Delivering Cost Effective and Sustainable School Infrastructure

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Introduction

The task of providing educational facilities to support the goal of providing universal access to primary education is very great. The approaches required to make sustainable progress are increasingly clear, but challenges to implementation remain considerable. This Guidance Note sets out how effective government programmes can be designed and implemented with a view to providing well planned, good value primary school infrastructure that meets the needs of users and contributes to better teaching and learning.

The Scale of the Challenge

In sub-Saharan Africa and the poorest countries in Asia, the challenge of providing adequate primary education facilities is huge. To meet the Education for All target of providing universal access to primary education worldwide it is estimated that up to 10 million classrooms need to be built at a cost of US$72 billion (World Bank 2003).

In sub-Saharan Africa alone it is estimated that up to US$30 billion will be required to address the shortfall in provision of suitable and safe learning environments. Typically, classrooms are overcrowded, many buildings and other facilities are inadequate, sites are poorly planned and there is little maintenance. This situation is not conducive to good teaching and learning.

The Importance of Educational Infrastructure Facilities

The condition, location and nature of school infrastructure have an impact on access and quality of education:

- the closer a school is to children's homes, the more likely they are to attend, both because of distance and safety issues;
- where the quality of infrastructure (particularly water and sanitation facilities) is improved, enrolment and completion rates are also improved and there is less teacher absenteeism, and
- where the condition of school facilities is improved, learning outcomes are also improved.

A basic minimum package of school infrastructure which is accessible, durable, functional, safe, hygienic and easily maintained therefore needs to be part of any strategy to meet the Millennium Development Goal for primary education.

In terms of educational infrastructure what will have most impact will vary from school to school. This Note therefore defines educational infrastructure as all of the facilities required for effective teaching and learning such as classrooms, outdoor learning and play areas, furniture, water and sanitation, administration buildings, storage, cooking and boarding facilities.

Supporting other Educational Inputs

However good the provision of infrastructure is, it is clearly not sufficient on its own to improve access and quality. For effective delivery there should be progress across the board particularly with regard to the supply of good quality teachers and teaching and learning materials. This Note assumes that infrastructure provision will support an education programme that will include other educational inputs such as curriculum

development, text book development and distribution, strengthening school management, and teacher training and deployment. It is recognised that coordination with other sectors such as health, water and transport are also important in improving access and quality.

Meeting the Challenge

Given the need for infrastructure and the limited resources available there is a responsibility on governments and development partners to work together to develop approaches that will contribute to significant, measurable and sustainable progress towards national goals and targets and provide good value for money.

The approaches required to achieve this should be based around the development of long term partnerships with a strong focus on good governance, capacity building, developing management systems and on ensuring that schools and communities (through school management committees and parent teacher associations) have participation in the process. Communities, non-governmental organisations, the private sector and religious organisations can and do make valuable contributions but do not replace the government's responsibility for providing adequate facilities.

Value for Money

While unit costs of construction are important, considering value for money allows a greater emphasis to be put on how infrastructure supports other educational inputs, how buildings are used and maintained, where resources are targeted and what added value can be incorporated into the construction process. Issues to be addressed when considering value for money therefore include:

- Targeting investments to where the need is greatest;
- Coordinating programmes with other educational interventions;
- Putting schools and communities at the centre of the process;
- Using modest design standards which provide safe, attractive, durable and flexible learning environments and allow access for all;
- Ensuring that there is a balance between new construction, renovation and maintenance;
- Using procurement approaches that are simple, transparent and lower costs;
- Focussing on the quality of construction;
- Emphasising the provision of water, sanitation and hygiene promotion;
- Increasing the efficiency of building use, and
- Providing predictable, long term financial support, capacity building, monitoring and evaluation.
- Creating a 'child-friendly' enabling learning environment (following UNICEF's guidance on this), with particular attention to the needs of girls.

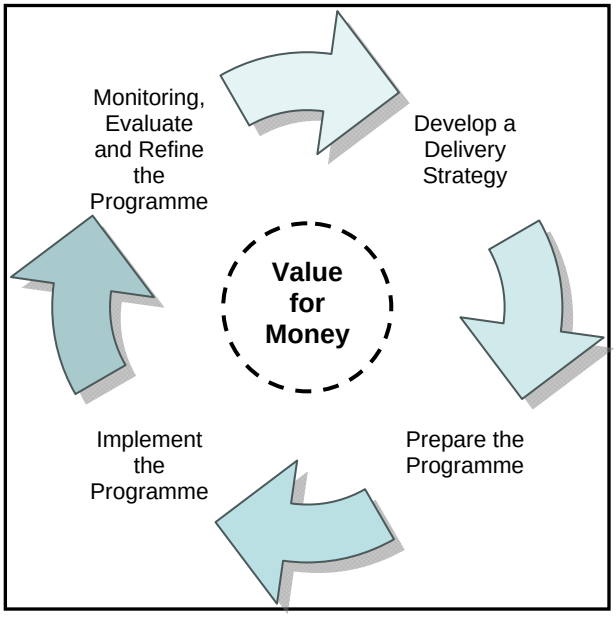
The Programme Cycle

This Note considers how these issues can be addressed when designing an educational infrastructure programme through a process of development, preparation, implementation, monitoring, evaluation and refinement. Following this process is in itself important for the achievement of good value for money.

Subsequent sections of this Note are therefore based round the programme cycle shown below. Section 1 sets out the main issues to be addressed in developing a delivery strategy. Section 2 sets out how the programme is prepared. Section 3 sets out the key issues that relate to effective implementation, including monitoring and evaluation. Annex A addresses important considerations in the design of the physical school environment.

Annex B sets out indicative unit costs for educational infrastructure. Annex C contains a decision tree and series of checklists for each stage of the process. Each section is accompanied by a number of 'Must Have Links' Finally, three case studies illustrate programmes in Kenya, Malawi and India.

Programme Cycle



Briefing Note Scope

This Briefing Note has been written to provide guidance to officials and staff of national governments and development partners when embarking on the design of new government based primary school infrastructure programmes or when reviewing existing arrangements. It should not replace the professional construction advice that should be available throughout the design, implementation and/or review of any such programme.

Useful Links

World Bank (2003). *Education Notes: Education for All – Building the Schools.* A brief note setting out the extent of construction required to meet the EFA goals

World Bank. (2004). *Books, Buildings and Learning Outcomes. An Impact Evaluation of World Bank Support to Basic Education in Ghana*. Evaluation of the Ghana programme showing the impact that infrastructure and other inputs have had on access and quality of education

Section 1
Developing a Delivery Strategy

This section sets out the key issues that need to be addressed when developing an effective strategy for the delivery of cost effective primary school infrastructure that meets the needs of schools and communities.

Getting Started

In all cases there will be constraints to be overcome if a successful construction programme is to be designed and implemented. Ministries of Education and development partners may have limited experience of construction and there is often an increasing emphasis on decentralisation and improved school management. New approaches and ways of working may need to be introduced if the programme is going to have the required impact. To overcome these constraints:

- there should be the political will on the part of government to support innovative approaches and new ways of working;
- long term support should be available from development partners to the government, and
- professional expertise should be available to government and development partners throughout the design and implementation of the programme.

If any one of the above is not in place then the programme is unlikely to meet its objectives. It is important therefore that at a very early stage there is a process of dialogue between all parties in order to develop a joint understanding of the main issues to be addressed, a shared vision and an understanding of what part each party needs to contribute to the process. Identification of key individuals, or 'champions', who can push the process forward can be very valuable at this stage.

Developing a Delivery Strategy

Once there is broad support and agreement the next stage is to develop a strategy for the delivery of all elements of the infrastructure programme. Development of the strategy needs to be undertaken in a participatory manner and involve a range of stakeholders with experience in education and construction but also in social development, disability, governance and financial management. Ideally, a core team from government, development partners and possibly the non-governmental sector with external professional support, should take the work forward.

The context will determine the type of programme that is required. There are however a number of important issues that must be addressed in any delivery strategy (Box 1 and following paragraphs).

Box 1 – Key Issues to be Addressed in a Delivery Strategy

1. Rationale, scope and objectives of the programme
2. Data and information
3. Resource targeting
4. Procurement
5. Involvement of schools and communities
6. Risk management, monitoring and evaluation
7. Quality Control
8. Targets, budgets and timelines
9. Financial planning and management
10. Roles, responsibilities and capacity building
11. School planning and design (including water and sanitation)
12. Asset management (maintenance)
13. Disability
14. Environmental assessment
15. Social assessment (including gender)

Item 1 - Rationale, Scope and Objectives

The rationale, scope and objectives of the programme should be based on national policies and there should be a clear indication of how infrastructure will relate to other educational initiatives and other sectors. The strategy should therefore set out:

- a summary of relevant national and sector policies and plans and how the programme will contribute to them;
- how the programme will link with and support other relevant sector initiatives, such as use of double shifts, multi-grade teaching, feeder schools, use of boarding schools and teacher deployment and;
- the scope for coordination with other sectors, such as health, water, sanitation and transport.
- how the programme will take gender issues into account.

Item 2 – Data and Information

If there is not a comprehensive database of education data available to planners a process of collation of existing information and school mapping should be undertaken. Data is often not available in a format that can be used for effective targeting and is set out as average figures which can mask considerable regional differences.

In terms of infrastructure planning, adequate data is required to:

- clearly identify the location, numbers and condition of existing building stock;
- accurately assess the difference between what exists and what is required;
- accurately target resources;
- provide a baseline for monitoring and evaluation and
- to plan the construction of facilities in a logical and economical manner.

The strategy should therefore clearly set out:

- what information is currently available together with an assessment of its adequacy;
- requirements for additional information and how and by who it will be captured, collated and analysed, and

- how and by whom the updated information is going to be used to improve the planning process.

Box 2 – School Mapping

School mapping is an essential tool for educationalists to use in planning for future requirements and for optimising the use of resources, and for infrastructure specialists preparing a strategy for the construction of new or the renovation of existing schools. The design of any school mapping programme therefore needs to be undertaken by an interdisciplinary team to ensure all the relevant information is collected in the most effective way.

