Briefing Note: Key Factors in the Cost Effective Design and Construction of Primary School Facilities in Low Income Countries.

Summary

In sub-Saharan Africa and the poorest counties in Asia, the challenge of providing adequate primary education facilities is huge. DFID spending on educational facilities in 2005/6 alone exceeded £41 million. Given this need and DFID's level of investment it is important that approaches to delivery are cost effective, which means not only focusing on unit costs of classrooms but also the main issues that affect value for money and effective delivery. Whilst there are often differences of opinion as to what design standards and procurement strategy is most appropriate, there is an increasingly well understood set of approaches that can be utilised to promote good value for money and provide school infrastructure of acceptable durability at a relatively low cost.

These include: (1) ensuring that infrastructure investments are properly targeted and coordinated with other educational interventions (2) using modest design standards which provide safe, attractive, durable and flexible learning environments which allow access for all (3) making decisions based on lifecycle costs of buildings, where construction and maintenance costs are considered together (4) having a good balance between developing adequate maintenance strategies and new capital works (5) developing procurement approaches that are simple, appropriate, transparent and consistent and building adequate capacity for quality assurance - it is clear that procurement using community-based approaches and/or the use of small and medium sized contractors reduces costs and provides better value for money (6) put schools and communities at the centre of the process so that local priorities are addressed (7) ensure school water, sanitation and hygiene promotion is adequate incorporated, with realistic costings and suitable budgets (8) understand that increased efficiency of building use, by multigrade or double-shift teaching has significant potential to reduce overall costs, and finally (9) recognise that programmes benefit from predictable, long term support.

Direct comparison of costs between and within countries requires much care as they vary considerably due to factors including exchange rate, procurement method, amount of community contribution, location and taxes. The development of a benchmark 'unit cost' for a standard classroom is therefore problematic. However, current estimates would point to an average cost of approximately US$100/m^2 being a reasonable but rough guide for rural classrooms of acceptable durability and quality, constructed using small local contractors with some degree of community involvement. For initial assessment, costs significantly below this should direct attention to the quality and durability of construction – higher figures may indicate that there are potential avenues for reducing costs by reviewing the programme against some of the criteria above.

Briefing Note: Key Factors in the Cost Effective Design and Construction of Primary School Facilities in Low Income Countries.

Introduction

1. In sub-Saharan Africa and the poorest counties in Asia, the challenge of providing adequate primary education facilities is huge. Worldwide, to meet the Education for All (EFA) goal of providing universal access to primary education it is estimated that up to 10 million classrooms need to be built at a cost of US$72 billion (World Bank, 2003). DFID spending on educational facilities in 2005/6 alone exceeded £41 million (US$58 million) spread across at least 12 countries (Smawfield, 2006). Given this need and DFID's level of investment it is important that approaches to delivery are cost effective. This means not only focusing on unit costs of classrooms (and other facilities) but also the main issues that affect value for money including (a) targeting and coordination (b) design (c) maintenance (d) procurement strategy (e) capacity and (f) the involvement of schools and communities. This Briefing Note presents these issues based on a rapid review of key documents.

2. Educational facilities in low income countries are often both insufficient in number, of poor quality and inadequately maintained. Average pupil to classroom ratios are high and often in excess of 100:1. Typically, there is considerable variation in the types and methods of construction including (a) temporary facilities made from locally sourced materials and constructed by communities (b) adequate permanent facilities, constructed by artisans or small contractors often with external financial support and/or technical advice (c) facilities that are highly specified and constructed by large national or even international contractors. The range of classroom environments, durability and cost is huge - the question is what combination of them and which procurement method provides the best value for money?

Review of Primary School Classroom Costs

3. Analysis of World Bank education projects has shown that since the 1980's average unit costs of classrooms in Africa have halved from US$15,000 to around US$7,000, whilst in Asia costs were relatively stable and lower at around US$4,500 **(Annex A, Table 1)** (World Bank, 2003; Theunynck, 2002). For comparison, current unit costs for the DFID Malawi programme are US$8,700 per classroom (including for substantial cost inflation in 2007/8) (DFID, 2008).

