

Effective Cost Planning in Buildings and User Participation

A case study approach

Harriet Eliufoo

Building Economist

Univ. College of Lands & Architectural Studies (UCLAS), Dar es Salaam, Tanzania

Abstract

The paper has looked into the cost planning process for a building project in Tanzania and analysed the influence of the user in the process with a view to emphasise the user's significance for a successful construction process. A brief introduction is given covering social economic conditions of the country and the property market. An analysis is made of the contractual arrangements, project organisation structure, procurement methods, and the building production process and lastly but not least aspects of the building operation stage and the environment with respect to the case studied. It has been observed that the user has a significant role to play in the construction process and can influence effective cost control; poor cost control results to cost overruns and time delays and that cost checking during the design is vital in the cost control of a project. It has also been observed and recommended for actors to incorporate property managers during the design phase as early as possible so as to produce economic designs which will facilitate better management of properties. Lastly emphasis has been made for professionals and actors in the construction process to enhance their levels of environmental awareness with a view to conserve and preserve the environment in their decisions and actions.

Introduction

Aim of the Paper

This paper looks at the cost planning process in a building project in Tanzania at the municipal city of Dar es Salaam and analyses the roles that are played by the various actors in the process. The paper aims at emphasising the significance of user participation for effective cost planning.

Terms Used in the Paper

Cost planning is to cover all aspects of cost control undertaken during the design phase so as to have a building which fulfils the client's goal of having a building which is within the budget, at the desired quality and delivered within the agreed time.

Cost reconciliation is a feedback process of evaluating the actual expenditure as opposed to the expected expenditure on various sections of work or elements.

Cost check is a monitoring exercise whereby the targeted costs of various items of works are checked as the design is developed to ensure the design is within the agreed cost limit; also done on the completion of the production process as a feedback for further projects.

Socio-economic Conditions and the Construction Industry

Various studies have indicated that the construction industry has a significant contribution to the economy of a country as seen in its contribution to the GDP, Total National Employment and the Capital Formation. The studies have also indicated that countries with a high GDP per capital had higher per capita value added in the construction, as well as per capita gross output in construction (UNCHS, 1996:2).

Tanzania has been experiencing for the past decade a growth in its GDP and the economic growth rate has been registered to be at an average of 4% (Bank of Tanzania Economic Review Bulletin, Feb. 2000). The implication has hence been an increase in capital value added by its construction industry. Inflation has presently been reduced to a one digit figure of 6.3% plummeting from a 30 % inflation rate of the mid 1980's (Bank of Tanzania Economic Review bulletin Feb.2000)

Role of construction in national development is also more tangibly seen in the various sectors of the economy like in the production of building materials e.g. cement, aggregates, timber etc; the production of capital goods, and in service and production areas e.g. factories offices, and lastly as a producer of infrastructure utilities like roads, bridges, ports, etc. which all contribute positively to the social – economic development.

The Property Market in Tanzania:

The property market in Tanzania could be described to be at an infancy stage and not very active. It is the author's opinion that the market has had a period of stagnancy in the years between 1967 to 1987 when the nationalisation of properties occurred in 1967 and the subsequent policy of Ujamaa which discouraged private ownership of property. Had the government enough economic strength the property market would not have suffered, as it would have simply been a development in the stock of property that was nationalised, both qualitatively and quantitatively. Nevertheless this had not been the case and the market had felt the impact. Looking at the rental market one may categorise two main rental markets: rental housing which is monopolised by the government agency, the National Housing Corporation, and the commercial market. The former constituting the nationalised stock of the 1960's while the later comprise mainly offices, financed by financial institutions, pension funds, and insurance companies. However currently with the ongoing privatisation exercise one sees a rental market comprising of government organisations, letting out property for rental purposes and in some cases making outright sales so as to relieve themselves the cost of maintaining the properties and as a means of earning revenue. In major towns one also sees a small proportion of owner – occupier properties and individuals having one or two housing properties for rental and as securities. Private real estate companies are few and small focusing on the service aspect of the business, mainly the identification of lettable areas for prospective clients and very few invest in the acquisition of housing estates or in the ownership of land.