Typically, this will include data on the building stock and facilities, numbers of children of school going age and of teaching staff. Results should be shown on or referenced to appropriate scale maps along with physical features and possibly overlays showing hazards and poverty data. Geographical Information Systems (GIS) when used for school mapping are powerful tools but are often not used to their full potential by planning departments. Any GIS-based mapping programme will need to provide technical support and capacity building together with hardware and software.

Item 3 - Resource Targeting

Programme resources should be targeted to areas of greatest need. The prioritisation and selection process for regions, districts and schools should be fully transparent and be based on school mapping information and field verification. This will also help reduce political or other interference. The strategy should therefore set out:

- criteria for the selection of regions and districts to be included in the programme;
- criteria for the selection of individual schools for inclusion in the programme;
- the role of regional and district officials and local communities in planning and needs assessment exercises;
- how the prioritisation process will be verified, and
- clearly and objectively articulate where the greatest needs occur.

The prioritisation process should also inform programme design with respect to programme phasing or in identifying any geographical areas that have particular issues (for example remoteness, inaccessibility, conflict) which require special consideration.

Box 3 - Achieving Value for Money from Good Planning and Targeting

Where there are limited resources it is important that they are they targeted efficiently and equitably. This is often not the case and facilities are not constructed in a way that effectively matches demand. Even where average pupil/classroom ratios are high, it is not uncommon to find schools where there are unused or underused facilities. In Guinea, as many as 16% of classrooms were recorded as unused in 2000 and in Madagascar the number was about 7% in 2005. This is because of a tendency to construct schools with a standard number of classrooms rather than with the number of classrooms required by the actual and planned enrolment. The provision of smaller schools in rural communities can result in more efficient use of resources, reduce travelling distances and increase access. (Theunynck 2009).

Item 4 - Procurement

Procurement strategy will have a significant impact on unit costs, delivery times and quality. While every situation needs to be assessed on its own merits:

- Paris Declaration principles mean that where possible programmes should use government procurement systems, and
- in many countries decentralisation requires an increased role for district administrations, and for school and community committees and associations.

The key issues that therefore need to be addressed in the strategy are:

- the prevailing procurement legislation and guidelines;
- the proposed procurement system, with a justification for its selection in terms of value for money, alignment with government systems and decentralisation policy if appropriate;
- the existing procurement capacity for the chosen system, requirements for capacity building and support and an assessment of risks to the programme;
- any areas where the programme should support improvements to existing procurement systems and
- requirements for the development of guidelines, contracts and other documentation that may be needed.

Where any sector wide assessment of procurement methods is made (as part of development of a sector-wide approach for example), it should include a section specifically related to infrastructure provision and where possible the infrastructure design team should provide inputs into the development of Terms of Reference for the work.

Where resources are limited and there is need for large volumes of infrastructure to be constructed year on year approaches that use small and medium sized contractors and/or delegate authority and responsibility for procurement to schools and communities are most likely to be suitable. The use of small contractors and in particular the use of community-based methods may not be the easiest or quickest strategies in the short term, but they represent the best chance of constructing value for money infrastructure at scale and of building sustainable capacity in government and improving school management over the medium and long term. Whatever method is selected, it must be well planned, effectively implemented and supported by the requisite legislation, guidelines, documentation, capacity building and technical assistance.

Box 4 – Procurement Options

The evidence is clear that for primary school programmes unit costs are significantly lower when small and medium sized contractors are used when compared to the use of larger national or international contractors. In Africa at least, the most effective approach in terms of cost has been where procurement has been delegated to schools and communities supported by the correct resources and technical assistance. Average unit costs for classroom construction are approximately US$270m^2 when international competitive bidding is used, US$180m^2 for national or local competitive bidding and US$100/m^2 for community managed programmes. Community managed programmes also have advantages in developmental terms because more local labour and materials will be used and more money will be retained in the local economy. Where schools and communities are involved and the process is well planned and effectively implemented, their ability to undertake similar projects in the future and the possibilities for building school management capacity are be increased.

Item 5 – Involvement of Schools and Communities

School and community involvement, (through school management committees, parent teacher associations or similar bodies) has an important role in any infrastructure programme. Participation at this level can increase local ownership, improve the planning process, ensure local priorities are addressed, provide oversight and promote better maintenance. Infrastructure programmes have the potential to play a role in strengthening school management and the strategy therefore needs to set out:

- what the role of the school and community will be in the planning and construction process;
- how they will be supported to fulfil this role;
- whether community members will be trained in basic maintenance skills;
- how infrastructure priorities at each school will be identified and prioritised and how this fits into the overall school planning process, and
- an assessment of any particular constraints or risks related to the above.

When community contracting is used, the procurement, management and accounting procedures must satisfy government requirements but not alienate the users. Community contracting requires a flexible but transparent approach based on a partnership between all parties who must receive training as necessary to enable them to carry out their roles and responsibilities.

There can be resistance to the use of these approaches by governments and they are often not well supported by national procurement and financial management legislation. It is important therefore that these constraints are properly considered at this stage.

Item 6 - Risk Management, Monitoring and Evaluation

The programme should incorporate robust systems for assessing risk, monitoring progress and evaluating impact.

This process should provide accurate and relevant information in order that progress against agreed objectives and targets can be assessed by the programme managers, governments and development partners, risk can be managed and the programme can be continually refined. The strategy therefore needs to set out:

- the main risks to the programme with mitigation measures;
- how the management of the programme will be assessed and reported against;
- how progress will be monitored and how information on key targets will be collated and presented and;
- how the impact of the programme will be measured.

It is vital that governments and development partners recognise the importance of these issues and that they are addressed throughout the life of the programme in order that value for money can be demonstrated.

Item 7 – Quality Control

Construction quality will be better if there is competent supervision of the works. Without regular professional site supervision contracts cannot be managed properly, the durability of completed facilities is likely to be compromised, maintenance costs will be higher, health and safety procedures will be difficult to enforce and there will be less transparency.

Supervision is often undervalued and inadequately budgeted for even when very significant sums of money are being disbursed for capital works. The strategy therefore must:

- set out how quality control will be addressed;
- include budgeted proposals for the provision of competent supervision by suitably qualified personnel (preferably from the private sector) and
- set out how community members can be equipped with basic maintenance and monitoring skills.

Item 8 - Targets, Timelines and Budgets

Realistic estimates of what will be delivered, in what order, over what time period and at what cost will be crucial to the success of the programme and while these estimates need to be flexible, it is important that efforts are made to ensure that they are as realistic and accurate as possible. The strategy therefore needs to include:

- a range of targets that are based on what can realistically be achieved taking into account the time frame and implementation capacity;
- a timeline that: clearly shows the logical progression of the programme phases, the proposed activities and the dependencies between them; is realistic considering the prevailing constraints including the construction season and that allows time for preparatory work to be undertaken prior to any disbursements of funds for capital works;
- a budget that: covers all activities required to deliver the programme effectively and is based on an independent cost baseline.

The programme design should include for the development of a cost database based on market rates (rather than any fixed or standard rates) for all the types of infrastructure to be constructed. Infrastructure unit costs should be based on the actual designs and procurement method to be used and include an analysis of regional price differences. Project estimates and tender prices can then be compared to this database and where they are significantly below it this should direct attention to potential quality and durability concerns, or the ability of the contractor to complete the work effectively Where they are significantly higher this may indicate deliberate price inflation or collusion in the tender process.

Direct comparison of costs between and within countries, projects and programmes can be difficult because they vary considerably due to factors including exchange rate, procurement method, taxes, location, availability of materials, logistics, climate, geology and the infrastructure design. However, as an indicative guide for well managed programmes classroom costs may range from as little as US$7,000 for a community managed programme to US$15,000 for one using small and medium sized contractors and national competitive bidding.

Box 5 – Balance of Programme Costs

An assessment of the relative proportions of budget spending across a programme will give an indication of its overall balance. Proportions will vary with the type of programme but as an indicative guide they should be in the region of:
Capital works: 75-80% (of which school water and sanitation at least 10% of this).
Design and site supervision: 10 -15%
Capacity building: 5-10%
Programme management and technical assistance: 5-15%.

Any major departures from these figures should warrant further investigation. Where a community-based approach is adopted the proportion to be spent on the capacity building and supervision components will normally be higher.

Item 9 - Financial Planning and Management

Adherence to good financial planning and management practices must be a mandatory requirement for all partners. Without this, problems with programme implementation and lack of transparency are inevitable and value for money generally will be compromised. It is therefore important that the strategy sets out:

- how financial planning and management will be undertaken generally;
- an assessment of the financial risks for the proposed procurement system with specific and budgeted recommendations for mitigating any risks that are identified;
- in the case of community contracting, how financial management procedures and guidelines will be developed (see Item 5) and
- guidance on how assets purchased under the programme are used and disposed of.

Where any sector wide assessment of fiduciary risk is made (as part of development of a sector-wide approach for example), it should include a section specifically related to infrastructure provision and where possible the infrastructure design team should provide inputs into the development of Terms of Reference for the work.

Box 6 – Approaches for Reducing Risk of Corruption

The programme can use a number of approaches to increase transparency and reduce risk of corruption. These include:

1. having an agreed programme strategy in place;
2. supporting schools and communities to have a greater oversight role;
3. ensuring regular and planned funding disbursements to the programme;
4. the use of transparent disbursement procedures including publishing payment schedules in the local press, as well as on district and school and community notice boards;
5. having good baseline information (including a detailed cost database) that proposals, estimates and tenders can be monitored against;
6. development of clear, standardised contracts and comprehensive record keeping;
7. provision of professional site supervision, reporting, monitoring and verification procedures;
8. provision of the necessary training to all parties to allow them to fulfil their roles and responsibilities and
9. establishment of a system of reporting of suspected corruption independent of the programme management.

Item 10 - Roles, Responsibilities and Capacity Building

The success of the programme will depend on getting management processes right at all levels and ensuring good governance, building capacity as necessary and the active participation of schools and communities. The strategy therefore needs to:

- clearly define the roles and responsibilities at each level, given the proposed procurement system;
- assess existing capacity at each level, including in the construction sector;

- set out what capacity will be required to effectively implement the programme and a plan and budget for achieving this, and
- determine the extent of and budget for the technical assistance that will be required to effectively implement the programme.

It is important that capacity building is more than just training. It should ensure that all parties are aware of their rights and are able to fulfil their roles and responsibilities. The capacity building component will be central to effective implementation but will also be logistically one of the most difficult. It is therefore particularly important that it is designed as a central rather than peripheral part of the programme.

