

Construction in Ethiopia

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Summary

As the intensive construction in Ethiopia today becomes more complex, the demand for housing and project management services is increasing. During the housing construction the application of project management the progress against time, cost against tender or budget, quality against specifications is can be confusing for all parties involved in the construction process. Therefore, the main task of this paper is to indicate the problem solutions.

This menace, first of all any project before its design starting should have a briefing stage, sketch design stage, scheme design stage and detail design. Also design should include the climatic design of building materials, earthquake safety and energy conservation for low-cost housing as well as for complex buildings. Apart that, to have quality and effective construction work there should be quality control.

Introduction

Even though Ethiopia has its own several ancient civilisations, from the 60s there is a great influence by the international style of architectural design. Because of these, every building is reduced to plain vertical and horizontal lines of concrete blocks, which being unimpressive and ugly, are a menace to the society and a cause of environmental degradation. They are also a cause of a complete break to traditional values and cultural patterns. Apart from that, because of the international style influence, the country can not relate itself with tradition while, we have not yet been able to satisfy the basic housing needs of our people even with the modern solutions. But I think, it is very important to learn from mistakes done on built housing blocks that were implemented with out thorough study of function. And it is important to encourage construction of buildings with local materials and of course with consideration of functional requirements and proper management.

Aim of the paper

As the intensive construction process of today becomes more and complex, in Ethiopia the demand for professional project management and real design services are increasing. People within the construction do not agree about what the concept project management implies and this can be confusing for all parts involved in the con-

struction process, including a client who intends to hire a Management Company.

My main objective in this paper is to highlight a general understanding of project problems with real design, tendering, and management and present my own proposals and solutions to the problems.

Basic Information about Ethiopia

Location

Ethiopia is located in the Horn of Africa and is the largest country in the continent. It has an area of 1,112,000 km² and it has an elevated central plateau varying between 2,000 and 3,000 meters above sea level



Figure 1 Map of Ethiopia

Population

The population of Ethiopia is about 58 million. According to the 1997-population census. The population living urban areas accounted for about 15% and 50% of the population are under 22 years of age. The average number of inhabitants per km² is estimated to be 26 people.

Structure of the construction industry

The construction industry consists of various sectors. These are the building and residential development sector, civil engineering sector, professional services sector and

self-building sector. The construction industry consists of different types and size of firms. These operate in the different sub-markets characterising the construction industry. Construction firms must be registered and licensed in order to undertake any construction work in Ethiopia. The firms are classified according to size, expertise and financial capability by the ministry of work and urban development (MWUD). The self-building sector is characterised by an informal sector, consisting of informal groups that supply materials and labour. These informal groups are not licensed or registered. However, they employ a great number of people. The professional services sector consists of architects, civil engineers, electrical engineers, sanitary engineers, and mechanical engineers, quantity surveyors and surveyors who provided the design expertise. The services of these consultants are not utilised in the informal and self-build sectors. There exists a great separation between the design consultants and the contractors. This generates conflict in the construction process and results in project delays and cost escalations due to claims. It is important that methods for conflict mitigation are developed for the industry.

Design of buildings

The design process

The design process in building design enterprise (BDE) and other consultants of the design of buildings in the formal sector is a co-operative effort between the client and various consultants. The client provides a set of requirements and constraints that the consultants attempt satisfy during the design process. To satisfy the client brief, a design team is constituted which consist of all the consultants. The team in most cases is headed by the architect or by the consultant in recent times. The consultant is appointed by the client and takes care of the client's interests according to the general condition of construction. The contributions of each consultant in the design process can be summarised as follows:

- Brief Stage

Client provides the design brief that consists of the requirements and constraints to the design team.

- Sketch Design Stage

Architect prepares a preliminary sketch to satisfy the designs brief and possibly provides alternative proposal. Quantity surveyor prepares preliminary cost estimates based on the Architect's design sketch. Quantity surveyor provides the initial cost plan that forms the basis of cost control and budgeting. Client approves sketch and cost estimates.

- Scheme Design Stage

Architect designs to a greater detail to meet the submission requirements of the local authority. Quantity surveyor undertakes various costs, checks and ensures that the budget is not exceeded. Architect provides scheme designs to the civil (structural), mechanical and electrical engineers for the engineering design of the project. Archi-

tect submits scheme design for approval to the local authority.

- Detail Design Stage

Architects proceed to detail design the elements and components of various spaces and prepares specification for the project. Quantity surveyor prepares bills of quantities and final cost check. Engineers finalise their drawings and specifications.

Climatic Design of Buildings

The decision to incorporate climatic design criteria is based on the climatic conditions prevailing in a given area. The most common design parameters employed in passive design of buildings in Ethiopia include orientation, shading, ventilation, glazing and thermal properties of materials.