4. Construction costs per square metre (m^2) are often more instructive that unit costs as they take into account differences in classroom size. Here, the same studies calculated the average cost as US119m^2$ in Africa and US108m^2$ in Asia **(Annex A, Table 2).** A review of the DFID Malawi construction programme estimated costs at US$91/$m^2$ (2005/6 prices) compared with US$92/$m^2$ in Kenya and an average of US$85/$m^2$ for similar programmes in Ghana (DFID, 2007a). Recent costs for post earthquake primary school construction in Pakistan show a huge range - from approximately US$140/$m^2$ to US$750/$m^2$.

5. Other approaches to cost analysis compare (a) classroom costs with teachers' salary and (b) annualised costs of building a classroom against the annual cost of educating students in that classroom. Both these measures give an indication of the cost of classroom provision against recurrent costs. In both cases the relative cost of provision is much higher in Africa than Asia **(Annex A, Table 3)**.

Direct comparison of costs needs much care as they vary considerably due to factors including exchange rate, procurement method, amount of community contribution, location, taxes and so on. Therefore, development of a benchmark 'unit cost' for a standard classroom is problematic. However, current estimates would point to an <u>average</u> cost of approximately

US$100/m^2 being a reasonable but rough guide for rural classrooms of acceptable durability and quality constructed using small local contractors with some degree of community involvement. Costs significantly below this should direct attention to the quality and durability of construction – higher figures may indicate that there are potential avenues for reducing costs by reviewing the programme against some of the criteria set out below.

Issues Affecting Value for Money and Effective Delivery

6. Although there is an understandable focus on unit costs there is often less emphasis on value for money and how infrastructure will be effectively delivered. For example, construction of very low cost temporary facilities may boost enrolment in the short term but will probably do little to improve the quality of learning. Equally, an ill conceived procurement strategy may result in expensive, highly specified infrastructure of very poor quality. In both cases the result leaves under resourced schools with an ongoing maintenance burden. Whilst there are always differences of opinion (and often between educationalists and engineers) as to what standard of construction is most appropriate, what is clear is that there is an increasingly well understood set of approaches that can be utilised to promote good value for money and provide classrooms (and other educational infrastructure) of acceptable durability at a relatively low cost. These are summarised here.

7. *Issue 1 – Targeting and Coordination Increases Enrolment and Achievement.* Cost effective use of resources is dependent on targeting where the need is greatest. This is best done using simple and transparent processes to select regions, districts, and schools and will typically require information from basic education statistics, school mapping and condition surveys (CEC, 2001; Smawfield, 2006). Whilst the construction of classrooms (in the right place) has been shown to increase enrolment (DFID, 2007b; World Bank 2003) there is less clarity on whether improvement in facilities alone lead to better learning (for further discussion see CEC, 2001 and DFID, 2006). Although good physical facilities are an important contributing factor, for effective delivery progress across the board needs to be strong, particularly the supply of good quality teachers and ample teaching and learning materials. A major evaluation of the World Bank Ghana education programme concluded that increasing the availability and quality of classrooms and instructional materials directly contributes to both educational attainment and achievement and that replacing unusable classroom blocks with new and reducing journey times to schools both increase enrolment (World Bank, 2004). This emphasises the importance of coordinating infrastructure with other educational inputs and other factors that affect access, for example improving local transport networks.

8. *Issue 2 – Good Design is Important*. Design standards have significant implications for capital and maintenance costs. Standards need to be modest yet provide safe, attractive and durable learning environments. The most successful classroom construction programmes have been based on a design life of a least 25 years (World Bank, 2003). Designs need to incorporate materials and building techniques commonly used and understood by local artisans, be appropriately detailed to ensure durability and allow for acceptable levels of light, heat and acoustics. Standardisation of approach is important but there needs to be recognition that different climatic conditions and construction techniques may exist in different regions and enough flexibility for schools to adopt different layouts depending on need, topography and site orientation. The classroom and school environment can be improved at very little additional cost by incorporating items such as storage areas, chalk boards and reading corners in classrooms and planning outside space to improve security, privacy and provide flexible learning spaces (Benyon, 1997; Bonner *et. al.,* 1996; CEC, 2001; ITDG, 2005; Educational Consultants India Ltd, 1999; Smawfield *et. al*., 2006). Additionally, with good design at the outset the cost of making schools accessible to all should not be prohibitive and is generally less that 1% of

construction costs (World Bank, 2006). Particular attention to design is required in regions prone to natural hazards (Bonner, 1996; Coburn *et. al.,* 1995).