Box 7 - Capacity Building in the Kenya School Improvement Grants Programme

Under the School Improvement Grants Programme in Kenya, 4,686 primary schools have received grants totalling £47 million. School committees are supported to develop School Infrastructure Development Plans (SIDPs), which they implement using their grants. Capacity building has been at the core of the programme and over 4 years 23,430 members of school management and infrastructure committees have received training to ensure that they have the skills to develop their SIDPs and manage their resources effectively and transparently within the programme guidelines. This has been done at a cost of 8% of the value of grants disbursed.

Item 11 – School Planning and Design

The incorporation of good school planning and design is essential if the programme is to provide modest yet safe, attractive, accessible and durable learning environments that meet local needs. To achieve this, the programme needs to:

- review national design norms and standards which are often inappropriate if they exist;
- produce a series of generic designs specifications, bills of quantities and schedules of materials for different topographical and climatic regions for all types of education infrastructure and
- put in place systems to ensure that good planning and gender sensitive design practice is incorporated into the design of the schools and facilities.

The strategy should therefore:

- set out what national norms and standards are in place and assess their suitability;
- set out how new standards will be developed or existing ones modified, where this is required;
- identify and list what standard designs and documentation should be developed;
- show how principles of good planning and design will be incorporated into the programme (this is a particular issue when community contracting is being used) and
- identify any particular land issues that are likely to arise (a particular issue in urban environments).

The strategy for doing this will vary but successful approaches include:

- the provision of information, advice, drawings, manuals, training and professional support to small builders, schools and communities,
- competent site supervision and;
- the construction of ‘exemplar’ schools or buildings to demonstrate key design and planning features to schools, communities, local builders and supervisors.

Particular issues that relate to the incorporation of water and sanitation into the programme could include: the involvement of other departments and ministries, such as water, health and sanitation (including separate arrangements for girls and boys); technical issues and how school and community water supplies may be combined. The strategy therefore needs to have a specific section setting out how the provision of school water and sanitation will be addressed in the programme.

School planning and design is covered in more detail in Annex A.

Box 8 - Exemplar Schools

School building programmes can be informed by the construction of demonstration ('exemplar') facilities to showcase good planning and design. A set of 'exemplar' school layouts and designs should be developed and constructed in different climatic, cultural or geographic regions through collaboration between education officials, architects and engineers and construction agencies together with local communities. As the main programme is rolled out the targeted communities will use these facilities to guide them as they prepare their own plans for construction. This approach will also assist in the development of a realistic database of construction costs and can be used to develop good practice through the involvement of school committees, communities, small builders and local architects and engineers.

Item 12 – Asset Management

Investments in repairs and maintenance are very cost effective but have historically received little priority or attention from governments or development partners. The current deficit of classrooms is due in part to poor maintenance of the existing building stock.

In order to obtain the maximum value for money from educational facilities it is essential that their lifecycle costs are minimised and that they remain serviceable throughout their life. This means the provision of school infrastructure with a design life of at least 25 years and of regular maintenance. The annual budget for routine maintenance is on average between 1.5-2% of capital costs or between 45-60% of the capital costs over the life of the building.

The introduction of school maintenance programmes has historically been challenging as very few (if any) countries have had an effective national policy, strategy or budget for asset management. Maintenance is best managed by schools and communities and is therefore mainly a school management and funding issue.

It is important that the strategy:

- sets out how the programme will inform or support development of national policies and strategies for improving maintenance of school facilities;
- sets out how the programme will combine new construction with renovation and maintenance and what approaches will be used to encourage better maintenance;
- highlights the anticipated costs of maintenance and how it will be financed and
- sets out what training and support will be provided to schools and communities to enable them to undertake maintenance of their facilities.

New programmes should aim to set up a maintenance programme at least in the schools that are receiving funding. This could be done by providing training and handbooks and by including ring-fenced funding for maintenance for a period after initial construction in order to demonstrate the benefits of better maintenance.

Item 13 – Disability

The disabled comprise one of the largest single groups of excluded and chronically poor people in the developing world. Inclusive education means the participation of all children in their local schools and is related not just to access but an overall child centred approach to education. In addition, accessibility to schools allows parents with disabilities to participate in the education of their children, and the use of school facilities by all members of the wider community.

The cost of providing increased accessibility is insignificant being generally less than 1% of total costs as long as it is taken into consideration from the start of the design process. This requires careful site planning and the revision of overall standard designs, rather than just the addition of accessibility features. Particular attention should be paid to the provision of accessible water and sanitation facilities.

The strategy needs to specifically address disability and therefore should:

- include a process of engagement with disabled people's organisations to inform the programme design and implementation;
- include a process for raising disability issues where this is an unfamiliar idea and especially in the architectural and engineering professions and
- ensure that national norms and standards, and standard designs of all facilities, including water and sanitation take into account the disabled and support inclusive education.

Item 14 - Environmental and Social Assessment

The design of the programme needs to be informed by environmental and social assessments which should comply with any national legislation and any additional requirements of development partners. Where possible, these should be coordinated so that one assessment satisfies the requirements of all parties.

The programme should be subject to at least an environmental and social screening exercise. This should be carried out at the start of the design phase to identify any particular issues that will need to be addressed further. The strategy should therefore:

- clarify what environmental and social assessments are required, by who and by when;
- set out who is responsible for producing and funding the assessments, and
- identify what issues if any should be addressed in more detail either as part of programme preparation or in separate assessments.

Where the assessments are not being managed by the programme team, it is important that they are involved in development of Terms of Reference to ensure that infrastructure is specifically included.

Environmental assessments would typically address: the types of construction materials used; the location of the facilities, including any land issues and the risk of natural hazards; climate; any possible impact on surrounding land uses; health and safety; water and sanitation.

Social assessments are always important but particularly so when community based approaches are being used. Typically they should address issues such as: the need for resettlement; the local economic cycle; creating a child friendly learning environment, with particular emphasis on strategies to encourage girls' participation; gender division of labour; payment for labour provided; the impact of community contributions on income

generating activities and the potential benefits to the community that the proposed approach will bring.

Useful Links

Theunynck, S (2009). *School Construction Strategies for Universal Primary Education in Africa: Should Communities be Empowered to Build their own Schools?* World Bank, Washington DC. A very useful up to date publication setting out and assessing the different approaches to school construction that have been used in Africa over the past 30 years. It is particularly strong on assessing the relative advantages and disadvantages of different procurement systems.

Benyon, J. (1997) *Physical Facilities for Education: What Planners Need to Know*. Paris: UNESCO International Institute for Educational Planning. <unesdoc.unesco.org/images/0011/001184/118467E.pdf>. A comprehensive reference work on planning matters from both a practical and policy point of view.

Cambridge Education Consultants (CEC). (2001). *The Contribution of Planning and Engineering to Education Strategies: Report of a Scoping Study*. Contains good background information on asset management, school mapping, community construction and other background information. Available on a CD format.

Max Lock Centre. (2003). *Building Capacity for Community Asset Management in India.* Max Lock Centre, University of Westminster, London 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.

National Audit Office. (2010). *Report by the Comptroller and Auditor General HC69: Department for international Development - Bilateral Support to Primary Education*. TSO, London.

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

DFID *(2007) How to Note: Working with Disability in County Programmes.* A practical note setting out the main issues and providing practical advice on how they can be incorporated into programmes.

World Bank. *Safeguard Policies* http://go.worldbank.org/WTA1ODE7T0. A guide to all prevailing World Bank safeguards.

DFID (2003). *Environment Guide – A Guide to Environmental Screening.* DFID guidance on the requirements for environmental screening for DFID projects and programmes.

Section 2
Preparing the Programme

Once an agreed delivery strategy is in place a period of preparatory work is required to develop all the elements of the programme that will be required for effective implementation. This section sets out the typical activities that should be undertaken during this stage, which may last up to 12 months.

Preparing the Programme

The delivery strategy will have identified what elements of the programme need to be developed during the preparation stage before construction can commence. Activities will vary depending on the nature of the programme and what previous work has been undertaken. However, technical assistance from construction professionals will in almost all cases be required to provide support and assistance to this process.

All elements of the programme need to be properly prepared before the implementation phase commences and any significant funding is disbursed.

The preparation stage is likely to take from six to twelve months depending on what information and capacity is available. Programme timelines and budgeting should take this into account.

Box 9 – Typical Programme Preparation Activities

1. Continuing efforts to raise awareness of the programme and to work in a coordinated fashion;
2. Setting up or strengthening the infrastructure management unit within the Ministry of Education;
3. Putting in place necessary structures at district, community and school level;
4. Development of management, procurement, financial management and accounting procedures and guidelines, especially where community-based approaches are being used;
5. Data gathering and school mapping;
6. Development of agreed selection criteria for the targeting of resources and the selection of programme beneficiaries;
7. Review of building standards and production of standard designs, specifications, bills of quantities and schedules of materials;
8. Construction of exemplar facilities;
9. Developing a cost database based on prevailing market rates and prices;
10. Preparation of a detailed construction implementation programme that takes into account local factors such as the rainy season and farming cycles;
11. Commissioning design and supervision support from the private sector and
12. Developing capacity building materials.

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Section 3
Implementing, Monitoring, Evaluating and Refining the Programme

Once the preparation phase is complete, funds for capital works can start to be disbursed and the construction process can commence. This section identifies the key areas on which governments and development partners should remain focussed during implementation.

Summary of Key Issues

If the programme is well planned and prepared this should assist in ensuring successful implementation. All programmes will however require continual support, review and modification over their lifetime. Key issues that need to be addressed during implementation, based on previous experience are set out in Box 10.

Box 10 – Areas of Focus to Ensure Effective Implementation

1. Technical assistance to support the programme
2. Regular, planned disbursements of funds
3. On-going capacity building for all programme personnel
4. Monitoring, evaluation and reporting
5. Taking a long term view
6. Monitoring and re-evaluating risks
7. Continual refinement of the programme

Issue 1 – Technical assistance to support the programme

Implementation of the programme will require the provision of technical assistance. Capacity for managing construction programmes in many Ministries of Education is limited and often officers have had little opportunity to learn from international experience or scope to introduce new approaches. Attempts to provide this capacity by seconding staff from Ministries of Works normally prove to be unsuccessful.