Building materials

In Ethiopia the major problem is building materials, especially the roofing materials. As a common practise round tree (usually Eucalyptus tree) and corrugated iron sheets are widely used. Today, these materials have become very expensive so that low-income people are almost unable to build their houses. Reinforced concrete slabs were tried, but they were found out to be difficult to make water tight in most constructions. This in fact could be improved if proper management and good quality control of materials were available. But for low cost houses, a rather cheap roofing material should be introduced. Several research works are still on the way to find a replacement for the corrugated iron sheet. Even though concrete results are not yet obtained.

Earthquake safety

Since the Great Rift Valley pass through Ethiopia, some cities are categorised under the seismic zone of Ethiopia. Now days due to this, every building is designed considering the expected maximum earthquake loads. According to the Ethiopian standard code of practise, comparisons Between wind loads and earthquake loads are considered and every building is designed based on the worst condition.

Building regulations

The building code sets out building regulations and requirements. It is a legal document and it confers powers to all the local authorities to over see that the building code and building by-laws are maintained in the areas of their jurisdiction. But since the housing policy of Ethiopia was not strong in the past, several disorganised urban plans, designs, construction methods are visible. To overcome these problems, research works on up grading low-income housing, proposing new low-cost housing projects, introducing new sanitation methods, use of local building materials and transfer of construction technology are still in progress. It is my belief that the out come will be beneficial and applicable in the country to somehow overcome the housing problems of the country.

Standardisation

Standardisation in building is a process of creating various elements in building to a certain specification size and quality. Standardisation is an important principle of rationalisation and requires that buildings be built of standardised components. The other benefits of standardisation include reduced Construction time, improved quality and reduced costs. In Ethiopia there has been standardisation programs in the industry, and also major manufacturers have been offering standardised product range. Standardised materials available to the industry include roofing materials, pre-cast concrete materials, steel windows, doors and electrical fittings.

Energy conservation

Ethiopia's main sources of energy are wood fuel, petroleum and hydro electricity. Alternative sources of energy like biogas; solar energy is being developed. Ethiopia is currently facing energy crisis. For example even though housing problems exist, the growth in demand for electricity is more than expected and the situation is more serious for fuel wood, where the shortages have led to rise in prices of charcoal. Use of fuel wood is also an important cause of deforestation. Energy conservation guideline for buildings does not exist and energy use is not regarded as major design criteria in buildings. The designers are designing more and more energy incentive buildings that rely more on air-conditioning, artificial lighting and mechanical ventilation systems. There is a need for research studies on energy use in buildings and the possibilities of energy conservation.

Low-income housing

The provision of adequate shelter for every family has been the long-term objective of the government. In urban areas there is a high population growth that has led to development of squatter settlements. The situation is characterised by reduced access to basic infrastructure like water sanitation, building and planing regulations that discourage development of low-income housing and weakening municipal authorities. The projected housing need, taking in to account the population growth rate is about 100,000,000 up to the year 2010. The Ethiopian government has developed several strategies and programmes aimed at alleviating housing shortage. These include settlement up grading, site and service schemes, tenant purchase, encouraging owner building and institutional provision of housing to employees.

To meet this need the government should revise the national housing policy and encourage development of low-cost materials technology and it's dissemination. The government should ensure the housing finance is made available to developers and homebuilders.

The government should provide land infrastructure for housing development. To reduce speculation on land, the government should introduce direct tax on idle land. The role of the NGO's, in the provision of shelter should be encouraged.

Construction and management

Project organisation

Most common form of project organisation practised in Ethiopia is the line staff organisation; figure below shows Construction organisation structure. Deferent organisations have deferent levels depending on the magnitude of project and staff available.

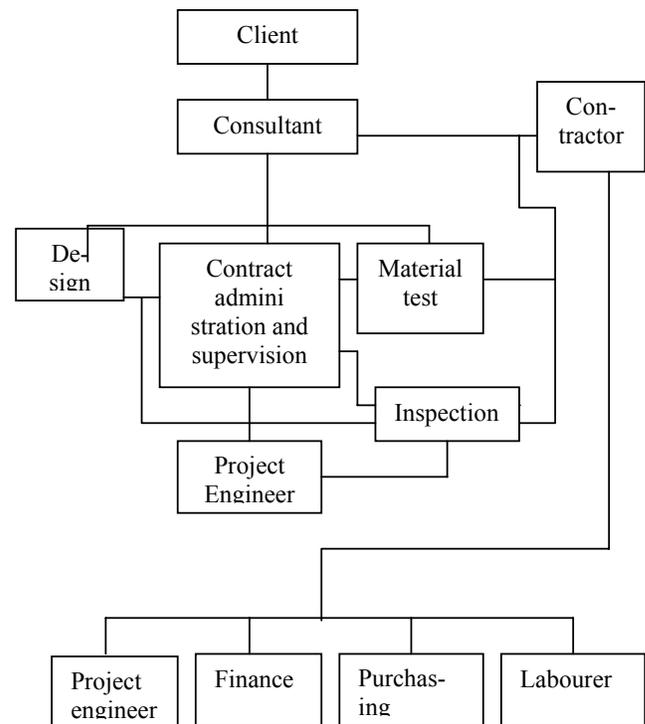


Table 1 Project Organisation table

There are various stages involved in the construction process.

