

Primary Schools in Coastal Zone of Tanzania

Standard Design as a Solution

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Introduction

This paper is about a study carried out in primary schools in the coastal zone of Tanzania and has led to a proposal of standard design of primary school buildings, which could be used to improve both indoor and outdoor learning environment.

The paper outlines the strategies that have been used to achieve the set objectives. Description of the key actors and the proposed standard design form vital parts of my recommendations.

The final design proposal has been reached by following the economic, social, cultural, climatic and technical analysis made after a six-month detail study of the existing situation of the primary schools in the area. In the course of study, I made site visits to some of the primary schools selected to be pilot projects of the study.

Problem Definition

Primary School buildings in the coastal zone of Tanzania are not well designed for pupils to have a good learning environment. The size of classes gives problems to pupils and teachers. Most of their rooms are small, low in height and the openings are small. Building facades differ from one school to another and are monotonous.

Climatic data shows that temperatures in the coastal zone are normally high; between 29-32°C and humidity is equally high [63-95%]. This affects pupils who are normally congested in small rooms with small openings and low walls. At grass root schools in our country are under supervision of school committees, whose members are laymen of the design and building technology and therefore it is very difficult for them to tackle the fore-mentioned design related problems. Moreover most pupils travel long distances in order to reach school and some have to attend their classes outside in the open air due to inadequate classrooms.

Other schools have introduced two sessions, morning and evening sessions. This system sometimes cause hard times to teachers, as by teaching two sessions, they become exhausted and cannot go on teaching or delivering the expected quality of education.

In the set up of building professionals at the district level, there is no architect except a district engineer who is the only professional related to building construction. The situation becomes even worse when the district engineer is a mechanical engineer who does not have a building construction background.

Motivation for the Choice of Study

I have been involved in the design of primary school classrooms in Tanzania for quite some time. I have been very much concerned with the quality and standards of the buildings including the general learning environment. Having good standard designs of both in door and out door environment could improve the quality of the education as well as minimize the cost of construction of the buildings to a great extent.

Method of Study

To go through various designs of primary schools that I have been involved in, observing their functional aspects, costs of construction and any other relevant materials and also combine this with my own experience. Bottlenecks and positive aspects of the designs were noted and suggestions of more appropriate design were similarly given. Some of the key actors were interviewed and their response recorded. It was necessary also to make literature review before coming up with my proposals of the standard design. In this case, I visited Tanganyika library in Dar-es-salaam. However, the study I made includes: -

- 1 Physical visits to ten primary schools two from each of the five regions in the area.
- 2 Meeting the stakeholders, central government, local government, villagers and school committee members [Local-Level], school teachers, pupils and NGO's.
- 3 Compilation of the case study report.

Primary Education Background in Tanzania

When Tanzania got its independence in 1961 it inherited a colonial system of education. At that time people paid for school fees. In 1967 the government introduced the Arusha Declaration, which was a mile stone change in the history of the country. In line with this declaration, education was declared free for all levels from primary school to university. The central government used to cater for her education needs through the normal annual budget.

In 1972/1973 the government introduced villagization policy. In this policy people were supposed to live in communal villages where community facilities including schools could be located easily and cheaply. Through this approach the government supplied building materials for construction of the schools e.g. corrugated iron sheets and cement. The communities were supposed to provide labour force and the other remaining costs. In some cases people were supposed to offer sites for the construction of the schools.

Tanzania mainland consists of 23 administrative regions. The Coastal zone is the zone bounded by the Indian Ocean and comprises of five regions, which include Tanga, Pwani, Dar-es-salaam, Lindi and Mtwara. The zone has an area of 117,800 sq.km, which is about 12.5% of the total area of the country. It has a population of about 3,100,000 people with a population density of about 40 people per square kilometre and a population growth rate of about 3% per year. With this rapid growth the demand for primary schools is as high as it is in all other parts of the country [National census 1988]. However the provision of primary schools has been depending much on the economic situation of various parts of the country. The coastal zone with resources that have not fully been exploited has failed to honour its contribution to the provision of the required quality and standards of the primary schools.

However with rising demand of the need for primary schools the government has introduced school fees as part of community contribution to supplement government's efforts in the provision and running of primary schools.

Decentralization of Primary Education

Before Decentralization

Primary education was among the most important responsibilities of the central government. However, almost half of the local government funds were spent on primary education activities [including school buildings]. Two-thirds of the local government workers were teachers who currently are employed by the central government. Local government decision-making was vested in their respective district councils, which were under the leadership of the district commissioner [the state instrument]. This expressed the desired state of affairs; that central government was in full control of education and local government was an agent of the central government.