Description of the Project

The project consists of an office building with lecture facilities for staff and students at the University of Dar es Salaam. The forms of construction consist of a three – storey reinforced concrete structure with solid concrete blockwalls, steel trussed roof structure covered with aluminium corrugated roof sheets, glass louvered windows and ceramic and terrazzo floor finish, painted internally with emulsion paint and tyrolean render externally. The gross floor area was initially 1100 m² on commencement of contract but presently with introduced changes is at 1470 m² of gross floor area.

The Client for the project is an academic institution - the University of Dar es Salaam (UDSM) while the financiers are a donor agency (major) and the users. As it is typical for the University to provide consultancy services this project was awarded to the consultancy agency within the University which deals with the construction. An agency, BICO was hence awarded the consultancy work for the Engineering work and was also to be the main consultant, referred to as the project co-ordinator. Consultants for other fields were another University affiliated to the University of Dar es Salaam. This is the University College of Lands and Architectural Studies (UCLAS). These were to provide architectural and quantity surveying services.

The project contractual agreements can be looked upon as indicated below whereby there are multiple agreements within the project. The Client has two contracts, a contract of production with the main contractor and a contract of service with the consultants. Likewise the two consultants have their own agreement.

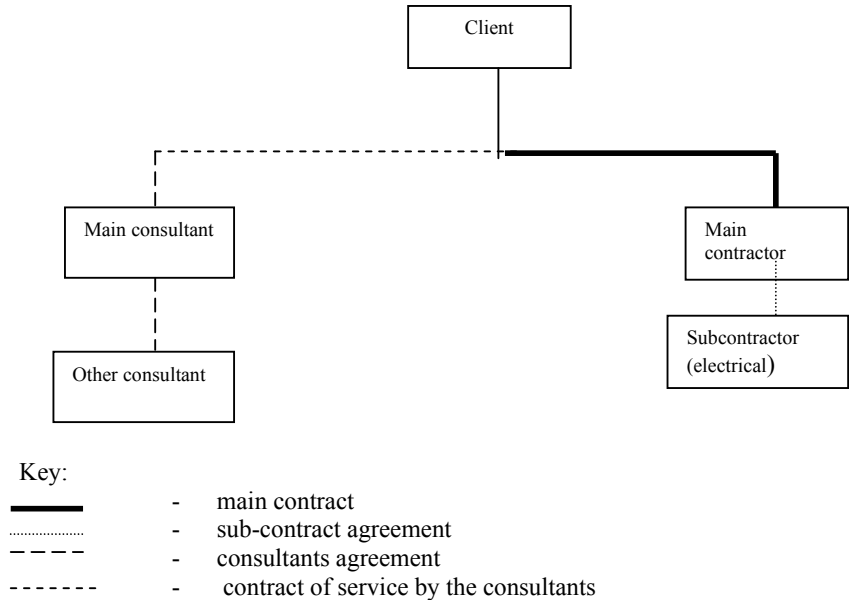


Figure 1: Contractual arrangements

It has also been agreed that all communications to the client has to be through the main consultant who is BICO. Hence the role being played by the main consultant is a project manager's role – except in this case of course, apart from taking the co-ordinating role only, he is also providing some of the services.