9. *Issue 3 – Consider Lifecycle Costs.* This approach considers capital, design, supervision and maintenance costs together. Buildings constructed by large contractors have lower supervision and annual maintenance costs than those built using small contractors and/or community based approaches, but they have much higher capital costs meaning greater lifecycle cost, assuming similar durability (Benyon, 1997). On this basis, buildings constructed using small contractors and/or community involvement, with appropriate and adequate designs and supervision to ensure quality and durability, combined with effective maintenance present the most cost effective long term approach, rather than cheaper alternatives that advocate buildings of a temporary nature and/or poor durability. Supervision costs are typically in the region of 10% of capital costs and annual maintenance approximately 1.5%.

10. *Issue 4 - Promote Effective Maintenance.* Investments in maintenance are very cost effective but have historically received little priority or attention from governments and development partners. The current backlog of classroom construction is due in part to poor maintenance of the existing building stock. It is estimated that US$4billion of the US$6 billion cost for providing classrooms to meet the EFA goal is to replace existing substandard facilities (World Bank, 2003). However, there are some encouraging signs of an increasing emphasis on maintenance, particularly in relation to direct grants to schools and school improvement planning. Decentralised approaches that involve schools and communities do offer a promising avenue. The most effective approaches give responsibility to schools and communities, but complement their contribution with a package of resources tailored and earmarked for maintenance (ADEA, 2003; Max Lock Centre 2003). These types of approaches are beginning to evolve – for example in Kenya the SIGs programme is a good example (MoEST, 2006), Malawi has a successful annual 'Best Kept School Competition' and is piloting the use of school grants and in Guyana the Ministry of Education has completed proposals for a national school maintenance strategy (MoE, 2009).

11. *Issue 5 – Procurement Strategy is Critical.* It is clear that procurement using community-based approaches and/or the use of small and medium sized contractors (as opposed to large national or international contractors) reduces costs and provides better value for money irrespective of the source of financing (ADEA, 2003; Theunynck, 2002). However, often national (and development partner) procurement procedures are more suitable for centralised approaches and large construction contracts rather than providing appropriate community infrastructure. In addition, procurement in recipient government ministries often suffers from weak capacity, bureaucracy, confusion and corruption. It is therefore critical that construction programmes (a) develop simple, appropriate, transparent and consistent procurement approaches which promote good practice and (b) ensure adequate capacity is in place at the right level to provide proper contract management, oversight, training and monitoring and evaluation, and importantly to provide the necessary support and supervision to ensure acceptable levels of quality. This process also allows for a range of 'added value' components such as artisan training, HIV/AIDS awareness and promotion of core labour standards to be incorporated (Ladbury *et. al.* 2003). Properly designed decentralised approaches can have significant benefits in terms of boosting local economic activity and helping to promote better school management and community involvement.

12. *Issue 6 – Consider the Whole School.* Classroom construction is a priority in many schools but in others refurbishment of existing building stock, provision of water and sanitation facilities, security fencing or school furniture may be equally or more important. Priorities are best decided on locally, and providing what best meets individual school needs is more likely to contribute to improving the learning environment. Combining

infrastructure provision with initiatives to decentralise school management, such as supporting SMCs and PTAs, promoting school planning and providing direct grants to schools (as per the Kenya SIGs programme, for example) better allows local priorities to be addressed.

13. *Issue 7 - School Water, Sanitation and Hygiene Promotion must be an Integral Part of any Construction Programme.* Schools need to have adequate and appropriate water and sanitation facilities for boys, girls and teachers (including facilities for menstrual hygiene management) and hygiene promotion. There is much evidence to suggest that lack of such facilities affects participation, lowers enrolment rates and performance and increases absenteeism, especially in the case of girls at puberty. School construction programmes (and education programmes more generally) need to incorporate water and sanitation as a central element, with realistic costings and suitable budgets, whilst recognising that effective solutions will be multi-sectoral in nature (Bharadwaj, S *et. al.,* 2004; Mahumbuga *et. al.,* 2005; Snel, 2003; UNICEF, 1998; WEDC, 2004). Costs for water and sanitation provision vary considerably depending on the situation and nature of facilities to be provided and are best investigated on a country by country basis.

