers were in old former army huts which leaked, were cold and vulnerable to damage. They had little incentive to stay after school in such surroundings. Now they have to be turned off the premises by the caretaker!

Foundation Secondary

"The impact on motivation and quality of teaching has been huge with the greatest lift coming, paradoxically, from the small scale rationalisations of accommodation rather than the big capital projects."

Capital investment and pupil motivation

An important link was also identified between capital investment, pupil motivation and pupil behaviour

Community Secondary

"Pupil behaviour was never bad but is easier to maintain particularly as a result of the alterations made to circulation. The original section of the building had corridors and two sets of stairs which gave access to a second storey serving 8 rooms from each separate staircase. These have now been linked up so that pupils go up one staircase and down the other from 16 rooms. This removes the actual danger of jostling on the stairs as well as removing the pretext for misbehaviour."

Capital investment and the amount of learning

Enhancing the breadth of teaching

One of the key ways in which capital investment contributed to the amount of learning was through the creation of specialist spaces which the school lacked before, and which had prevented schools from teaching the National Curriculum. Specialist areas related to Science, Technology and Information and Communications Technologies (ICT), were the curriculum areas most frequently quoted by heads as being enhanced by capital expenditure. Other headteachers made reference to improvements in Physical Education brought about by the building of a Sports Hall and to Drama by the creation of a new studio.

Increasing learning time

Another way in which capital investment enhanced learning time was through the replacement or reorganisation of inadequate accommodation, which was inherently expensive in the use of teachers' or pupils' time, or inhibited desirable teaching methods. In this category of capital expenditure, heads indicated that time within the teaching day had previously been used for supervision or pupil movement, and the new accommodation allowed the time to be devoted to teaching.

Voluntary Aided Primary

"The new building makes it easier for pupils to move around without losing time. Before, some had to come down two flights of stone steps to go to the outside toilets at the far end of the playground

The savings can be quantified!

The new school on one storey means that pupils moving around the building in classes (start and end of sessions) do not need monitoring by as many teachers. The stone stairs before made monitoring of movement by all staff essential to avoid danger to pupils. Now only one member of staff is necessary and there is less inherent danger to avoid."

The head was able to quantify this saving as a net gain of 7 minutes (10 previously and 3 now) per day per teacher. With 8 staff this equals about one hour per day; 180 hours per year or 10% of a teacher

In addition, the design of the playgrounds and the hall (used for school dining) has meant that the school now employs 5 lunchtime assistants rather than the previous 8.

Community Secondary

The headteacher's estimate is that moving staff between sites cost 10% of lesson time (6 minutes per lesson) for 20% of lessons. There are roughly 750 lessons per week so the saving by moving onto one site has been 15 teaching hours a week or roughly 0.5 of a teacher.

Since any pupil is being taught for some 25 lessons a week of one hour duration, each pupil now has 30 more minutes teaching each week (a 2% increase). In fact the gain is greater since while a teacher was moving sites the pupils were either unattended and likely to misbehave or were being monitored by another teacher whose class was also not being taught. When the teacher arrived the pace of learning had been lost between lessons.

The previous OfSTED (Office for Standards in Education) inspection, while the school was still on a split site, showed 70% of lessons as satisfactory or better. The OfSTED inspection afterwards showed this figure at 90%. In the head's opinion, the removal of the split site accounts for about half of the improvement.

Other impacts included extending the school day, for example by siting the information centre deliberately separate from the other school blocks, it could be made available after hours while the rest of the school was secured. Other factors affected by capital included parental support, teacher leadership and teacher recruitment.

CONCLUSIONS FROM QUALITATIVE STUDY

Teacher motivation; capital investment was found to be one of the two most important levers on teacher motivation through, for example, the boost to morale which teachers get from working in an appropriate and quality physical environment;

Pupil motivation: e.g. through the visible sign that their education is valued by the teaching staff, and society in general;

Amount of learning: e.g. by reducing the amount of time lost moving between different school buildings and classrooms.

QUANTITATIVE ANALYSIS

This used both correlation and multivariate analysis. For details refer to the main report.

CONCLUSIONS FROM QUANTITATIVE ANALYSIS

The main aim of the quantitative analysis was to assess statistically the nature and strength of the relationship between capital spend and pupil performance, using data for English schools. Amongst the key findings to have emerged from the research are the following:

- The analysis provides *some* evidence of a positive and statistically significant relationship between capital investment and pupil performance,
- However, the estimated relationship between capital and performance is not universally positive, nor is it universally statistically significant.
- The results also suggest that some performance measures are more sensitive to capital investment than others**.**
- The absolute size of the effect of capital spend on pupil performance is relatively weak, ;
- Good teaching takes place in schools with a good physical environment,
- The general attitudes, behaviour and relationships amongst pupils and staff are more conducive to learning in those schools which have had significant capital investments.