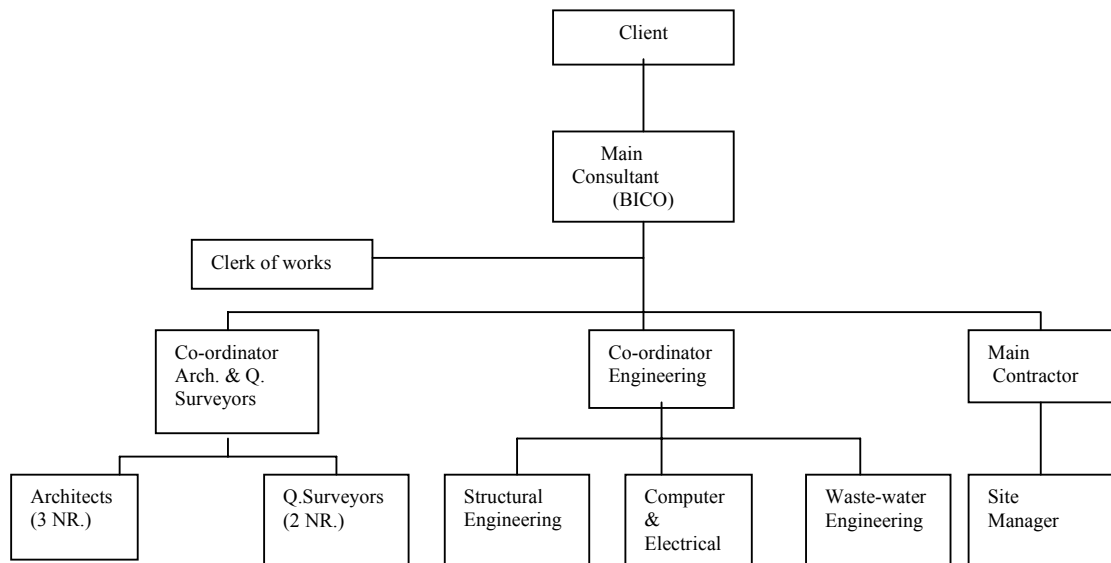


Figure 2: Project Organisation structure

The organisation structure portrays the levels and channels of communication between the parties to the project. May be it is important at this early stage to comment on the absence of the Users on the above project organisation structure. Although the user would not be taking an active role in the day to day activities of the project I am of the opinion that it is important for him to be well informed on the project from its inception to the completion. The other interesting feature in the project organisation shown is the question on the effectiveness of the consultant (BICO) taking the project managers role and providing the engineering services.

Procurement Methods in the Building Industry in Tanzania

In Tanzania a contractor can be procured through the open, open selective or the negotiated method. The most commonly used is the open selective whereby invitations are being made through the national local newspaper identifying the classes of contractors eligible to tender. For this project the open selective method was used and contractors between class I – III were invited. The class categorisation catering for values of work from Tshs 600million (\$750,000) to unlimited values (The Contractor: 2000). The successful bidder was awarded the contract at a Fixed Contract sum of Tshs 446million which is equivalent to US \$557,500 (\$1= Tshs 800) or SEK 4,460,000 (SEK 1 = Tshs 100). A standard agreement and conditions of contract the “East Africa Conditions of Contract 1970 Edition was adopted and duly signed by the parties.

Project Financing, Budget and Budget Control

The mode of financing for the project was as per the standard agreement referred to earlier which offers a stage payment method. Within a period of four weeks an evaluation of value of work done by the contractor is done and the contractor paid within a period of 14- 30 days based on the days stipulated in the agreement. Based on the contracted sum and the project duration a cashflow projection averaging Tshs 10,136,364 per week was established. To date at 27 weeks the gross valuation is Tshs 189,708,229, which is approximately 42.4% of the total value of the project, and lower than the projected value of Tshs 273,680,000, which should have covered 61.4% of the total value, implying that the work progress is behind.