14. *Issue 8 – Increased Efficiency of Building Use Reduces Costs.* The efficiency of use of educational buildings is generally low, with facilities unused during the holidays and school days being relatively short. Often there are huge variations in class size with lower grades vastly overcrowded and those at higher grades under-utilised. Improving the efficiency of building use by double-shift or multigrade teaching has a considerable impact on overall numbers of classrooms required and associated costs. Flexibility of design may also allow school buildings to be used for other community purposes. For example, in Malawi it is estimated that doubling the efficiency of 10% of classrooms would result in 5,000 less being required (to meet a 1:60 classroom pupil ratio), saving initial costs of £40 million, annual recurrent expenditure (for maintenance) of £400,000/annum and depreciation of £1.0 million per annum. Clearly, efficiency of building use is a key factor affecting the overall cost of educational infrastructure provision and needs to be considered as an important policy issue.

15. *Issue 9 – Take a Long Term View.* Programmes benefit from predictable, long term support during which effective approaches can be developed and refined, capacity built up and processes institutionalised. Working through SWAPs and pooled funding arrangements and with increased development partner coordination is likely to provide better opportunities for longer term support than more traditional project based methods.

Environmental Issues

16. Environmental issues that relate to construction of educational facilities include (i) the quantities and types of construction materials used (ii) location of the facilities, including any land issues and the risk of flooding and other natural hazards (iii) impact on surrounding land uses (iv) health and safety issues and (v) public safety issues. All these can be addressed at no or little additional cost by ensuring good planning and design principles and procedures are followed. One particular issue often encountered is the used of locally fired bricks (and sometimes other locally sourced products), which contribute to local deforestation and/or other environmental degradation. If environmental screening identifies these types of issues some additional costs may be incurred if replacement materials need to be specified (either in direct costs of the materials themselves or for support and training to produce and work with the new products). Alternatively, new approaches may turn out to be cheaper. This would need to be assessed on a case by case basis. There is considerable environmental benefit in improving efficiency of building use to reduce the number of classrooms (and therefore materials) required.

Costs for Urban Schools

17. Construction in urban areas presents a number of different challenges to those in rural locations including the availability of land, security issues, potential availability of mains services, (possible) higher cost of labour, greater use of multi-storey construction (which restricts use of community based approaches), different building regulations and a general expectation that the standards of construction should be better in an urban environment. Individual designs are often required for each school. All this tends to increase construction costs, although some of this is often offset through cheaper construction materials and transport. Given this, provision of a standard 'benchmark' cost for urban schools is problematic. Cost estimates for programmes considering construction in urban areas should develop cost estimates relevant to the particular country and circumstances.

Issues Relating to Secondary School Infrastructure

18. Whilst primary school construction has been the focus of most DFID supported programmes in recent years, the secondary sector in most low income countries suffers similar problems of poor infrastructure and lack of equipment. Problems are often becoming more acute in countries where the introduction of free primary education is resulting in increased demand for secondary places. Infrastructure costs for secondary schools tend to be considerably more expensive than in the primary sector, mainly due to (a) the higher level of specification (b) the need for specialist facilities such as science laboratories and IT rooms (c) the need for electricity supply and (d) a continuing reliance on 'traditional' procurement methods. For example, cost of construction of ADB funded secondary schools in Malawi is approximately US$500,000 for an equipped four classroom school. In Guyana an eight class secondary school costs approximately US$1,000,000 or US$600/m^2. Given the current high costs, any programme to increase secondary access significantly would need to look critically at where savings could be made. For example, in Malawi, many of the construction techniques and procurement procedures successfully developed in the primary school programme have potential to drive down costs of secondary school construction.

Further Reading and Information

19. A list of key references for further reading is included in **Annex B** for those requiring more information.

Prepared by Bill Leathes
for TI-UP resource Centre
23 January 2009

References

Association for the Development of Learning in Africa (ADEA) (2003). *The Challenge of Learning - Improving the Quality of Basic Education in Sub-Saharan Africa.*

Bharadwaj, S and Patkar A. (2004). *Menstrual Hygiene and management in developing countries: taking stock.* Mumbai Junction Social.