The past responsibilities of the ministry of education and those of the ministry of local government respectively were rather ambiguous. In practice however the local governments had little real influence on educational basic issues e.g. curriculum, school building etc. The District Education Officer [DEO] was however not an

employee of the council but of the central government-controlled local government services commission. Unfortunately he did not have access to the ministries school inspection reports, which contain much relevant information on the performance of teachers, school buildings and pupils in each district.

Local governments did not have much influence on central government resource allocation to primary education. Decision-making was highly centralized with wide ranging powers located at the ministry level and the relations among the main actors in the system were not very clear. Moreover, the role of donors who have been contributing to primary education for sometime in the country was not specified.

Decentralization

This was a reform to give power to local government to gain a substantial and meaningful role in primary education. The Ministry of Education remain as a facilitator of primary education. Currently, it has been possible for the local authorities to make decisions regarding their respective primary school activities. This can be explained as a milestone to the crucial issue of improving the overall learning environment of the primary schools in the country.

After Decentralization

The role of local government in primary school education is the same as what was mentioned earlier. The addition here was to give or increase mandatory powers to them.

The source of money in local government comes from the day to day tax collections and the development budget of the central government.

A good example of what was done by local government is the construction of TB dispensaries in urban and sub-urban areas in Dar es Salaam region. The architectural drawings were the same in all sites.

School committees have a decision in the implementation of the required standards of the primary education including buildings. Their prime function is to promote the integration of the school in the community life and to cooperate with teachers in solving local educational problems. In practice, this mainly means involvement in solving disciplinary problems with pupils, and in some cases with teachers.

For the past three years there has been some improvement of school developments compared to the past, where about 90% of schools inspected had succeeded to add one or two rooms. Much more the local-level has managed to increase the number of desks in classroom by requesting some pupils to come with desks.

Moreover, after decentralization, donors were confidently happy to work with local government. Construction of fence wall around primary school buildings in coastal zone is a good example of donor [International agencies] participation in school projects. About 20 schools were fenced and 40 classes were built in different schools.

Funding of Primary Education / Building

It is of interest to note the breakdown of contribution of the different actors in primary education in 1987/1988 financial years as shown below.

Table 1. Funding of primary education 1987/1988

Source	Investment %	Recurrent %
1. Donors	29	23
2. Central government	20	45
3. Regional government	0	0
4. Local government	3	0
5. Parents	48	32
Total %	100	100

The currency 1US\$=Tshs 195 [1988]

The figures in the above table are based on rough estimates and include donor and government funds for investments and recurrent expenditures plus direct contributions in cash and kind by communities and parents. Regional and local governments were insignificant as funders of primary education. They depend

almost entirely on central government subsidies. Parents in rural areas pay an average of 40% of total expenditure per student enrolled in primary schools.

The Strategies

Objectives of the Project

The overall objective was to find ways of improving the indoor and outdoor learning environment, which could be adopted in different areas of the coastal zone through involvement of all key actors. The mile stones to this overall objective includes the following sub-objectives:

- To have a standard design of a primary school, which can be used in different areas of the coastal zone, where there are difficulties in obtaining architectural drawings. In places where architects are available, the standard design may be the starting point for the better improvement or changes to be made by the architect[s].
- To use the common language that can be simply understood by most of the key actors, who are not conversant with the language used by the professionals especially during the implementation of the standard design.

Strategies for achieving the Objectives

This is an on going project and one of the strategies was to undergo an extensive study of the existing situation and later come up with the proposal of the standard design, which can be friendly used by the majority the key actors.

To narrow down the areas of study by focusing on primary schools available in the coastal zone of Tanzania whose design is more complicated in order to be able to come up with suggestion and a new design, which would later be widely used to improve the situation in other areas of the country.

To simplify the terminologies and or translate the foreign language commonly used by building professional when specifying the building components.

Study and Interviews

Data was collected from five administrative regions namely Tanga, Pwani, Dar-es-salaam, Lindi and Mtwara. Primary schools were examined in terms of their building structures, aesthetics, building and room heights, openings and relationship with their surroundings as far as anthropometrics are concern.

Information was also obtained through discussions with pupils, teachers, parents, school committee members, and other relevant parties. Specific discussions were held with officials from the ministry of education and culture, local government and NGOs.