On the inception of the project the client contacted consultants whereby requirements were discussed. A discussion by the project Architects with the faculty heads who are one of the users later on followed. At this stage of the project space requirements and some general layout preferences were the main issues discussed. A cost limit was hence established using the superficial floor area method, which involved establishing the gross floor area of the building and multiplying by a superficial market rate. At the time of writing this paper, the superficial rate for buildings within the city of Dar es Salaam with good quality finishes ranges from Tshs 380,000 to Tshs 450,000 per m² of gross floor area. (Equivalent to US \$475 to 563). Hence for this project the cost limit was found to be Tshs 450,000,000 (Equivalent to \$562,500 or SEK 4,500,000). As the cost limit of the project was seen to be over the client’s budget it was hence agreed for the consultants to consider alternatives, which would fit within his budget. As more information was received regarding the forms of construction and some specifications the conceptual drawings were produced and an elemental cost planning was undertaken, producing the preliminary estimate (refer Table 1.) The elemental cost analysis done gave a total estimate of Tshs 404,387,894 (equiv. to \$505,485 or SEK 4,043,878). This is a lower value than the previously established estimate using the gross floor area method. One of the explanation for this lower value is the fact that one is now working with more information and choices have been made on the quality of finishes to be adopted. The other explanation, is the fact that the estimate allowed for quite a number of items to be measured provisionally, in the contingency sum. For instance the estimate did not cover as individual items the external works i.e. landscaping and drainage works and even the prime cost items. One may also note that in the budget shown in Table.1 cost of land acquisition has not been considered. This is due to the fact that the client is constructing on his own land. Project financing has also not been considered as a component in the project’s budget owing to the fact that a major portion of the finance will be through a donor agency and money is not being borrowed. Hence on

obtaining a cost limit which is within the clients budget and actually more favourable being slightly lower, everyone is happy and the designers were given a go ahead on developing the design further. Thereafter there was very little contact between the designers, the quantity surveyors and the engineers while the design was being developed to produce the working drawings – everyone was waiting for the detailed drawings for them to start their speciality undertakings; the Q.S. to prepare the bills of quantities, the electrical and sanitary engineers to prepare working drawings for the electrical, water supply and waste disposal systems.

What can be observed here is that a crucial stage was omitted while the design was being developed to produce the working drawings. No cost checking was undertaken during the design. The consequence was felt on receipt of bidding from the tenders. A comparison between the preliminary estimate and the successful tenderer is indicated in table 1 below whereby the difference between the consultant's estimate and the successful tender is by Tshs 99,592,110 i.e. 19.8 % higher. This difference is high as the generally acceptable and one considered to show professionalism is within a margin of $\pm 5\%$

Table 1: Elemental cost analysis summary at pre-contract and at tender date

Element- group	Estimate Tshs	Tender bid Tshs	Difference Tshs	% difference
1.0. Substructure	39,281,900	47,644,720	8,362,820	17.6
Superstructure (frame, upper floors, roof, stairs, walls, windows, doors) total	202,272,600	333,290,562	131,017,962	39.3
Internal finishes (walls, ceiling, floors)	24,002,800	65,256,200	41,253,400	63.2
4.0. Fittings & Fixtures	6,000,000	10,946,500	4,946,500	45.2
Services (electrical)	25,768,667	66,459,900	40,691,233	61.2
Preliminaries & Insurance	25,954,407	19,000,000	-6,954,407	-36.6*
7.0. Contingencies (substructure, design detailing & diversion of services)	38,931,610	20,000,000	-18,931,610	-94.7*
8.0. External works (Drainage)	Allowed in 7.0	4,039,510		
9.0. P. C. & Provisional Sums (fire fighting other specialist work)	ditto	8,800,000		
□ Profit & attendance	ditto	4,700,000	4700000	100.0
Total Building cost	362,211,984	580,137,392	83,788,020	18.8
		*correction factor = 446,000,00		
8.0. Professional Fees	42175910	57980000	15,804,090	40,0
Total development cost	404387894	503,980,000	99,592,110	19.8%

* Negative values indicating tender figure lower than estimate

The Production Process

Project Planning

During the design phase the consultants formed a technical committee that focused on the progress of the tasks assigned to the individuals. A plan for the various activities was established using the Gantt Chart. No quality plan at this design phase was made; the main focus was on the time schedule adherence. On submission of tender bid the contractor had submitted the programme for the total works. During the construction process this programme also presented in Gantt chart form, is broken down into four weeks intervals so as to facilitate a closer monitoring of the progress.

Quality Management

In order to assess the quality management it is the authors opinions that it is imperative that terminologies used to describe the situation in this case study are described.

i) Quality assurance – this covers all the planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements

ii) Total quality management is to be considered as a process that emphasises continuous improvement, as opposed to something which ensures that quality systems are in place; encompassing, satisfaction to external customers, a right first time attitude or culture, teamwork – involving all stakeholders of the project, satisfying internal customers etc.