It is therefore incumbent on development partners to provide assistance in a consistent and coordinated fashion. Implementing programmes without the provision of sufficient technical expertise will result in poor value for money and the loss of possibilities for the introduction of new ideas.

Issue 2 - Regular Planned Disbursements of Funds

Erratic disbursement of funds is a common problem that faces construction programmes and delayed disbursement is one of the major reasons for government and community partnerships to falter and for contractors to fail to complete works on time and budget. Almost as damaging are unplanned and unexpected disbursements which typically are allocated to construction programmes near the end of the financial year and which are expected to be utilised in extremely short timeframes.

When funding is not disbursed as agreed, confidence in the whole programme is undermined and the likelihood of corruption and a poorly executed project is increased. Government and development partners must ensure that there are regular and planned disbursements of funds in order to minimise programme risk.

Box 11 – The Effects of Erratic Disbursements and Late Payments

Erratic disbursements and late payments can be very disruptive to construction programmes in three main ways. Firstly, when small contractors are being used, late payments cause cash flow problems, delay on site, conflict and can result in in them going out of business. Secondly, where funds are being disbursed to schools or communities, disbursements must coincide with capacity building initiatives or raised expectations will not be met. Finally, programmes should be designed around the construction season (which must take into account factors such as the rainy season and agricultural activities) and when payments are delayed this can result in this programme being disrupted.

Issue 3 – On-going Capacity Building

Capacity building and the provision of quality assurance (including site supervision) will be on-going exercises that will support communities, districts and the centre in the delivery of good quality infrastructure. Government and development partners must agree on and be fully committed to such an approach and see it as an integral component of the programme. These activities need to be seen as an investment to support programme implementation, maximise the impact of the available resources and increase value for money, rather than being perceived as optional extras with limited value.

Issue 4 - Monitoring, Evaluation and Reporting

It is essential to establish a process of continuous monitoring, evaluation and reporting from the start in order to provide: management information to the programme team; assurance to government and development partners and information that can be fed back into the programme to inform activities such as the design of new facilities, planning capacity building exercises and ascertaining future research needs.

To achieve this, monitoring and evaluation should be undertaken in an open and transparent manner by a multi-disciplinary team. Reporting must be clear and accessible and reporting milestones, such as annual or sector reviews should be used as fora for the discussion of monitoring reports from previous years so that informed discussions concerning the future direction of the programme can be undertaken.

Issue 5 - Taking a Long Term View

Programmes benefit from predictable, long term support of at least 5 and preferably 10 years during which effective approaches can be developed and refined, capacity built up and processes institutionalised. Working through sector-wide approaches and pooled funding arrangements and with increased development partner coordination is likely to provide better opportunities for long term support than the project-based approaches that have traditionally been used.

Issue 6 - Monitoring and Re-Evaluating Risks

The implementation of large scale construction programmes will always incur risks. The risks identified in the programme design phase should be continually monitored, periodically reassessed and actively managed over the lifetime of the programme and annual workplans should set out how risks will be mitigated. Risk assessment and management can be powerful tools but they are often underutilised.

Issue 7 – Continual Refinement of the Programme

The programme should be continually refined throughout the implementation stage in light of feedback from the monitoring and evaluation and field experience. Ideally the delivery strategy should be updated annually. All programme materials should also be regularly reviewed and updated as required. End users and those attending capacity building courses should be actively encouraged to provide feedback that can be incorporated during the revision process.

Annex A
Designing the Physical School Environment

This Annex sets out the key issues that should be considered when choosing a site for a school, laying out the buildings on the site and in designing appropriate buildings. Getting the location and design right is essential for: the provision of effective spaces for teaching and learning; ensuring access for all; reducing risks from natural disasters and achieving value for money.

The Existing Situation

Many schools in developing countries are poorly designed and constructed, with facilities that are badly laid out and that are either too hot or too cold or are dark, unhygienic, uncomfortable, inaccessible, dangerous and generally not conducive to effective teaching and learning.

These problems are often caused not by a lack of resources but as the result of inappropriate standards, a lack of imagination, a poor understanding of the links between infrastructure provision and education delivery and an incorrect perception that doing things differently is going to increase costs. Good design does not have to cost more – in fact it should improve overall value for money as well as making the whole school environment more welcoming and a place where teachers are supported and learning is encouraged.

Guiding Principles of Design

While school designs will vary between and within countries, it is possible to set out general principles of good school design that apply almost everywhere. These are that:

- the 'whole school environment' should be considered not just the classrooms;
- the spaces provided accommodate the required functions;
- buildings are accessible for all, appropriate in scale and attractive to the users;
- designs relate closely to the culture of the surrounding community and the local architectural tradition;
- designs respond to the local climate, topography and any potential hazards and
- construction is simple and cost effective and aims to minimise maintenance costs.

Design Standards

Design standards have significant implications for capital and maintenance costs and need to be based on the local climatic, educational and economic conditions. Standards need to be modest yet provide safe, attractive and durable learning environments. They need to be flexible rather than prescriptive, possibly in the form of performance specifications and buildings should have a design life of at least 25 years. National standards are often inappropriate or non-existent and will therefore need to be reviewed or developed if not in place. Once this has been done a range of standard designs can be prepared (Box A1).

Box A1 – Requirements for Standard Educational Infrastructure Designs

Prior to any construction taking place the programme should support the development, where these do not already exist of a series of generic designs for different topographical and climatic regions for all types of educational infrastructure. These designs should:

1. be based on national standards;
2. be designed to mitigate risk from hazards;
3. incorporate features and flexibility to promote multi-functional use and to ensure accessibility for all;
4. be designed to ensure durability and provide acceptable levels of light and heat and good acoustics;
5. incorporate materials and building techniques commonly used and understood by local artisans;
6. be presented in a range of formats depending on whether they will be constructed by contractors or communities;
7. have associated standard specifications, bills of quantities and/or schedules of materials.

Key Issues Relating to Site Location

The site for any existing or new school needs to be suitable. When existing schools are being extended or renovated their sites should be re-assessed. The site for a new or existing school should be:

- within easy access of children's homes and preferably situated within a settlement;
- of an adequate size for existing and/or new buildings and for any possible future expansion;
- large enough to provide space for outside play;
- well drained, level, not subject to flooding and have good soil conditions to allow for simple foundations;

The tenure of the land should also be well established; an issue that can be particularly problematic in urban areas.

Limited resources should not be spent at sites that are either inappropriate or will be expensive to build on if alternative sites are available.

Key Issues Relating to School Layout

The size and shape of the site, the terrain and the prevailing climatic, economic and cultural conditions will all have an effect on the design and layout of a school. These factors are often not taken into account resulting in inappropriately designed school compounds that are unattractive to children and do not support a modern education system. When designing a school the following factors must therefore be taken into account:

- buildings should be arranged in the most economical way taking into account orientation, the slope of the site and the prevailing climate;
- layouts should incorporate courtyards and other external spaces for recreation, teaching and learning;

- layouts should allow for flexibility and future expansion and promote safety and security;
- water and sanitation facilities, formal circulation routes and boundary walling should be incorporated in the planning and shown on the drawings and
- facilities should be planned so that they are accessible to all.

The Effect of Climate on Design

Climate is a major influence affecting the comfort of children attending school and the layout and design of the buildings needs to reflect this. The key issues are that:

- correct orientation of buildings in the tropics is essential if the sun is to be kept out of rooms and off main walls although in warm, humid climates it might be necessary to modify the orientation in order to face the buildings into the prevailing breeze;
- elements of building design, such as roof overhangs, window openings and roof construction will affect ventilation, heat and light levels in the buildings and need to be properly considered, and
- the use of planting to provide shade and help to keep buildings cool is often very cost effective and should not be overlooked. Trees can be planted at a safe distance to buildings to provide shade and climbing plants can be trained over verandas and roofs if these do not compromise the need to collect water from the roof.

Cost effective techniques of computer modelling for the design of buildings are now widely available and can be useful in assessing levels of comfort, light and acoustics during the design stage.

A Minimum Package of Facilities

The educational infrastructure that will have the most impact will vary from school to school and will include the provision of facilities such as classrooms, outdoor learning and play areas, furniture, water and sanitation, administration buildings, storage, cooking and boarding facilities.

What constitutes a minimum acceptable package in a particular country or school is open to debate and most countries do not have national guidance in this regard. Water and sanitation facilities and furniture certainly need to be included; office space is often included and boundary walls are often prioritised by communities, especially where safety is an issue. Basic outdoor play equipment can be provided at relatively low cost.

The provision of teachers' housing is often a priority for Ministries of Education particularly in rural areas but they are expensive to construct and the cost effectiveness of providing them at all schools is difficult to demonstrate. While the provision of housing may be a priority at individual schools, many other factors affect teacher deployment and retention. Any programme for the construction of teachers' housing should therefore only be embarked upon in rural areas and only when the effectiveness of such a programme in the deployment and retention of teachers can be demonstrated.

Resources can be targeted most effectively to individual priorities at schools if an effective process of participatory planning is included in the programme process. This may take various forms but should result in a prioritised list of improvements which has been discussed and agreed by the school, the pupils and the community. Then, as resources become available the priorities can be addressed. To be effective this process should be designed so that school and community members can be taken through it step by step identifying actual need and at the same time building capacity.

Sizing the Classroom

While most countries have norms for classroom size (i.e. space per pupil and/or numbers of pupils per classroom), in many countries classrooms are generally too small for the number of students they have to accommodate, particularly in lower grades. Classrooms are usually designed to accommodate 40-60 students at 1.0/1.4m^2 per student and an overall size of 55/60m^2, although there are significant variations between and within countries (often as a result of development partners adopting different norms).

There is therefore no 'standard' size of classroom and this will vary from country to country and over time due to economic and other circumstances. When deciding on the size of the standard classroom for a programme a number of factors should be taken into account: the classroom should allow sufficient space for the maximum number of students that the teacher can effectively teach in comfort; in small rural communities it should allow adequate space for multi-grade teaching; it should allow and encourage innovative teaching methods; it should allow space for changes in teaching methods during its lifetime and it should allow space for the provision of 'book corners'.