The coverage and details of the information collected from different actors are as elaborated here under: -

- 1 Pupils: Distances from their respective homes to the schools, attendance of teachers to classes, their views on their classrooms and the school environmental in general were asked for.
- 2 Teachers: Number of pupils in classes, situations of buildings, nature of the school environment, pupils attendance to school and their performance, the participation of central and local governments, parents and NGOs in the development affairs of the schools.
- 3 Parents, Schools Committee and other people: Their role in the provision and development of the schools, their views on the situations of existing buildings and the school environment as a whole, and the need for alternative design of primary school buildings, which could serve the school requirements better.
- 4 Ministry of Education and Culture: Their role in the provision and running of primary schools, their general views on the situation of primary school buildings and learning environment in particularly in the coastal zone of Tanzania and the need for alternative designs of primary school buildings which could serve the needs of the schools better.

- 5 Local Government: Their role in the provision and running of primary schools, the steps they intend to take to improve the situation of primary schools in the coastal zone and the need of alternative designs of primary schools.
- 6 NGOs: Their participation in the provision of primary schools, how they could participate in improving the situation of the primary school buildings including their environment especially in the coastal zone putting in mind the need for having alternative designs for school buildings

Comments from the Key Actors

Ministry of Education and Culture

We are quite aware of the problems facing primary school children in our country. We have tried at our level best to put in place the right policies and legal framework under which the education system in Tanzania could work. However, the resource constraints face every sector in the country.

We call upon local authorities, the people, NGOs and community organization to fully play their role in this area. The role of the central government is to facilitate. Parents are again reminded that, they now have the responsibility on contributing to a large extent to the education of their children unlike in the past.

Local Government

We shoulder the responsibility of running primary schools in the country. However, there is a resource constrain. We call up on the parents to contribute more to the primary schools. We further more, request NGOs to come to our assistance as well. We strongly advocate the availability of standard designs for the construction of primary schools. This will definitely reduce the cost of construction of such schools.

Our concern is to maintain standard classroom of 35 pupils like that of secondary school but we have failed to do so due to the following: -

- 1 Unawareness of the increased number of pupils.
- 2 Villagization policy, efforts were put on trying to adjust people to live in communal villages slowing down the required pace towards establishment of primary schools, health centre and infrastructure.
- 3 Abolition of school fees lead to increased burden to the government in the provision of primary education.
- 4 Poor tax collection, lead to reduced Government budget for meeting its needs e.g. education.

NGOs

It was wrong for the government to think that it could handle the issue of construction of primary schools alone. There is a need to involve parents, international agencies, communities particularly NGOs. The era when governments used to do everything is over. We need to be involved in all the process of programme implementation especially for programmes, which touches all people.

The issue of standard design is welcome because this can be considered as the NGOs contribution.

School committee, Villagers, Teachers and Pupils

The following were main observations obtained from the interviews made with pupils, teachers, villagers and school committee members on the general environment of the school: -

- 1 Parents pay a lot of money for construction of school buildings; some of them could pay even more than USD200 per year.
- 2 Majority of them complained about the attention paid by the local governments, to issues like curriculum and neglecting the intolerable situation of the school buildings.
- 3 The introduction of two sessions, (morning and evening sessions), caused hard time to teachers, as the same teachers had to teach both sessions continuously.
- 4 The congestion of pupils in one classroom was one of the causes of poor performances of the pupils.

“We would like to invite design changes in development of school buildings, which could reduce the total construction costs by eliminating architectural costs”. One of the committee members noted.

Table 2. Comments from school committee, villagers, teachers and pupils [year-2000]