Quality, or rather the lack of it, has been cited as one of the reason behind the problems the construction industry is currently facing. Furthermore it is stated that emphasis on Total quality management within the construction industry appears to be placed on cost control – partly because of the emphasis on costs and timing as the critical features in a successful project, and also because of the effect that poor quality can have on overall project costs (Boaden and Dale: 1992). This observation is also portrayed in this case study as seen in the approach taken in the quality control. The approach adopted focusing mainly on quality assurance, whereby the quality of works is ensured through the consultant’s specifications that appear in the drawings and in the Bills of quantities. A BOQ will have a preamble section that will give descriptions of the specification of materials and workmanship. This can be related to the AMA book in Sweden (Jan Soderberg, 2000). A clause was inserted in the tender instructions to address incidences of conflicting specifications of the tender documents. In case of such incidences the contract conditions followed by the bills of quantities will overrule all other documents. Other aspects of quality assurance are at the site level where the architect, engineer, quantity surveyor visit the site on a regular basis and there is a permanent clerk of works on the site. Certification of standards for materials is also requested regularly but yet at random. To date certification has been obtained for the reinforcement used in the project. However it is to be noted again there is no quality plan, hence the quality assurance is seen to be at random. The client would definitely get more value for his money if quality plans were made beforehand and adopted throughout the construction process.

One aspect of total Quality management is as that mentioned earlier, that is in the emphasis of teamwork approach, involving all stakeholders of the project from the inception to completion. The stakeholders referred here include the client, users, all contractors, all consultants, all suppliers and the statutory authorities. The importance of effective communication in all aspect of quality matters is vital as observed in a particular incident, which occurred. All reinforced concrete for use in the project was specified by consultants as concrete grade ‘20’(i.e. mix of 1:2:4) cement: sand: coarse aggregate; and all plain in situ concrete to be concrete grade 15(i.e. mix of 1:3:6). However only on award of contract fortunately before the work on site had commenced did the client make a statement regarding the quality policy of its buildings .The policy requires, all reinforced concrete to be grade ‘25’ (1:1/5:3) and plain in situ concrete to be of grade ‘ 20’ only. This was definitely a change of specification and hence it necessitated a variation. Hence the first certificate started with a variation! The total effect of this is an addition of Tshs 14 million (\$17,500 or SEK 140,000). Had there been effective communication between the technical committee and the client, this could have been cleared from the outset. In the site meetings where the user is now participating and is getting a better understanding of the project as the work is coming up, the significance of effective communication was again observed. The user realised that they have their own preferences regarding the specifications provided for by the consultants and hence a number of changes are proposed by the user which have cost implications on the project as indicated in Table 2.

Table 2: Variations and cost implications

Proposed changes	Net additions		Net Omissions		Purpose
	Tshs	\$	Tshs	\$	
addition of an extra floor	106,000,000	132,500			functional
roof cover	6,595,500	8,244			aesthetic
roof ceiling material	4,993,300	6,242			aesthetic
window type	7,772,600	9,716			aesthetic
finish to external wall	4,262,500	5,328			aesthetic & functional
room layout	800,000	1,000			functional
add air conditioners	9,000,000	11,250			functional

miscellaneous	1,000,000	1,250	functional
	140,423,900	175,530	1,209,300 1,512
Sub -Total	139,214,600	174,018	
Change concrete grade	14,000,000	17,500	
Total	153,214,600	191,518	

As can be observed in the table the project contract sum has been superseded by far as a result of the intended variations. There is now an additional Tshs 153,214,600 (\$191,518) to the original contract sum. The project is less than halfway but to date the cost overrun is at a third of the contracted sum. Making a projection of the final cost and figure for this project one can foresee that the additional will be quite considerable in terms of cost and time. Refer table 3 below.