Creating a Positive Learning Environment in the Classroom

Conventional classroom designs are often based on the traditional approach to teaching with the teacher at the front and students in rows facing forward. Improved classroom designs and layouts should offer more flexibility and should where at all possible support the teacher in the use of innovative and inclusive approaches to teaching, such as group work, practical activities and those involving the whole class. Where possible, there should be no 'bad seat' in the classroom.

Design features that can be included at little or no extra cost during construction include;

- reading corners with built in benches and display space (this is a much more cost effective way of improving reading outcomes than providing libraries);
- storage areas for books and other teaching materials;
- pinboards, built-in hooks or the provision of timber strips around the classroom walls for displaying work and;
- tiles by local artists showing maps or the alphabet.

A good quality chalkboard provides very good value for money. Normally, classrooms are supplied with one chalkboard but consideration should be given to the provision of a second chalkboard on another wall which can be especially useful for group work or multi-grade teaching. Chalkboards can also be placed on walls outside classrooms to create overspill teaching space. In lower primary classrooms there is a strong case to be made for painting a one-metre chalkboard strip around the classroom for children to use to practise writing and drawing.

Box A2 - Creating Positive Educational Environments in Malawi

In 2003, the Malawi Ministry of Education and DFID formed a partnership to build much needed primary school classrooms. The programme managers worked with the coordinating committee overseeing the development of a new curriculum for primary schools to ensure that the construction design reflected its priorities. This resulted in new approaches to school furniture being introduced, together with cement roof tiles to reduce noise levels, reading corners, local tiles illustrating key indigenous knowledge and values, built in hooks for displaying children's work and chalkboards in classrooms for children to use.

Designing and Constructing School Furniture

One of the primary objectives of most education programmes is to introduce improved and innovative teaching methods. In many countries the design of school furniture does not allow the flexibility which is necessary for the introduction of innovative teaching methods or give space for group and project work. In many schools there is insufficient useable furniture for all of the students. There is a need for physical comfort when sitting, reading and writing and furniture plays a major role in ensuring the comfort of learners and thus enabling the learning process.

Furniture should be seen as a resource in the same way as buildings and it should be:

- well designed and constructed;
- correctly sized;
- fit for its purpose and
- if possible made and repairable locally.

There should also be simple ways of disposing of furniture that is damaged beyond repair in order that valuable classroom space is not taken up with un-useable but un-disposable items. Costs of school furniture vary considerably but are often in the region of US$1,500-2,500 per classroom.

Box A3 – School Furniture

A simple design for school chairs that has been used very successfully in many countries has been developed by UNESCO. It is simple to construct and the design lends itself to factory or cottage industry construction or a combination of the two. The chairs are stackable and easy to make and repair locally. This chair and a double desk both made from simple timber components have been used in projects in Sierra Leone where local carpenters made them on site and in East Timor where over 75,000 sets of chairs and desks were made and supplied to primary and junior secondary schools.

Designing for Flexibility

Designs for schools should encourage the use of school facilities out of school hours thus increasing the efficiency of the building use and improving value for money.

Governments and development partners need to recognise the potential benefits of using school facilities for other purposes such as community learning centres. This sort of use will promote better links between schools and communities and could also bring in revenue to the school from renting out facilities.

In design terms the use of school facilities out of school hours will mean providing easy access and possibly making some larger. This must be borne in mind at the design stage.

Choice of Materials and Construction Techniques

The design of facilities should take into account both the building materials available locally and the skills of and techniques used by local artisans. This will reduce costs, produce better quality buildings, assist the community to identify with the finished buildings and improve the chances of repair and maintenance being undertaken. The use of local materials and skills will also help generate employment and income in the community and on-the-job training will increase the pool of local skills.

The use of local materials and skills should not however rule out innovation completely but any new materials should bear some relationship to existing ones. For example, stabilised-soil block technology has been successfully introduced in Malawi but only after much research and training and it is now accepted as a cost-effective technology.

Providing Lighting and Power

There are advantages in providing lighting and power in schools. Lighting extends the number of hours a classroom can be used, ceiling fans produce a more comfortable environment for learning and electricity enables equipment that can help teaching or school management (i.e. computers) to be used. The provision of power also increases the potential for income generating activities at the school.

The provision of lighting and power is not essential however in most rural primary schools as they are mainly used during daylight hours. Buildings should not be provided with wiring and electrical fixtures and fittings where there is no existing or anticipated access to the electricity grid. Where there is access to the grid there is the question of who provides the budget to cover running and maintenance costs.

Where it is thought necessary to have lighting and power in rural (off grid) locations, then solar power is an option. It is however expensive and issues remain over maintenance, theft and long-term sustainability. The use of generators is not recommended on the grounds of cost, reliability and maintenance.

Key Issues in Relation to Disaster Risk Reduction

Reducing the risk of disasters at schools requires a combination of:

- hazard identification;
- appropriate location of school facilities;
- good design and construction and
- disaster management planning and community awareness.

The most common hazards related to school construction are earthquakes, windstorms (cyclones and hurricanes), lightning, floods and land instability. In some locations these can interact to form multiple hazards. Mapping is sometimes available as a guide to what hazards there are at a particular site – in other cases local knowledge and site investigations may be the only guide. Any assessment should take into account the possible effect of climate change anticipated over the life of the facilities.

The siting of facilities plays an extremely important part in risk reduction particularly in the case of flooding, lightning and land instability but also in the case of earthquakes and windstorms where design and construction are more important. Where it is intended that schools should be used as emergency shelters it is obviously incumbent on the designers to ensure that the facilities are fit for purpose.

Effective Approaches for Reducing Disaster Risk

The key factors to be borne in mind when designing to reduce the risk of disasters are:

- for windstorms, the use of sheltered sites and windbreaks and the construction of properly braced buildings with wind resistant roofs are the best protection;
- for earthquakes the strength of the building and the use of lightweight roofing are the key issues;
- for lightning site location and use of lightning conductors are important and

- in order to reduce the risk of failure due to any outside forces, good design, construction and competent site supervision are critical.

Whilst the principles of designing and constructing buildings to resist windstorms and earthquakes are well understood, and can be applied to most common building materials the real challenge is one of ensuring these principles are followed. This should not however preclude the use of small contractors and communities in areas of high risk but there will be a need for increased support and supervision to ensure that the buildings are constructed in accordance with the designs and specifications.

Professional engineering advice should be sought when designing structures in hazard prone areas but engineering solutions need to be combined with programmes of disaster preparedness and other strategies for reducing risk including education, skills development and preparedness planning.

Box A4 - Affect of Hazards on Schooling

In nine major disasters that have occurred since 2000 in El Salvador, Venezuela, Italy, Turkey, Cambodia, USA, Pakistan and China more than 28,000 children and teachers have lost their lives because of unsafe school buildings. The 2005 Pakistan earthquake alone killed at least 17,000 and seriously injured 50,000 students and in total over 300,000 children were affected. An estimated 6,500 primary schools were destroyed or badly damaged and in some districts 80% of schools were destroyed. The poor seismic resistance of the existing building stock was a significant factor in the large death toll amongst children. The issue of 'school safety' incorporating adequate building standards and construction quality has now been put high on the reconstruction agenda.

Schools in Urban Environments

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.

School Water and Sanitation

In many low income countries schools suffer from non-existent or inadequate sanitation facilities, unsafe, erratic or non-existent water supplies and inadequate hand-washing facilities. Facilities are often poorly maintained, unsanitary and do not meet the needs of users and teachers and children often have little hygiene awareness. In the poorest countries of the world more than half of primary schools have no safe drinking water or any type of sanitation facility. The provision of water and sanitation is still overlooked or underemphasised in many education programmes.

All children need a safe and hygienic learning environment but the lack of such facilities both inside the school and in the wider community impacts more negatively on girls than boys and on the disabled when facilities are not accessible. At school there is clear evidence that the enrolment and retention of girls increases when there are clean, safe, separate and private toilet facilities for girls.

Where there is a focus on hygiene and proper maintenance of toilets and water supplies, sanitary conditions are invariably better and where children are taught how to use the facilities properly there should be less maintenance.

No primary school construction or renovation programme should therefore be undertaken without ensuring the provision of drinking water supplies and sanitation facilities with separate provision for boys and girls. In many ways this is more difficult than other infrastructure as:

- more coordination is required with other ministries such as water and health;
- the provision of water and sanitation is often quite site specific and technical advice is required to ensure their provision;
- provision of water to schools is often linked to that of the community;
- hygiene promotion is linked to general health promotion in the school and
- the operation and maintenance of water supplies and toilets depends on good school management.

Box A5 - Latrine Design and Siting

In most situations the VIP latrine is the most appropriate and cost-effective way of providing school toilets. Costs vary widely but are often in the region of US$1,000-1,500 per latrine. Although the technology is simple and it is often expected that schools and communities will build them, it is important that the right design is chosen, that it is constructed and located properly and allows disabled access. Often, when this is not the case facilities are difficult to maintain, underutilised and sometimes dangerous. Where suitable site conditions exist VIP latrines are simple to construct and a wide range of local materials can be used. Unless there are very good reasons the floor of the latrine should be made of reinforced concrete both for strength and ease of maintenance. Where there is a high water table or the ground is particularly hard or soft there will be the need to take specialist advice. The use of the double-pit VIP latrine should be considered for use in schools as it is more sustainable and a changing and bathing room for girls to use during menstruation should be provided if possible.

Standards for pupil:latrine ratios vary by country and by type of schools and whether urinals are used. However in a non-boarding school a ratio of 25:1 for girls and 40:1 for boys would represent a good level of provision assuming the facilities are constructed to an adequate quality and are well located. In many situations a ratio of 1:60 may represent a more achievable target.

Siting of latrines is an extremely important issue and security, privacy, the environment, water access and cultural conditions all need to be considered. While layouts will vary from site to site latrine blocks should be about 10m from and downwind of school buildings and boys' and girls' facilities should be separated by at least 10m and preferably screened from each other. VIP latrines should also be at least 30 metres away from any wells. Access paths should be provided if possible, toilets should not be situated near the school perimeter and doors should face inwards towards the school.

Toilets should be located so that there is no possibility of the contamination of local water resources and that they cannot become flooded with surface water. Finally, any local religious and cultural traditions need to be taken into account in both the design and location of toilets.