Schools	Pupils	Teachers	Villagers	School committee
Mshihwi	-We are congested -No light -We walk 2km from home.	-Extra room required -Understanding 60% -We like new design -Gender=1: 1.9F/M.	-We need support -We need new technology	-We plan to add more rooms -Yes, we need changes, -We pay US\$ 25/pupil/year not all afford to pay
Ngolanga	-Better to stay outside -Leaking -Suffocation	-Pupils decide to smoke -Leaking -Congestions -We need changes -gender=1:2.1F/M	-We need changes -We are tired	-We need changes -We pay about US\$20/pupil/year and someti mes more.
Mkuranga	-Walk long distance -Inside is hot -Better to stay home	-Little respond from local gov. -Understanding 55% -Leaking -We need changes -gender=1:1.8F/M	-We need changes -We have to build no way	-We need changes -We pay US\$25/pupil/year -External support is not enough
Kongowe	-Suffocation -No light -No desks	-Asked intern. agency for support -Gender=1:1.3 F/M -We need changes	-Where is local gov.? -We need changes	-We need supports -We pay about US\$ 25/pupil/year, not all can afford to pay
Mbagala	-Walk long distance -Busses do not want to take us -Walk 3km	-Understanding 60% -Asked inter/agency for support -We need changes -Gender=1:1.6F/M	-We need new technology	-We need new proposal -We pay US\$ 25/pupil/year, not all can afford to pay.
Mpakani	-Leaking -Inside is hot -No light	-Asked S.A embassy for support -Gender=1:1.2F/M -Understanding 50%	-We need new technology	-We need changes -We pay about USD25/pupil/year, not all afford to pay.
Nangali	-Walk 3km from home -Sit under tree -Desk not enough,	-No support from local gov. -Performance 49% -We need changes -Gender =1:1.6F/M	-Yes, we need changes	-We need changes -We pay US\$ 25/pupil/year. Not all can afford to pay.
Sanya	-We feel ok -Walk long distance -Sometimes hot	-Performance=77% -Respond from local gov. 25% -We need change -Gender=50%	-We need changes -We need good environment	-We need changes -We pay about US\$ 35/pupil/year -Large number afford to pay
Nangungu	-Inside is hot -Walk long distance -Seat on dirty floor.	-Understanding 40% -Gender=1:3.1 -No respond from local gov. -We like the changes.	-We need changes	-We need changes -We pay about US\$ 25/pupil/year; large number cannot afford to pay.
Nandembo	-Suffocation -No enough light -Sit on dirty floor.	-Concentration=40% -We need changes -Gender=1:2.6 -Need more room/desks	-Yes, we need changes.	-We pay about US\$ 25/pupil/year, large numbers cannot afford to pay -We need changes

Analysis

Analyses of the case studies have reflected the following issues: -

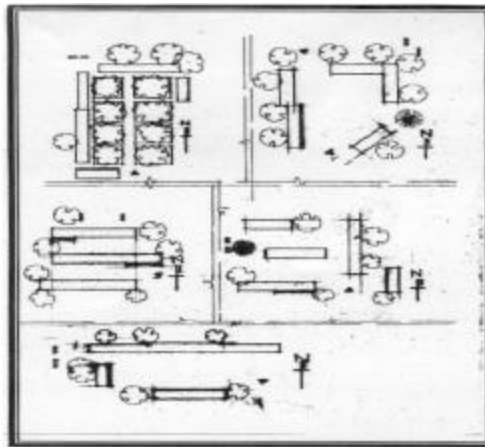
- 1 There is heavy congestion of pupils in classrooms. A classroom, which under normal circumstances and standards could accommodate 35 pupils, now is occupied by the average of 56 pupils. This makes the learning environment for pupils become more difficult than expected.
- 2 Most classes are of small rooms, which have small windows, and low heights, which make them uncomfortable especially during the class sessions due to the hot and humid tropical coastal climate.
- 3 The government in the allocation of its resources has many other pressing issues of national concern and as such fails to allocate enough fund for the running of primary schools.
- 4 Parents have been contributing to the construction of primary schools all over the country. Their contribution depends on their economic base of the localities. However, for the coastal zone their total contribution has not been much because

the income levels of their people are relatively low. The economic situation of the area reflects the inferior quality of the schools.

- 5 Self-help has not fully been applied in the construction of primary schools in this area.
- 6 The services of non-governmental organizations [NGOs], community based organizations and generally the private sector has not fully been utilized in the provision of primary school in the zone.
- 7 The use of innovative local building materials has not been put into consideration in construction of the buildings.
- 8 The existing school committees in most cases involve influential people or political leaders without including technical people who are vexed with construction technicalities.

Building Forms

Most of buildings are randomly built and they differ from one school to another. Externally they do not look as school buildings and they have low room heights. However, many schools have embarked on a tree planting campaign, an exercise that was very much helpful for creating a cool and conducive learning environment.



Figures above show the layout of five primary schools visited; looking from top left is Mbagala p/s [Dares-salaam], Ng olange p/s [Tanga], Sanya p/s [Lindi] Kongowe p/s [Pwani], and Nangali p/s [Mtwara]. Down left is an existing situation of pupils in a classroom, and right is an appearance of school buildings.

Performance Assessment of the School Buildings

The government does not have a standard design for primary school buildings. Each school has the responsibility of designing its buildings, which meet the intended purposes. Designs do not follow the approval procedures as laid by government organs concerned and hence most buildings do not conform to the required standards.