Table 3: Projected final contract sum for the project

	Amount Tshs	Amount \$
Value of work done to date	189,708,229	237,135
Total variations to date (approved and yet to be approved)	153,321,000	191,651
Provisional works remeasured and priced	11,000,000	13,750
Value of work yet to be done	256,290,000	320,363
Allow for loss and expense claims	3,000,000	3,750
Sub total	613,319,229	766,649
Allow for professional fees 3% for post contract work	18,399,577	22,999
Projected total figure	631718806	789,649

The projected final figure indicates a cost overrun of Tshs 185,720,000 (\$232148). Considering the turnover of work per week of the contractor the overrun on time would be about 18 weeks. Hence what we are having is a 41.6 % additional amount over and above the contracted sum. The client and the user are now well informed of the cost implications of the changes and are to solicit additional funding. Whether they are successful or not is yet to be seen, so far the project is still in progress and two of the variations have been carried out, i.e. the change of specification for concrete and the additional floor. However time is even of more significance now since the contractor is on site and he is not prepared to wait for the client to obtain the additional money.

General Observation, Conclusion and Recommendations

Contractual arrangements -The case study has revealed a number of areas that could be improved so as to enhance the construction process. The project has opted for the traditional mode of contractual arrangement, which has its known shortcomings - such as the design process taking relatively longer, late incorporation of the contractor etc. However as the project did not have a particular urgency of time and the fact that the project is simple, having a typical reinforced concrete frame structure the benefits of alternative arrangements like the design and build do not become significant. Furthermore, the more contemporary contractual arrangements are still new in the country and it is my opinion that the market has yet to acquire the skills needed for such arrangements like the design and build, turnkey or package deal arrangements or the build operate and transfer.

Project Organisation structure – The project organisational structure could be improved by the introduction of the Users in the structure. I would recommend a representation of all the Users, and in this case a representation from the academic staff and the students who would also use the facilities. A lot of positive feedback to the project could be facilitated by their participation, especially during the design phase. Introducing the Users to the structure I would consider them to have a staff relationship to both the client and the consultants as shown in figure 3

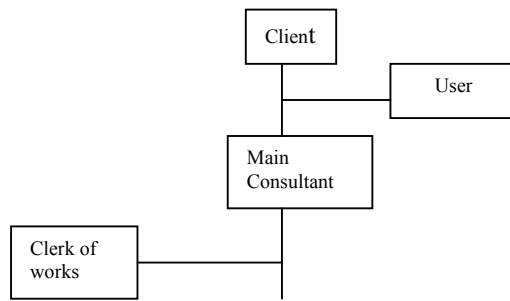


Figure 3: Organisation structure with User participation

The effectiveness of taking the lead consultant to act as a project manager is put to question by some; however it is the authors opinion that if finances allow the client would get better value for money if the project management is carried by an independent body or person.

- i. **Procurement methods** – It is almost common and almost imperative for government projects or projects carried by its institutions or agencies to be procured by the open method. I still consider this an appropriate method to counteract favouritism and give chances to new contractors in the market. However I would encourage clients to have a short list of contractors with proven good performance whom they could use for small projects for other arrangements like negotiated contracts or the open selective which have a relatively shorter and less costly precontract period. The limits for the size of the projects for such arrangements however would have to be set within the individual organisations.
 The measure and value contract had been opted in this case being dictated by the type of contract i.e. the traditional or the general contracting method whereby the design and construction are identified as distinct phases and the later can start only on completion of the former. The time taken to produce the drawings and the bills of quantities are among the setbacks experienced in this case. This is also brought by the fact that everything was done manually except the typing work, hence minor alterations had time repercussions. For instance the production of the bills of quantities took about four weeks something that could have taken about a week with the use of information technology packages (IT).
- ii. **Project financing and budgeting** – The consequences of poor cost control are observed in the case study. Inadequate attention given to cost checking as the design was developing led to the tender figure being above 19.8 % of the latest estimate submitted to client. Time between an estimate and the production of the working drawings are of essence hence the update of the estimate as the detail design is carried has again been proven to be of significance. The detail of checking will definitely be dictated by the bases of information in previous estimate, extent of changes since previous estimate, complexity of the project, experience of the cost planner with the architect e.g. is the architect cost conscious or not.
- iii. **User participation** - the significance of ensuring that the user actively participates in the project from the inception has been observed in this project. I would emphasise even more the participation of the user during the design phase, as it is during this phase of a project where there are greater chances of influence with relatively less costs. Fig.4 illustrates the point and shows possible cost check points e1, e2, and e3 at the briefing, conceptual and detail designs stage of a project.