Benyon, J. (1997). *Physical Facilities for Education: What Planners Need to Know*. UNESCO: International Institute for Educational Planning, Paris. http://www.unesco.org/iiep/english/pubs/recent/rec6.htm (PDF file).

Bonner, R. (1996). *Appropriate Building Materials and Technology – Workshop on Natural Disasters and Human Settlements.*

Bonner, R and Das, P.(1996). *Vidyalayam Cost Effective Technologies for Primary School Construction*. ODA, New Delhi.

Cambridge Education Consultants (CEC). (2001). *The Contribution of Planning and Engineering to Education Strategies: Report of a Scoping Study*.

Coburn, A., Hughes, R.,Pomonis, A., Spence, R. (1995). *Technical Principles of Building for Safety*. ITDG, London.

DFID Malawi. (2007). *Annual Review 2007 of the DFID Malawi Infrastructure Management Unit.*

DFID Malawi. (2007). *Evaluation of the Impact of DFID Funded District Level Education Infrastructure Investments (in Malawi).*

DFID Malawi. (2008). *Project Memorandum: Support to National Education Sector Plan (Malawi) – Infrastructure Appraisal (Draft).*

Educational Consultants India Ltd. (1999). *Building Rural Primary Schools: towards improved designs.*

Intermediate Technology Development Group Limited (ITDG). (2005?). *Technical Brief: School Buildings in Developing Countries*. ITDG, Rugby, UK.

IRC (International Water and Sanitation Centre). (1991). *Just Stir Gently: The Way to Mix Hygiene Education with Water Supply and Sanitation: Technical Paper Series 29.*

IRC (International Water and Sanitation Centre). (2004). *The Way Forward: Construction is not enough: Symposium Proceedings and Framework for Action*

Ladbury, S., Cotton, A., Jennings, M. (2003). *Implementing Labour Standards in Construction: A sourcebook.* Water, Engineering and Development Centre, Loughborough University, UK.

Mahumbuga G, Mugogo, N and Lodiaga, J. (2005). *Effect of Sanitation Facilities on Quality of Education under Crowded Universal Primary Education Conditions.* http://www.aku.edu/ied/conference2006/abstracts/033.asp

Max Lock Centre. (2003). *Building Capacity for Community Asset Management in India.* Max Lock Centre, University of Westminster, London http://www.wmin.ac.uk/builtenv/maxlock/CAMweb/CAM1/Report.htm .

MoE (Guyana). (2009). *Proposals for a National Asset Management Strategy for Educational Facilities in Guyana*.

MoEST (Kenya). (2006). *Kenya Education Sector Support Programme 2005-2010 - Strategic Plan for the Development of Primary School Infrastructure.*

Smawfield, D.(2006?). *Understanding and Supporting the Role of Infrastructure in Effective Education Services Delivery.*

Smawfield D. and Du Y. (2006). *Building Children's Schools: Transforming the Learning Environment: the Gansu Basic Education Project Experience and Beyond.* DFID/GBEP: Lanzhou, Beijing, London, Cambridge).

Snel, M (2003). *School Sanitation and Hygiene: Thematic Overview Paper.* IRC, (International Water and Sanitation Centre).

Theunynck, S (2002) *School Construction in Developing Countries - What Do We Know?*

UNICEF. (1998). *A Manual on School Sanitation and Hygiene*. UNICEF, in collaboration with the International Rescue Committee (IRC) International Water and Sanitation Centre, the Netherlands. http://www.irc.nl/sshe/manual/

Water Engineering Development Centre (WEDC). (2004). *Briefing Notes 2: the Education Millennium Development Goal – What Sanitation and hygiene can do*. Loughborough University, UK.

World Bank (2003). *Education Notes: Education for All – Building the Schools.*

World Bank. (2004). *Books, Buildings and Learning Outcomes. An Impact Evaluation of World Bank Support to Basic Education in Ghana*.

World Bank (2006?). *Education Notes: Education for All: The Cost of Accessibility*.