In the analysis it was found that: -

- 1 The average number of pupils found in one classroom was 60 pupils, which is far from recommended number of 35-pupils/ classrooms.

- 2 About 10 pupils were found to sit in one desk of 2400 mm long [the standard space recommended for four pupils].
- 3 Average room height was 2540 mm and roof height of 1110 mm. Showing that the slopes of the buildings are too low to quickly run rainwater down the roof.
- 4 Each classroom has about four to six windows and its average area is 8.56m² per wall of 35m². This is about 24% opening, which is less than 40% as recommended.
- 5 About 85% of the school buildings in the coastal zone need major rehabilitations.

Table 3. Performance assessment of the school buildings [year2000]

Schools	Region	Nr of rooms	Pupils	Pupil / room	Desks /room	Room height	Extern room area m ²	Win m ² / room	Bldg mat'ls	Shifts	Remarks
Mshihwi	Tanga	8	1260	60	12	2.6	35	7.2	-Bricks - C.i.sheet	2	Std HV, 2streams/2shifts @60 pupils Std V-VII, 2streams/2shifts @50 pupils Each class have one day of self-reliance -Sometimes two streams stay together
Ngolange	Tanga	11	1048	56	10	2.5	38	7.2	-Bricks - C.i.sheet	2	Std III, 2streams/2 shifts @50pupils Std V-VII 2streams/1 shift @56pupils Each class have one day of self-reliance -Sometimes two streams stay together
Mkuranga	Pwani	9	1140	60	9	2.6	40	7.8	-Sand cement block - C.i.sheet	2	Std III 2 streams/2shifts @50 pupils Std IV-VII 2streams/2shifts @45pupils Std VII one stream of 60 pupils
Kongowe	Pwani	10	1240	60	11	2.4	37	10.6	''	2	Std HV 2streams/2shifts @45pupils Std V-VI 2streams/2shifts @50pupils Std VII 2streams/2shifts @60pupils Population increases in the area -Sometimes two streams seat together
Mbagala	D.s.m	12	1640	70	12	2.6	41	7.8	''	2	Std I 3streams/2 shifts @70pupils Std II-V 2streams/2 shifts @60pupils Std VI-VII 2streams/2shifts @65pupils Sometimes two streams seat together -One day for self-reliance/class/ week
Mpakani	D.s.m	14	1920	65	12	2.6	38	10.2	''	2	Std I 4streams/2 shifts @65pupils Std II-VI 2streams/2shifts @60pupils Std VII 2 streams/2shifts @50 pupils Other pupils shifts to other schools -One day for self-reliance /class/week
Nangali	Lindi	12	1400	60	6	2.5	32	9.6	-Bricks - C.i.sheet	2	Std II 2 streams/2 shifts @60pupils Std III-VI 2streams/2shifts @50pupils Std VII 2streams/1 shift @60 pupils Population increased
Sanya	Lindi	9	480	35	8	2.6	39	10.8	''	2	Std II 2 streams -morning @35pupils Std II-IV 2 streams -afternoon @35pupils Std V-VII 2streams-full time New school in a village -Two hours for self-reliance/class/week
Nangungu	Mtwara	8	650	50	4	2.4	39	7.2	''	2	Std I 2 streams-morning @50 pupils Std II-IV 2 streams morning @50pupils Std V-VII 2 streams-afternoon @40pupils One day for self-reliance/class/week
Nandembo	Mtwara	9	785	48	5	2.6	36	7.2	''	2	Std I 3 streams-morning @55pupils Std II-III 2 streams -morning @53pupils Std IV-VII 2streams-afternoon @50pupils -Some pupils drop school

Actors in Primary Education

The 1978 Tanzania National Education policy elaborates the responsibility of different actors in the provision and running of primary schools in the country.

The *central government* [Ministry of education and culture] is responsible for the promotion of education in the country by putting in place policy and regulation of guidance. Principally the ministry acts as a facilitator or enabler.

On the other hand *local government* have the responsibilities of overseeing the provision and running of primary schools in their areas of jurisdiction. They are therefore responsible for mobilizing resources for the construction of schools.

Parents [villagers and school committee] should contribute to the primary education. It is no longer free as it used to be sometime in the past. They can either contribute in cash, labour or building materials.

Non-governmental organization [NGOs] and community-based organisations are called upon to help in the mobilization of people and resources for the construction of schools. They are to facilitate a community approach in such developments. Self-help approach should very much be encouraged.