Box A6 - Water Supply Design

The design, construction and cost of water supplies will vary considerably from site to site and may consist of a connection to an existing system (normally with a stand pipe on the school site); a borehole or well with a hand-pump or rainwater collection. Although many designs exist for each of these options, the selection of the most appropriate supply requires technical advice. Hand washing and water points need to be located in such a way that they encourage their use – again many standards designs, many using locally available materials have been developed over the years. In most cases hand-pumps are more reliable and require less maintenance than electrical submersible pumps, which are not recommended. Cost varies depending on the method of water supply but is often in the region of US$5,000-10,000 per school.

Box A7 – Approaches for Maintaining Water and Sanitation Facilities

In the case of latrines day to day maintenance mainly consists of keeping facilities clean. This is usually achieved by using cleaners, rotas of children or assigning latrines to individual class groups but individual schools should be encouraged to develop their own systems. Some girls will begin their menstrual periods while still at primary school and this is an important issue in latrine maintenance. Soiled materials used for menstrual hygiene can be safely placed in pit latrines but if girls are expected to recycle cloths then an additional facility for washing cloths and themselves in the latrine block is clearly desirable. It is important to maintain a regular supply of water and soap for hand washing and where schools do not have piped water any hand washing facilities will need refilling regularly.

Must Have Links

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Read, RA and Jones H*. Water and Sanitation for Disabled people and other vulnerable groups:* <http://wedc.lboro.ac.uk/resources/books/Water_and_Sanitation_for_Disabled_People_-_Complete.pdf> A comprehensive guide to the subject including practical guidance on school water and sanitation for disabled people.

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Annex B
Indicative Unit Costs

Development of reliable benchmark unit costs for classrooms and other educational infrastructure is problematic. Direct comparison of costs between and within countries, projects and programmes can be difficult because they vary considerably due to factors including exchange rate, procurement method, amount of community contribution, taxes, location and the infrastructure design. Some countries will have higher prices than others because of factors such as labour costs or materials availability. Given this, infrastructure cost estimates should wherever possible be based on local market rates and relate to the actual designs and procurement method proposed. However, it is possible to make some estimates of costs based on existing information which can be used for indicative and comparative purposes.

Cost and Procurement Method

The procurement method has the single most impact on construction cost. Numerous procurement options are available depending on the nature of a project or programme including (a) using central Ministries of Education (b) through Project Implementation Units, Contract Management Agencies or NGOs (c) by decentralisation of responsibility to local government and (d) use of community management. An analysis of over 200 school construction programmes in sub-Saharan Africa undertaken by Theunynck (2009) shows quite clearly that on average (a) use of national and local competitive bidding results in much lower unit costs than international competitive bidding and (b) delegation of construction management to communities results in significantly lower unit costs than management by central ministries or local government. **Table B1** provides a summary.

Table B1 – Average Unit Costs per Procurement Method

Type of Procurement Method	Average Unit Cost (US$/m2)	Average Cost per Classroom (US$)
Central Ministry International Competitive Bidding	269	17,485
Central Ministry National Competitive Bidding	189	12,285
Delegation to Project Implementation Unit/Contract Management Agency	190	12,350
Delegation to NGOs acting as Contractors	180	11,700
Ministry Decentralised Office National or Local Competitive Bidding	180	11,700
Local Government National or Local Competitive Bidding	172	11,180
Delegation to Communities from Ministry	103	6,695
Delegation to Communities from Local Government	95	6,175
Delegation to Communities from NGOs	80	5,200

Notes: [1] All costs in this Table are taken from Theunynck (2009) and are based on a comparative study of 215 projects in Sub-Saharan Africa [2] All costs adjusted to 2006 prices [3] Average cost per classroom assumes a 65m^2 gross classroom area in all cases.

Evidence from DFID supported programmes in Kenya and Malawi support this analysis. In Kenya, average construction costs are around US$14,700 (US$170/m^2) for contractor built schools using national or local competitive bidding, compared to US$7,400 (US$86/m^2) for those constructed under the Ministry of Education's community managed

School Infrastructure Improvement Grants Programme. In Malawi, classrooms procured using small and medium sized contractors cost approximately US$12,140 (US$135/m^2), which is lower than the average of US190m^2$ for this type of approach. Recent analysis has shown possible savings in unit costs of 30% if a community managed approach was adopted.

In Nigeria, a recent study of government and World Bank supported construction programmes managed by State Education Bureaus across three states indicate classroom costs of on average approximately US$180/$m^2$. Similar JICA funded projects using Japanese management cost approximately US$360/$m^2$. Recent project preparation for a World Bank funded project in Liberia estimates costs of US$175/$m^2$.

Costs in DFID Education Portfolio Countries

In 2009 DFID collated the average cost of classrooms in some of its education portfolio countries as part of the portfolio review. These were referred to in the 2010 National Audit Office review of Bilateral Support to Primary Education. **Table B2** summarises this data, which (not unexpectedly) reveals wide variations between countries. Differing procurement systems, costs of labour and materials, classroom sizes and specifications and individual characteristics of programmes and projects are all likely to be contributing factors.

Table B2 – Average Classroom Costs in selected DFID Education Portfolio Countries

Africa	Average Cost per Classroom (US$)	Asia	Average Cost per Classroom (US$)
Sierra Leone	11,000	Vietnam	11,000
Ghana	16,000	Cambodia	4,084
Malawi	12,140*	Bangladesh	5,000
Mozambique	15,000	Nepal	3,629
Kenya	7,400*	Pakistan	10,719
Nigeria	20,000		

Notes: [1] Where a range of cost is given in the original table, averages have been taken [2] Costs shown in this table are not directly comparable with those elsewhere as they have been supplied at different times and may include different items [3] Where * is shown original costs have been replaced with updated costs.

Although based on a small number of countries the data suggests that classroom construction is cheaper in Asia than Africa. Theunynck (2002) confirms this and estimates the average cost of construction at US$108/$m^2$ in Asia and US$119/$m^2$ in Africa.[1]

Costs of Other Educational Infrastructure

While the focus is commonly on classroom unit costs, they normally represent only approximately 60% of the capital costs required for provision of a basic minimum package of infrastructure facilities at a school, which includes water and sanitation facilities, administration space, furniture and external works such as drainage, paths and boundary fencing. As with classrooms, costs of other infrastructure vary according to the procurement approach and the particular characteristics of country, construction

[1] Note these unit costs have not been adjusted to today's prices and show a relative comparison only.

programme and the school site. However, **Table B3** sets out some indicative costs for these items.

Table B3 – Indicative Costs of Non Classroom Educational Infrastructure

Type of Infrastructure	Indicative Cost (US$)	Notes
Furniture for class of 60 pupils	1,500-2,500	Locally made and repairable furniture normally presents best value for money
Water Supply	5,000-10,000	Very much dependent on type of water supply which may range from cheap connection to municipal supply to a dedicated borehole
Sanitation (per single latrine)	1,000-1,500	Dependent on design and procurement method
Administration Unit	15,000	Will be dependent on size of school, assume 50m^2 for small school

Notes: [1] Assumes rural school with procurement through small/medium sized local contractors and suppliers.

Costs per Pupil Place

Little reliable comparative data on infrastructure costs per pupil place appears to be available. However, using average unit cost data it is possible to make an indicative estimate. This is shown in **Table B4**, assuming a basic rural 6 classroom day school with 360 pupils (60 pupils/class) constructed using small local contractors and suppliers.

Table B4 – Indicative Costs per Pupil Place

Type of Infrastructure	Unit Cost (US$/$m^2$)	Total Cost (US$)	% of Total Cost
Classrooms, 6no	12,500	75,000	57%
Furniture, 6 classes	2,000	12,000	9%
Administration Block	15,000	15,000	11%
Latrines (10no)	1,250	12,500	9%
Water Supply	7,500	7,500	6%
External Works	10,000	10,000	8%
Total		132,000	100%
Capital Cost per pupil place		US$ 366	
Capital Cost per pupil place per year (30 year building life)		US$12	

Notes: [1] Costs exclude design and supervision costs [2] Annual cost per pupil place is capital cost only and does not include costs for repairs and maintenance over the lifetime of the building.

Urban Schools

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.

Useful Links

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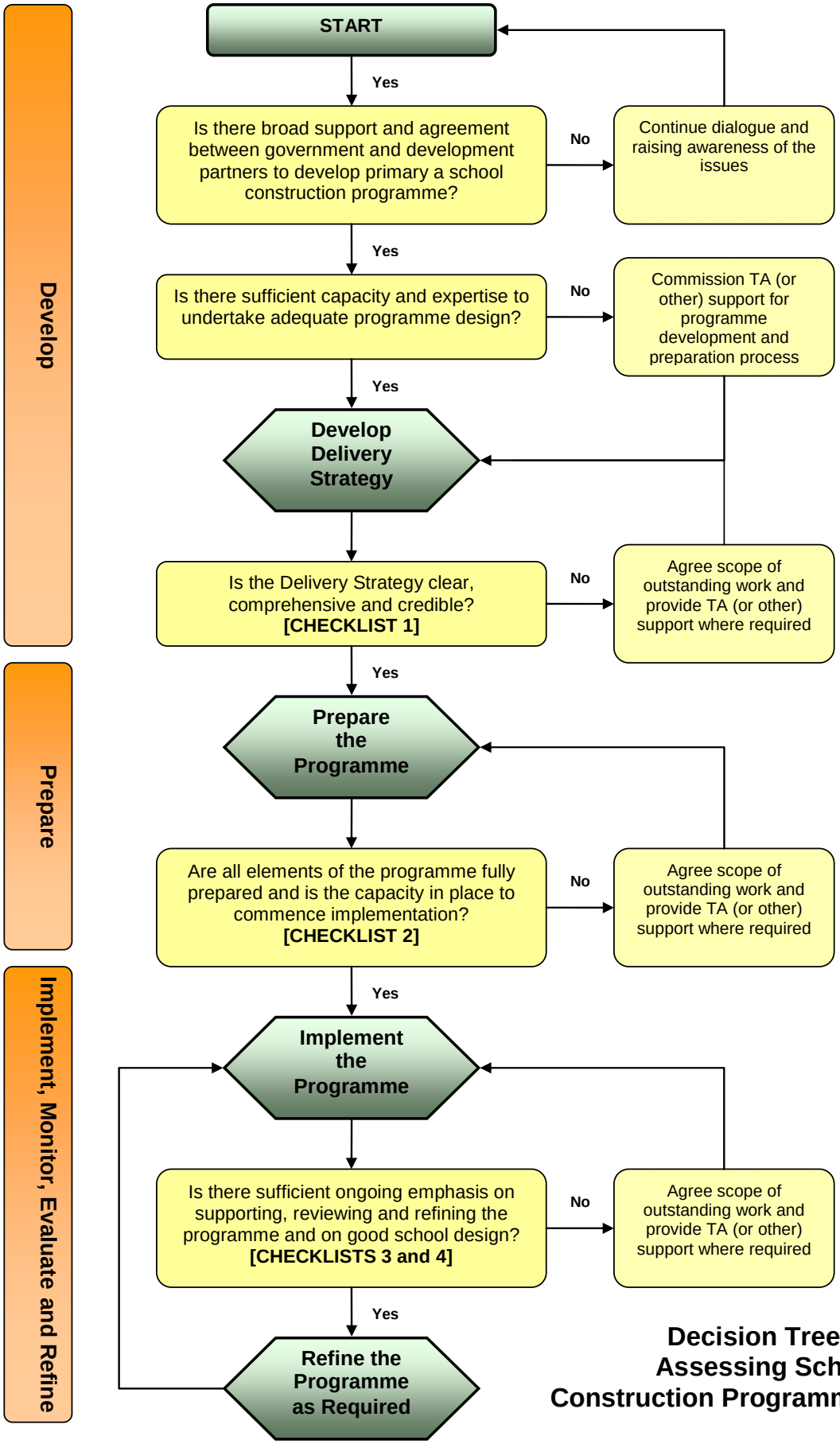
Annex C
Decision Tree and Checklists