ANNEX A - Tables

Table 1: Historical Classroom Unit Costs (Africa and Asia)

Africa			**Asia**		
Country	*US$*	*Year*	*Country*	*US$*	*Year*
Guinea	13,450	1989	Bangladesh	2,700	1980
	7,500	2000		3,900	1998
Mauritania	17,000	1984	India	3,700	1993
	4,700	2001		3,100	2001
Senegal	13,200	1982	Pakistan	8,700	1987
	6,400	2001	(NWFP)	6,800	2001

Table 2: Classroom Cost per square meter (Africa and Asia)

Africa			**Asia**		
Country	*US$/m2*	*Year*	*Country*	*US$*	*Year*
Chad	122		Bangladesh	91	1998
Guinea	134	1989	India	95	2001
Mauritania	91	1984	Pakistan	175	1987
Senegal	100	1982	Philippines	172	1996
Zambia	149	2001	Vietnam	58	2000
			PR China	55	1997
Average	119		Average	108	

Table 3: Construction Cost Compared to Recurrent Cost (Africa and Asia)

Africa			**Asia**		
Country	*Classroom as multiple of annual teacher salary*	*Annualized construction vs recurrent cost*	*Country*	*Classroom as multiple of annual teacher salary*	*Annualized construction vs recurrent cost*
Chad	6.6	49%	Bangladesh	2.1	15%
Guinea	6.2	35%	India	2.0	13%
Mauritania	2.5	15%	Pakistan	3.4	17%
Senegal	2.6	13%	Philippines	2.0	13%
Zambia	10.9	75%	Vietnam	5.3	18%
Average	5.7	38%	Average	3.0	15%

Annex B – Key References for Further Reading (appended where available electronically)

School Planning, Design and Construction

Bonner, Roger R.M. and Das P.K. (1996). ***Vidyalayam, Cost Effective Technologies for Primary School Construction*****, Overseas Development Administration, New Delhi. (Department for International Development, British Development Cooperation Office, 50 M Shantipath, Chanakyapuri, New Delhi – 110 021, India)**

A very useful guide and practical guide on school building with some emphasis on innovative technology and practice to reduce costs.

Benyon, John. (1997). ***Physical Facilities for Education: What Planners Need to Know.*** **UNESCO: International Institute for Educational Planning, Paris. http://www.unesco.org/iiep/english/pubs/recent/rec6.htm (PDF file).**

This 104-page publication, which is available in both French and English, comprises comprehensive reference work on planning matters from both a practical and policy perspective.

Civil Works Unit, Technical Support Group (Eds). (1999). ***Building Rural Primary Schools: Towards Improved Designs.*** **Educational Consultants India Ltd, New Delhi.**

The publication captures relevant aspects of the experience and learning associated with school construction in India and provides details of a wide range of innovative designs.

DFID (Department for International Development). (2001). ***The Contribution of Infrastructure to Education: A Scoping Study.*** **Cambridge Education Consultants.**

A CD based information resource on infrastructure and education – a wide ranging and useful introduction.

ITDG (Intermediate Technology Development Group Limited*). Technical Brief: School Buildings in Developing Countries.* ITDG, Rugby, UK.

A very useful concise introduction to the principles of school design and construction in the developing country context. Contains a good bibliography for those requiring further information.

Max Lock Centre. (2003). ***Building Capacity for Community Asset Management in India.*** **Max Lock Centre, University of Westminster, London http://www.wmin.ac.uk/builtenv/maxlock/CAMweb/CAM1/Report.htm .**

This comprehensive report provides background and tools to show how the capacity of local communities can be built to identify and manage buildings and public areas available for social and collective use by the community, including schools.

Procurement and Costing

Theunynck, Serge. (2002). School ***Construction in Developing Countries: What do we know?*** **World Bank.**

An informative document summarising the different procurement approaches that have been used in (particularly World Bank) school construction programmes and their effectiveness.

World Bank (2003) ***Education Notes: Education for All – Building the Schools*****:** A 3-page position paper stressing: the impact of construction; and the importance of maintenance,

sanitation provision, and community participation. A significant section also considers new ways of analysing construction costs.

Water and Sanitation in Schools

Snel, Marielle. (2003). *School Sanitation and Hygiene: Thematic Overview Paper.* IRC (International Water and Sanitation Centre).

Useful set of short papers on the key aspects of school sanitation and hygiene promotion. Very useful resources section, including websites.

Others

World Bank, 2004. *Books, Buildings and Learning Outcomes. An Impact Evaluation of World Bank Support to Basic Education in Ghana,*

A comprehensive evaluation of the World Banks Ghana Education programme from1988-2003