Donors assistances is very much welcome whenever is available in any of the areas of primary school development; a good example of such assistance has already been received from World Bank, European Community, Britain; Denmark, Japan and the Netherlands. The government wishes these efforts to be co-ordinated.

Standard Design

Design Criteria and Specifications of a Standard Classroom

The design of standard room for pupils in coastal zone is based on one of the objectives of ministry of education and culture where the number of pupils in a class would be 35 pupils. Other criteria, which would be taken into considerations is the climate of the area, where factors such as orientation of the buildings should be east west. These factors generally, reduce the effect of inclement weather and increase the comfort of the indoor and outdoor environments, which is very important for pupils' concentration. The standard design for the classrooms should also have a corridor, which would serve pupils during rainy season and create internal cooling effect during hot season. Finally, schools environment should be attractive and not boring to discourage pupils to attend classes.

Site Selection and Design

Location

In urban areas, schools are close to each other, the location of one school to another varying from 0.5 km to 5 km. Large number of pupils had to board a town bus to reach their respective schools, while in rural areas the location of the primary schools were such that could serve two or more villages. The maximum walking distance is 5km and average of 2.5 km. The average sizes of the land on which these schools are constructed range from 3 to 10 hectares. The school committee, villagers and sometimes the local government, usually do the selection of the new school site.

Soil investigation

About 40% of the soil in coastal zone is sand, and 50% is red soil better for burnt bricks, the left were covered by clay and loam soils. Thus it is recommended to carry out detailed soil investigation for any site in particular before construction works start in order to know the bearing capacity of the soil and hence reduce the possibility of extra costs due to the type and depth of foundation suitable for the buildings to be constructed on that type of soil.

Climate

Temperature

Average daily condition is hot and humidity through out the year. Mean maximum temperature is about 32°C; mean daily humidity lies between 63-95% and diurnal range of less than 80%. Generally, day conditions are such that it is uncomfortable throughout the year but excessive discomfort is never experienced. Due to high diurnal solar range, radiation has to be avoided to achieve maximum evaporation of moisture by air movement within the human comfort zone.

Vegetation

Pre-dominant vegetation in the Coastal zone are mangrove poles, bamboo trees, short bushes and weathering shrubs, while in other areas coconut, mango, and orange trees are dominant. These are very important for the beauty and comfort of the outdoor-learning environment especially during physical exercises, as pupils would like to play under shades.

Rainfall

Annual mean rainfall is 232mm, March to May and November to December are wet seasons. April experiences highest amount of rainfall 251mm. The lowest of all is

September with average of 200mm. This suggests the pitch of the roof to be not less than 23 degrees.

Ventilation and openings

Single banked house with maximum cross ventilation are recommended to achieve human comfort. Internal landscaped courts as attained through L, U, T or and H shaped buildings is highly recommended for solving microclimate problems. Openings are thus supposed to be between 40-80% of the wall area and should face on north and south wall to allow maximum cross ventilation and minimize solar radiation into the building.

Building Materials and Technology

Light walling materials with short time lag will reduce appreciably the discomfort, which is likely to rise during the night due to heat emission from the walls into the building especially for residential buildings for teachers. Light insulated roofs will also reduce the radiation input into the interior of the building.

Following below is the recommended building materials and their applications for construction of primary school in coastal zone.

Foundation. There are two types of foundations; the first one is deep foundation - not less than 1000mm deep and 500 mm wide were used for heavier construction such as concrete, stone and bricks. The second one is strip foundation, a trench of 1200 mm deep and 690mm wide is prepared, and then blinding of 50mm thick is poured at the bottom followed by concrete strip of 230mm thick.

Wall. Two different types of materials are proposed: cement-sand block and burnt brick.[230 mm thick].

Roof. Corrugated iron sheet is recommended. [26or 28 gauge] painted to prevent coastal rusts and glare. Slope not less than 23 degree, and allow air movement through wall plate.

Trusses. Timber truss, soft wood pressure impregnated with wood preservative, it is highly recommended as it is cheaper and available in all areas. The second one is a mangrove pole, which are available in the coastal zone.

Floor finish. Are in general made of sand-cement.

The figure below shows the building materials, its costs and where should be applied in coastal zone.