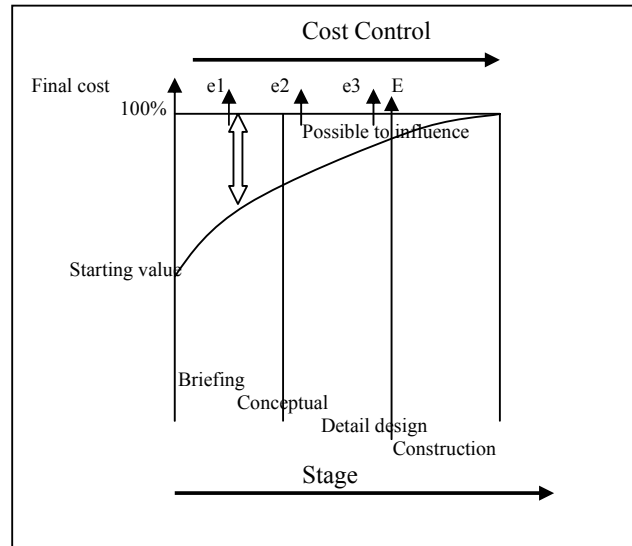


Figure 4: Possible area of influence in a project

Key: e1 preliminary cost estimate at briefing stage
 e2 estimate at conceptual design stage
 e3 estimate during production of working drawings
 E final estimate at tender stage

- iv. **Cost overrun** – On making best use of the time during the design phase, variations may be lessened during the course of carrying out the project. As changes in cost and time are accommodated in the preliminary stages, final cost figures will be more accurate from the outset and there will be less frustration to client and users. Times for completion will also be accurately established and hence delays, which are costly to the client, will be avoided.
- v. **Property management** – Emphasis is geared towards perceiving property management as a construction process in a property. It is actually the longest process in the life cycle of the building and hence presumably the costliest. Yet it is ironic when one looks at the time spent by the actors in the building process in making this final process a success. Reflecting on the case study one observes that choices had to be made between alternatives so as to ensure sound function beyond the production period. For instance glass casement windows chosen against louvered glass windows as the later preserve the cooled air much better and there is better consumption of electricity and possibly longer life for the air conditioning plants

Table 4: Choice of specifications with a maintenance perspective

Element	Alternatives	Alternative chosen	Justification
Windows	Glass louvered aluminium frame, Glass casement	Glass casement with aluminium frame	Preserves cool air; lower electricity consumption; longer machine life
Floor	Parquet, cement sand screed, polyvinyl plastic, Terrazzo, Ceramic tiles	Terrazzo (wet areas) Ceramic tiles	Durable withstands moisture, abrasion resistant, easy to clean
External render	Tyrolean render, emulsion paint	Special weather resistant paint	Resist mould attack which is common in the locality
Plumbing & Eng Install.	Vary	Grouping of pipes on one stack	Easy maintenance

The choice however is not as straight forward as one might think since one has to remember that the consultant has to make choices within a set budget and in some cases choices have been dictated by financial constraints. However there could still be room for improvement with respect to good property management during the design. Electricity is one of the major accounts in any property in Tanzania hence one would consider that attempts to lower consumption are made in the project. As

Tanzania is a country just about the equator where there are twelve hours of sunshine throughout the year, alternative sources of energy using solar could have been cost savers. Water is also a commodity that is scarce, attempts could have been made to lower consumption e.g. the specification of automatic flow control taps, use of smaller cistern tanks in the lavatories etc. One would also recommend the construction process to incorporate the property manager during the design stage so as to ensure a feedback mechanism is installed in the construction process. I would visualise the construction process as in figure 5 below where such systems would facilitate the establishment of reliable information regarding future budgets; the economic control of the design with a view to maintenance; the choice between alternative solutions during both the design and the property management stage.