The following pages include a decision tree and related checklists for each stage of the programme. These are designed as a tool for government officials and/or development partners to assess what work is required at each stage and can either be used in the design of new programmes or (with minor modification) assessment of existing arrangements. Alternatively, they can be used as a basis for discussion around what the requirements for the design and implementation of an infrastructure programme may be.



Decision Tree for Assessing School Construction Programmes

Checklist 1 –Delivery Strategy

Item Reference	Assessment Area	Assessment	Action Required	Inputs/Support Required
1a	*Clear programme rationale, scope and objectives*			
1b	*Overview of key statistics*			
1c	*Summary of contribution to national and sector plans*			
1d	*Links and support to other relevant educational initiatives*			
2a	*Statement of existing baseline information*			
2b	*Schedule of further information required*			
2c	*Plan for capturing and analysing data required*			
3a	*Prioritisation criteria*			
3b	*Initial identification of areas of greatest need*			
4a	*Assessment of procurement laws and guidelines*			
4b	*Assessment of procurement capacity and support required*			
4c	*Statement and justification of procurement approach*			
5a	*School and community involvement in the programme*			
6a	*Risk assessment and mitigation*			
6b	*Monitoring and evaluation proposals*			
7a	*Proposals for quality control and site supervision*			
8a	*Targets and indicators*			
8b	*Programme timeline*			
8c	*Programme budgets*			
9a	*Financial planning and management proposals*			
9b	*Financial risk assessment and mitigation measures*			
10a	*Roles and responsibilities at each level*			
10b	*Capacity building requirements and plan*			
11a	*Building standards and standard designs*			
11b	*Incorporation of good planning and design into programme*			
11c	*Incorporation of water and sanitation into programme*			
12a	*Repairs and maintenance strategy*			
13a	*Inclusion of disability in process*			
13b	*Inclusion of disability in planning and design*			
14a	*Environmental scoping and assessment*			
14b	*Social scoping and assessment*			

Note: For more information on each assessment area refer back to relevant item reference in the Guidance Note

Checklist 2 – Preparation

Reference	Assessment Area	Assessment	Action Required	Inputs/Support Required
1	*Awareness of programme and political will to implement the programme*			
2	*Capacity within Ministry of Education*			
3	*Structures at district, community and school level*			
4	*Management, procurement, financial management and accounting procedures and guidelines*			
5	*Data and school mapping*			
6	*Selection criteria for the targeting of resources and the selection of beneficiaries of the programme*			
7	*Design and supervision contracts*			
8	*Building standards*			
9	*Standard designs, specifications, bills of quantities and schedules of materials*			
10	*Construction of exemplar facilities*			
11	*Cost database based on prevailing market rates and prices*			
12	*Detailed construction implementation programme*			
13	*Programme guidelines and construction handbooks*			
14	*Capacity building materials*			
15	*Initial capacity building exercises*			

Note: Areas of assessment may vary depending on nature of the programme

Checklist 3 – Implementing, Monitoring, Evaluating and Refining the Programme

Reference	*Assessment Area*	*Assessment*	*Action Required*	*Inputs/Support Required*
1	*Technical assistance to support the programme*			
2	*Regular, planned disbursements of funds*			
3	*Capacity at each level*			
3	*Capacity building of all programme personnel*			
4	*Quality Control*			
5	*Monitoring, evaluation and reporting*			
6	*Taking a long term view*			
7	*Monitoring and re-evaluating risks*			
8	*Continual refinement of the programme*			

Checklist 4 - The Physical School Environment

Site Location	*Site Layout*	*Building and Classroom Design*
Is the site location in an earthquake or hurricane/cyclone zone?	*Are the buildings and other facilities set out in an imaginative manner that best uses the characteristics of the site, including the use of external spaces?*	*Are the sizes of each building appropriate and in line with accepted local standards and norms and do they comply with local building standards and regulations?*
Is the site prone to flooding or land instability?	*Are the buildings orientated to minimise solar gain and/or use prevailing wind for cooling and ventilation?*	*Are the buildings suitably designed and detailed for durability and accessibility and the prevailing climatic conditions and for resistance to high winds and earthquake where appropriate?*
Are the topography and ground conditions of the site suitable for cost effective construction?	*Has provision been made for ordered future expansion if and when required?*	*Do the designs incorporate local materials and technologies well understood by local artisans and respect local building forms and techniques?*
Is the site large enough for the facilities proposed and future expansion, including for outdoor facilities?	*Are the numbers, sizes and layouts of facilities appropriate and in line with accepted norms and standards?*	*Do the designs allow for adequate levels of light and heat and acoustics inside the classrooms?*
Is the site easily accessible?	*Are water and sanitation facilities included and located to encourage use by boys and girls?*	*Do classroom designs and external spaces include elements to improve the learning environment, and support teachers to deliver the curriculum?*
Are there any major issues with traffic or adjacent land uses?	*Does the site layout allow for access for all pupils and staff?*	*Do the designs allow flexibility for community and other uses?*
Is there clear and secure land tenure?	*Are suitable pathways, drainage, perimeter walling and other external works incorporated?*	*Is appropriate school furniture included in the design?*
Will it be easy to provide water and sanitation services to the site?	*Is planting and vegetation used in the design?*	*Are there designs for water and sanitation facilities which are appropriate to the site?*
Are there any particular security issues relating to the site?	*Is the site layout conducive to encouraging use by the community?*	
	Have teachers, pupils and the wider community had sufficient input into the site layout and design?	

Suggested Further Reading

General

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

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

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).

Wright, C et al. (2009). *MANUAL Child friendly schools.*

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Department for Education and Employment (UK) 2000. *Asset Management Plans Sections 1,2,3 and 4.*

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Water and Sanitation

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

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Miscellaneous

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Case Study - Transforming School Environments in Malawi

DFID has been supporting the Malawi Ministry of Education since 1997 to transform conditions at hundred of schools, for thousands of children throughout Malawi, as part of its support to the education sector. Construction has been carried out by small and medium sized local contractors, which has brought many advantages in terms of cost and local involvement. Maintenance has been encouraged through a 'Best Kept Schools Competition'

Transforming the Learning Environment

Mkwalawanjobvu Primary School is typical of a school that has received assistance through the programme. 270 children in Standards 1-5 were learning in one small thatched structure. Holes in the roof and walls meant constant leaks during the rainy season. The dirt floor had deep holes and there were no desks. Now, classrooms are durable, permanent structures. Water and sanitation facilities have been improved and there is a sense of pride in the community. Watching the bright faces in Mrs. Banda's Standard 2 classroom, it was evident that this is a child-friendly place. The new classrooms are painted bright primary colours and have lots of blackboard space and hooks on which to hang things.

'What do you like best about your new school?' the children were asked. Fingers snapped and eyes lit up. 'I like writing.- Before we didn't have a place to write,' said Lifineti, Standard 2. "In the whole district, we're the first school opened like this. We have the best school," said Movart, Standard 4. 'I'm teaching here freely!' said Mrs. Banda. 'The children have a place to sit on and even to write peacefully.'

Building the Contracting Sector

The programme uses small local contractors supervised by Malawian architects to construct the new facilities. This has not been without challenges, or 'chakhuwala', in the local contractor's terminology. Until the 1990s the sector was dominated by a few large companies. To succeed the programme had to develop new approaches to support emerging contractors: training and advice were provided and contracts allowed for working capital advances and prompt payments. Recognising that new contractors often under-bid, the programme set a minimum acceptable bid for all tenders. Private sector led supervision is provided at every site.

The support given by the programme has seen the number of small contractors grow and grow. By the end of 2008 4,000 new classrooms had been completed and 125 mid- and small-sized contractors were registered to bid for work. This approach provide good value and durable infrastructure and contractors use local labour, often from the immediate vicinity of the site. '*The policy has had a key role in the development of a lively and active local construction industry - most of the purchases and the profits for these contractors stay in the country,'* said a senior Malawian quantity surveyor.

Encouraging Good Labour Practices

The construction contracts include clauses to ensure core labour standards are adopted on site. These include provision for of workers' rights such as payment at least the minimum statutory wage, protective clothing, periods of rest during the working day, safe, clean water and first aid if necessary. The programme also allows for HIV/Aids prevention training and an apprenticeship programme. One male and one female receive vocational training with a skilled artisan at the site.