Table 4. Building Materials and Technology- [Foundation]

Existing building materials (Building standard-Tanzania)	Qty	Unit	Area where soil is recommended for burnt bricks US\$	Area where soil is sand and clay not suitable for bricks US\$	Remarks
Concrete strip foundation [1:3:6]	1	m ³	80	67	Area where burnt bricks are available, there is scarcity of sand and cement also cement is very high cost (US\$ 6.7 to US\$ 8.6) e.g. Mtwara and Lindi
Stone/ brick foundation base and wall	1	m ³	30	55	The availability of stone and brick in some area is as follows: Tanga [50%], Pwani [15%], Lindi and Mtwara [65%] of their total area
Cement sand block	1	m ³	45	35	It is cheaper to use cement-sand block in the area like Dar es salaam and other areas remained above.

Table 5. Building Materials and Technology- [Walls, pillars, roof, trusses].

Existing building materials	Qty	Unit	Group A Area where soil is recom - mended for burnt bricks US\$	Group B Area where soil is clay and sand not suitable for burnt bricks US\$	Remarks
Cement/sand block	1	M ³	22.2	18.5	Recommended in group "B"
Concrete block	1	M ³	29.6	27.2	Cancelled
Burnt brick	1	M ³	14.8	24.5	Recommended in group "A"
Reinforced concrete pillars	1	M ³	53.0	48.0	Cancelled
Stabilized brick	1	M ³	18.5	19.8	Need extra costs
Timber partition	1	M ³	15.0	21.0	Moisture affected
Corrugated iron sheets	3.6	M ³	16.4	15.4	Recommended in group "A" and "B"
Asbestos sheets	3.6	M ³	19.7	18.3	Cancelled
Aluminium sheets	3.6	M ³	34.5	33.9	Very expensive
Tiles	3.6	M ³	32.0	31.1	Very expensive
Timber trusses using soft wood (treated) 50x150mm	5	Nb	215.0	240.0	Recommended in group "A" and "B"
Mangrove poles Room sizes 6.8x8.3 m	5	Nb	35.0	48.0	Recommended in group "A"
Steel trusses using steel pipe 50 mm diameter Room sizes 6.8x8.3m	3	Nb	108.0	103.0	Cancelled

Functional Standard Design

The standard design that is going to be built has a standard size of 56.5 m² and it has been designed for 35 pupils. This was arrived at after making spatial analysis of five different system of sitting in primary schools in the country.

Always designs aim at achieving the required standards and specifications. In order to meet these, preferences are that; pupils should have own chair and desk. This will make pupils to concentrate and understand the lessons better. It would not increase so much the cost of construction because of the locally available timber. So far, the opportunity cost is the better performance of pupils in the long run.

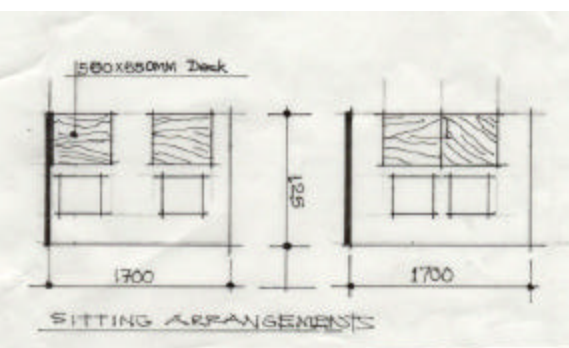
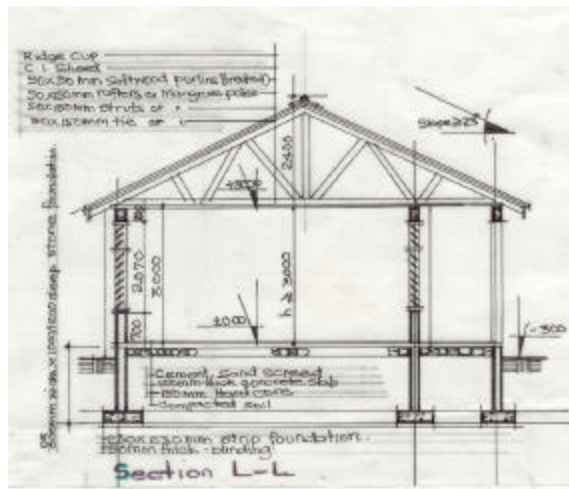
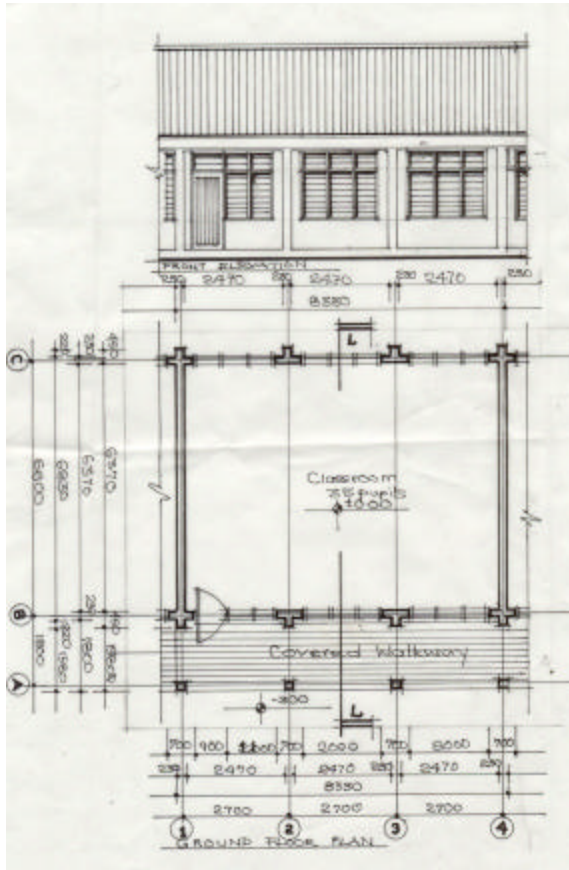
Both the size and the shape [proportion of the two sides of the classroom] make the classroom suitable for the intended purposes.