WHAT ARE THE IMPLICATIONS OF THE CAPITAL-OUTCOMES STUDY FOR ASSET MANAGEMENT?

There are a number of very interesting results for Asset Managers from this Capital-Outcomes study. Here are some (and I would be interested to hear from you about others that you may find of use.)

Firstly, we cannot treat capital dollars as if they were all alike. This report shows very clearly that improving service delivery outcomes is NOT simply a matter of 'spending more'. If it were, we would get a nice correlation between spending and outcomes, and we don't.

Secondly, the report shows that the relationship between capital spending and agency outcomes is a complex issue that needs to take into account:

- What the current capital requirement is, not in dollars, but in terms of what needs to be done
- Condition, capacity and suitability – and their relationship to future needs and directions
- Past history, how much has been spent and where
- The delay time in response to capital expenditure which may vary with the type of expenditure and the past history
- The complex interaction with other resources (teachers, students, non-capital expenditures)

This is good news for Asset Managers, because analysing the impact of past expenditures and projecting futures needs and likely outcomes, on a case-by-case basis, is (or should be) the day to day stuff of strategic asset management.

Thirdly, the report is interesting because it suggests that there are many ways in which we can measure, report outcomes and examine the interrelationships with capital assets. In the case of schools, the literature reported studies of outcomes that had looked at

- earning potential in the labour market,
- school grades, and
- propensity to stay at school longer,

In terms of the relationship they examined

- capital spending and pupil performance
- spending and 'school effectiveness',
- architectural design and pupil performance

How might you apply such an examination process to your own functions? What outcomes would you choose, what input measures?

Fourthly, the report is valuable for its recognition that capital affects outcomes INDIRECTLY through its impact on OTHER VARIABLES.

Measuring those other variables thus becomes important for asset managers.

It is not sufficient to gather technical data on assets if the aim is to show how effective they are! ■

READERS INQUIRIES

Did you know that you can ask for assistance, and provide it to others, by using our "Can U Help" page at www.amqi.com ? Just click on "Can U Help" on our home page and you are there. You can read the queries that others have submitted and provide help, or you can ask your own questions. Here are some recent inquiries.

Recent Inquiries

Benefits of Maintenance

Andrew Smales asks "Is there a way of establishing the benefits of spending more/less on asset maintenance, ie cost/benefit analysis? Are there any examples?

Editor: Several responses have been received but if anyone has good examples I would be happy to print them in this newsletter.

Readers may also wish to consult SAM Issue 53, Jan 12, 2001 where we do a cost benefit analysis of a real maintenance issue for the Snowy Mountains Hydro Electric Scheme and Issue 55, where we look at the related issue of the relevant discount rate.

Asset Risk Management Analysis software

Vivek Kangesu writes " We have developed a preventative maintenance model (fixed time), corrective maintenance model, condition monitoring model and condition assessment model for our water and wastewater assets and equipment. At this stage we manually analyse the risk of each asset/equipment and develop maintenance models.

I am looking for an economical (not costly) risk assessment software (water and wastewater equipment) to develop maintenance priorities and emergency response plans. Please email kv1@townsville.qld.gov.au

AC Mains

Alan Curran asks "Could people forward their experience of AC distribution watermains circa 1970s and current experience. We are currently experiencing increased burst rate at least 2/week at night and weekend during increased pressure on different mains 6" and 9" laid at the same time"

ASSET MANAGEMENT AWARENESS.

STEP 2: CREATING YOUR IN-HOUSE THINK TANK

Start an in-house think tank,

(1) **Choose an article** in a recent copy of SAM that interests you, one where you think there is more to be said on the topic is a good choice. You may like "Does it really pay to defer maintenance" in Issue 52 and argue about the appropriate discount rate, or further elements of the risk dimension. This would be good for a debate involving both finance and engineering.
Or you can choose one of the back page problems – preferably before we print our suggested answers, to give participants a clear run!

(2) **Select your participants.** If you are part of an asset management unit, you have a ready-made group. If you are on your own, choose a couple of 'friendlies' from engineering, finance, policy and planning or customer services. Three is a viable number but more is better.

(3) **Choose an appropriate time,** say an hour at the close of Friday, discussing asset management issues over coffee (or wine and cheese, or a can of beer) is not only useful for better understanding of asset management issues important to your organization, it can also cement good relationships – and besides it's a fun way to ease into the weekend.

(4) **Invite your group** – **and enjoy!**

And if you would like to tell me how you get on, I would be delighted to hear from you - penny@amqi.com

(Also see back page of Issue 66 for the first in this series of increasing asset management awareness.)