Verica Chipeta is one of the young people who completed the training, despite the doubts of her friends and neighbours who said *'A young woman, learning bricklaying and carpentry in Malawi? That's a man's work.'* Male construction workers said, '*You're not tough enough.'* She proved them all wrong. '*Before we had these skills, when we left school, we were just waiting for something to do,'* she said. *'Now none of us is idle. We also learned a spirit of fending for ourselves, rather than stealing or whatever.'*

The training directors summed up the value of the scheme. '*The youth gain skills that are in demand, opening a window for them to be employed. Second, it's a contribution to the community. We help prevent rural-urban migration because the youth are trained and then hired in their own communities and for the new primary schools, there is a pool of trained workers that can help maintain the buildings*'.

Maintaining the Facilities

The programme has not just focused on new construction. Maintenance also plays an important part. Since its inception as a pilot in 2005, the Malawi Best Kept School Competition is now a national event. One of the early winners was Kamimba School in Mzimba. There is participation from all members of the community. Rosters of children take turns with all of the cleaning chores. Parents and community leaders take care of the football field, which is trimmed even in the rainy season. Latrines

and hand washing sites are clean and well used. Books are carefully used and stored and walls, windows, doors and furniture are well maintained.

According to Mrs Yiwombe the head teacher, '*Children now know there's no leaning chairs and hands against walls, no banging doors, because these doors are expensive.'*

For its efforts, the whole school community shared the prizes for the contest - a new teacher's house, three bicycles for the school committee, soap and salt for community members, and books and pencils for the children. Even more important than the prizes is the pride and determination at the school. *'It's not just walls that are clean and cared for, but the children themselves. We teach the pupils facts about health, information that is reinforced with good habits every day,"* said Mrs. Yiwombe.

Looking to the Future

The programme in Malawi has been very successful in constructing good value, durable infrastructure and in embracing a 'whole school' approach. The challenge now is to incorporate these successful approaches which were developed in an external unit, into the Malawi government system. An Education Infrastructure Management Unit has been set up and is now managing the process. The commencement of a SWAp and joint financing in 2010 heralds a new chapter and new challenges.

Case Study - Kenya School Infrastructure Investment Programme

The Kenyan School Infrastructure Investment Programme (SIIP) disbursed Ksh 5.7 billion (£47.5 million or $76 million) to 4,686 public primary schools spread across 125 poorest districts of the country in its first five years of operation (2005 – 2010). The money went to improvements to existing infrastructure or provision of new facilities. This has assisted recipient communities to construct 6,000 new classrooms and renovate 9,500 existing ones, build 15,000 new toilet cubicles and 1,000 new water tanks and provide 80,000 new desks.




Background

The backlog in infrastructure provision across the Kenyan educational sector is enormous. Attempting to address it through conventional public works-managed programmes would require vast amounts of external financial support.

The SIIP provided a budget to assist almost a quarter of primary schools in the country with upgrading of basic facilities, such as provision of desks to all students, classrooms of a reasonable standard and schools with access to adequate toilet facilities and a source of clean drinking water. The programme did not attempt to provide every form of upgrading that a school might one. It was very much focussed on widespread basics.

When every child in Kenya has access to such basic educational infrastructure the programme can be extended to make further improvements and to provide other forms of infrastructure demanded by a modern education system.

"After 5 years of teaching in a series of dark and incomplete classrooms with many of my children sitting on the floor it is so nice to teach in a classroom that is light and well ventilated with a good floor and my children all sitting on good desks" Standard 2 Primary School Teacher.

School Planning as a Basis for Support

The foundation of the SIIP is a well-formulated five-year School Infrastructure Development Plan (SIDP) produced by each school during an initial School Management Team (SMT) capacity building exercise.

The SIDP is built up through a careful process through which the SMT first analyses enrolment trends to establish likely future physical requirements. They then analyse the school's current physical facilities to determine their suitability and condition.

Based on this information the SMT can then begin a process of annual review, determining exactly what they require for improved or increased infrastructure to meet the anticipated demand.

The five-year SIDP is broken down into a series of Annual Work Plans (AWP) prioritised to ensure the provision of basic requirements for every child in the school before making improvements to other, more advanced, aspects of the school's infrastructure.

Over four years 23,430 members SMTs have received training to develop their SIDPs and manage their resources effectively within the programme guidelines. This has been done at a cost of

£3.9 million, or 8% of the value of grants disbursed

Releasing Funds

When the SIDP has been finalised and approved by the community and the District Education Office, the Ministry of Education releases the first annual infrastructure grant directly into the school infrastructure bank account. All details of such transactions are published in local papers and on school notice boards to ensure transparency.


NUMIAS MUSLIM PRIMARY SCHOOL
INCOME AND EXPENDITURE FOR THE YEAR ENDED 31/12/2008.
KESSP PROJECT ACC.
RECEIPTS Shs.
KESSP GOVERNMENT GRANT 1 800 000
School Project Account 325
Total Receipts 1 800 325
EXPENDITURE
Toilets - Boys 425 980
Renovation-Office Block 65 840
2 Class Rooms 145 040
Toilets-Girls 990 165
Water Project 171 500
Contingencies-Bank Charges 650
Total Expenditure 1 799 175
Excess of income over Expenditure 1 150
Total 1 800 325
BALANCE SHEET AS AT 31/12/2008
LIABILITIES Shs.
Accumulated fund surplus for 2008 1150
ASSETS
CASH AND BANK BALANCES
Cash in hand —
Cash at bank 1150
TOTAL 1150

"We are very happy that these people will no longer be able to eat money provided for improving our children's schools" said one parent

Every SMT is advised to implement their SIDP and AWPs through a process of 'community contracting', 'market rates' and school based management processes. The MoE provides carefully prepared management and supervision manuals and a series of easy to follow financial and procurement management forms, along with suitable reporting formats.

"These management and reporting systems makes it very difficult for any government officer to misuse the financial support" District Education Officer

Providing Support

Technical support, quality assurance and general supervision are provided through a District Infrastructure Coordination Team made up of government officers from all relevant departments such as Public Works, Public Health, Water and Environment. The government supervision teams are supported by locally recruited technical support provided through the development partners.

The nationally-based School Infrastructure Management Unit (SIMU) makes annual monitoring and evaluation visits to a percentage of the recipient schools. At the national level, the MoE has been supported through architectural and quantity surveying support by the Ministry of Public Works. An international Educational Infrastructure Specialist has been provided through development partners to provide oversight and to assist with overall programme vision and planning.

Continuing Challenges

Despite many positive aspects of the programme there remain considerable challenges. Early successes of the programme meant that more responsibilities for construction across the education sector were directed to SIMU's portfolio but this was not matched with the extra staff required to adequately manage the new responsibilities. This meant that some of the well defined systems began to be diluted.

The demand for government financial support, and the pressure to provide it, has led to capacity building and monitoring exercises being curtailed in some cases.

Timing of disbursement of funds has been another major issue. It has proven impossible to match government financial support that is used primarily to fund the capacity building and monitoring exercises with release of development partner funding for the main physical activities. Thus communities are trained but have to wait for long periods before their grants can be disbursed or the grants are disbursed before the capacity building exercises can be implemented. Sudden unplanned disbursements from development partners have caused carefully prepared annual work plans and good management practices to be compromised.

Looking to the Future

The first five years of the SIIP has demonstrated the effectiveness of the management systems and allowed processes to be refined. The continued success of the programme will require further improvements and support in order to build on the first five years and continue to improve educational facilities for Kenyan schoolchildren.

Case Study – Exemplar Schools in the Andhra Pradesh Primary Education Project




Construction of 'Exemplar' Facilities

The Department for International Development (DFID)-funded Andhra Pradesh Primary Education Project (APPEP) began in 1995. It identified a range of different cost effective, low maintenance, labour intensive and environmentally friendly construction technologies. Through a nationwide process of resource mapping, eleven roofing and six walling technologies were adapted to construct school buildings at twenty nine sites in a rural district in Andhra Pradesh.

To ensure a suitable level of control, the schools were constructed in one geo-climatic setting with the same level of supervision, and are all being used by one ethnic group. In this way, comparable data relating to initial construction and maintenance costs (the lifecycle costs) of each combination of building technologies can be assessed.

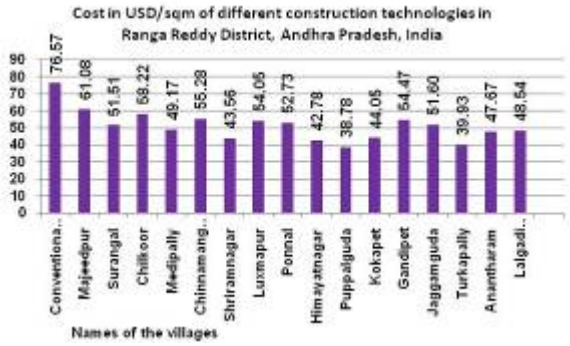
Types of Roofing and Walling Systems

Roofing Systems	Walling Systems
Reinforced cement concrete slab	Solid brick wall
Reinforced cement plank and joist	Rat-trap
Reinforced cement channel	Cement stabilised mud block
Ferro cement channel	Interlocking cement stabilised mud block
Micro concrete tiles roofing	Stone concrete block
Hybrid slab	Coursed rubble stone
Filler slab	
Stone roofing	
Jack-arch roofing	
Brick corbel arch	
Brick pyramid	

Capital and Maintenance Costs

Initial construction of the facilities gave an invaluable cost baseline for many different types of construction, as well as demonstrating feasibility and effectiveness. Whilst prices varied between villages and technologies it was clearly demonstrated that these new approaches were significantly cheaper than the 'conventional' approach set out in prevailing building standards, which were based on reinforced concrete technology. Research into the maintenance costs of each type of construction is still ongoing but to date the data clearly show that maintenance costs for the 'non conventional' buildings are significantly lower.

Costs of Different Building Technologies
(with 'conventional' construction on the left side)



Influence of the Exemplar Facilities

The influence of APPEP on the District Primary Education Programme (DPEP) has been a profound contribution to the attempt to achieve MDG 2 in India. Thousands of classrooms were constructed by adopting walling and roofing systems used in APPEP. The impact of APPEP is evident in non-educational buildings at the district level as well. After visiting APPEP schools, the Secretary of Healthcare and Family Welfare of the Government of Orissa requested that DFID provide technical support for cost effective healthcare buildings. The State Government provided the full project cost while DFID contributed technical support. Three complete primary healthcare centres were constructed based on APPEP systems in three districts of Orissa.