- 1 The scale and proportion of the classroom [at most a square], this decreases the distance between the teacher and the pupils.
- 2 The proportions of the room also facilitate a flexible use of spaces.
- 3 This in turn will improve the attendance of the children and the performance of the teacher.
- 4 The room is designed for the maximum number of the students which one teacher can teach at a time.

These make it possible to implement a standard design, which is suitable in all places of the coastal zone.

Table 6. Space standards for primary school

Nb	Description Design proposal in Tanzania	Area/ Pupil	Area/ 35 pupils	20%/25% circulation	15% external wall	Total
1	Desk and bench for 5pupils	0.77	27.65	5.53	4.97	38.15
2	Desk and bench for 4 pupils	0.83	29.05	5.81	5.23	40.08
3	Desk and bench for 3 pupils	0.90	31.50	6.30	5.70	43.50
4	Desk and bench for 2 pupils	0.99	34.65	6.93	6.24	47.82
5	Desk and chair for 1pupill	1.15	40.00	8.12	7.30	56.50



Proposed Standard Design.

The Budget for the Standard Design

Preliminary Cost Estimates

A preliminary cost estimates can be derived depending on the built up area and the current unit rate. The current rate of construction for low cost, low-rise building is USD 140 per m². Total built up area per one room is 56.5m² and corridor 14.95 m².

Table 7. Preliminary cost estimates.

Area [m ²]	Approximate costs
1. Construction costs 71.45 ×140	10,003.00
2. Contingency 5%of the above	500.15
3. Professional fees 12% of the above	1,260.40
Total appropriate costs = US\$	11,763.55

The construction costs include: Costs for foundations, floors, roof and fittings.

Contingency: This is the buffer allowance for unexpected cost/expenses.

Professional fees: 6% architectural drawings, 6% quantity surveying, structure and services design.

Recommendations

Most of expected recommendations have been revealed in the proposed standard design. However, the following are some of the remaining recommendations.

- 1 There is a need for change from past design proposal to new design standards of classrooms, which are now strongly recommended.
- 2 This implementation of standard design should be organised by local government and not central government.
- 3 Local people, school committee do not have adequate knowledge in construction technology, thus local government must be able to formulate special programme on supervision of construction of standard design.
- 4 Triggering the awareness of Local people/School committee to the responsibilities they ought to have, which could contribute to the construction or implementation of the standard design of school building. Their contribution must be visible and tangible to motivate the upgrading of education programme.
- 5 The standard design proposal to be developed should be regarded as a mere tool to contribute to” and not “to solve” all school problems.
- 6 It would be better if local government would start to make a pilot project to stimulate other local authorities to implement the same in their localities.
- 7 In order to encourage international agencies, local communities, NGOs to invest in schools the education policy should be redefined.

Conclusions

School buildings are tools to be used to promote the primary education, therefore, investing in the buildings implies improving the learning environment, which in turn raises the standard of the education in the areas. Thus the implementation of the standard design will give relief to pupils and create a better education environment in society.

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