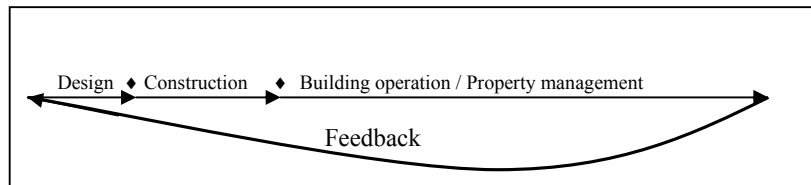


Figure 5: The construction process

- vi. **Construction and the environment** – Strategies for attaining ecological sustainability in construction have urged the actors in the sector to be more environmental conscious in their actions and decisions (Baris Der-Petrossian: 2000). Emphasis is put towards the use of secondary species of timber. The dominance of specifying mninga hardwood in building has had its repercussions in some regions like Kilimanjaro where this type of timber is presently almost not available; the selection of materials and systems which have a low embodied energy e.g. the choice of wood against metal or plastic; designing for long life adaptability and for eventual recycling; specifying materials that would require or permit the use of secondary, recycled and waste materials. Assessing the environmental consciousness levels of the project one can see that there is room for improvement in a number of areas. The roof structure is made of steel and this relatively costly material was justified by the span of the structure. I would consider the possibility of reviewing the design so as to accommodate a shorter span, which would enable a lower energy embodied material like timber. The aluminium sheet gutter, could also be substituted with plastic which is lower down the scale. These are just but a few examples that signify the need for the actors to have an environmental outlook in their actions and also potray the conflicting situations that the actors may be subdued.

Recommendations

The following is recommended based on the case studied

- Efforts should be geared towards the participation of all stakeholders in a construction process from the inception to completion so as to make the process a success. The user who is in most situations brought in at late stages of the process should now be actively involved from the early stages of the project, ideally from the inception and throughout the design to completion.
- Actors to a construction project should make best use of the phase at which it is relatively easier and less costly to make changes.
- Cost checking during design is a vital and integral constituent of a successful construction process and hence should be given its due weight.
- Property managers should be incorporated in the early stages of the project so as to facilitate a feedback mechanism, which will result to economic designs of construction project with a holistic view of the project's life.
- All professionals and the actors in construction process should put efforts towards designing and constructing with an environmental awareness. A starting point could be the incorporation of the environment as a subject in the training of these professionals.

References

- Boaden, R. J. and Dale, B.G
1992 *Total quality management in the construction industry: a preliminary analysis, International Journal Technology Management, special issue on Competing through Quality Production and Technological Innovation management, vol.7 no.4/5 pp.244-253*
- United Nations Centre for Human Settlement UNCHS
1996 *Policies and measures for small- contractor development in the construction industry.* Habitat, Nairobi.
- Bureau of Statistics, Planning Commission
1997 *Statistical Abstract: 1995*
Bureau of Statistics. Dar Es Salaam, Tanzania
- Jan Soderberg
2000 *The Construction Process.*
Lecture notes, International Construction Management Course 2000 held at Lund University 3rd April- 26th May 2000. Lund
- Sui Pheng Low and Willie Tan
1995 *Public policies for managing construction quality: the grand strategy of Singapore. Construction Management and Economics vol.14 pp.295-309.* Singapore
- 2000 *The Contractor.*
Newsletter of the Contractors Registration Board- Tanzania. Issue1: January 2000 pp.9
- Baris Der Petrossian
2000 *A strategy for attaining ecological sustainability in construction. Compiled from UNCHS publications by Baris Der Petrossian.* UNCHS (HABITAT). Nairobi.