- Construction activities: effective building activities require the co-operation of experts of various disciplines i.e., to construct within the agreed limits of cost and time.
- To construct within a specified quality and according to the contract documents.
- To control function includes feed back and belongs principally to the client although all other functions should have their Own control activities.

The building project management function is best, if performed by specialised professional management or organisation. The project management has control over the entire process, co-ordinates it and has authority to make decision on any problems that may arise. Its authority is exercised continuously rather than intermittently. The project management is able to detect and resolve conflicts between quality and cost or between cost and time.

Project financing

Building and financing within the country:

There are various forms of financing building projects in Ethiopia. Depending on the type and the nature of the project. To minimise the housing problem in the country, especially in densely populated cities, the government as well as private owners are constructing many new rental apartments. For the private sector, there is a special loan arrangement from housing and saving bank of Ethiopia. To minimise the housing problem and having owned house each person, the agricultural and industrial development bank of Ethiopia is giving loans for house builders. To be eligible to get a loan from the bank, it is a requirement that the client should manage to have at least 35% of the total estimated cost of the building. Then he could obtain the rest 65% from the respective banks. The combined interest per year is 10.5% since the government through the country owns land. It should be noted that it could be obtained from the government by leasing. Usually the lease will last for about 99 years. But due to shorter loan term and the higher interest value, very few have used the opportunity, in addition the average incomes of the middle class are too low to cover the payment of their loans to the banks regularly. Therefore, the main problems encountered by the sector should be clearly identified and studied.

Budget and budget control

Cost estimates are prepared at end of the design stage to establish the project budget. Consultant Quantity Surveyor appointed undertakes preparations of the cost estimates of the project by the client. The Quantity Surveyor uses several methods to prepare cost estimates depending on type of project. This estimate is normally used as a yardstick for cost control during design, tendering and Construction process. The main objective for establishing a cost estimate is to be used as a basis for cost control during execution of the construction project, to establish target budget for the given project, to determine the scope of the project and to establish cash flow and cost forecasting.

Quality and construction control

Quality control is the responsibility of the contractor. However it could be categorised into two parts i.e.

- The quality of workmanship
- The construction materials.

Concerning the workmanship, it is usual to have experienced Foreman to be on the Construction Site continuously until the project is completed.

Apart from this, the building materials are tested to ensure the quality i.e. since the Ethiopian standard code of practice sets minimum quality requirements, the materials should fulfil the standards specified by the code before using them in the construction project. These qualitative tests are mostly done according to the Ethiopian standards institution, by building design enterprise, as well as by the university and other firms.

Tendering documents

Tendering documents are important guide to the bidders and should therefore contain enough and unambiguous information regarding obligation of the parties involved.

Tendering document must contain

- Information on the kind and quality of materials,
- Information on the required quality of the finished work,
- Information on administration and legal matters usually the descriptions are referred to existing general documents as far as possible.

In Ethiopia, some of the references are

- national or international standards,
- general conditions,
- Regulations laws and by laws.

After all the above descriptions are stated in the specifications, the contractor submits his prices mainly depending on the estimated quantities of the Project. For variations further negotiations will be made between the client and the contractor.

The transfer technology is best undertaken through joint ventures between local and foreign contractors.

Information technology

The Ethiopian socio-economic development is based on local and traditional technologies, which have evolved over centuries in response to the subsistence needs of the people. However, recent appropriate technologies, such as computer for design, latest machinery for construction etc. is nevertheless taking ground in all sectors of the National economy. Especially, in the housing sector where, over the past few years, thousands of housing units have been constructed utilising not only locally available building materials, but also designed and executed Ethiopian national tool and equipment.

Experiences to use in future projects

As far as I have the access with designers and quantity surveyors, based on the experiences of the Lund University short course of international construction management, I will work with concerned parts

- First of all any project before design starting must have a briefing stage, sketch design stage, scheme design stage and detail design stage.
- Design should include the climatic design of building materials, earthquake safety and energy conservation for low-cost housing as well as for complex buildings.
- As far as quality is needed for construction of buildings, quality control is expected to make periodic quality checks and ensure that the contractor complies with all the quality controls.

Conclusions

It is important that training extends beyond the academic training, the professional disciplines should ensure continuous professional developments of its various members.

In order to properly plan, implement and manage our urban development activities, inter disciplinarily trained manpower is prerequisite. In this regard proper use of the existing staff and the training of new professionals are very essential.

Production process

Tendering and contract

In Ethiopia, several forms of contract agreements are available. One form of contract is (with or without quantities) and the fidic form of agreement. The government has its own form of contract known as ministry of works and urban development (MWUD) form of contract (with or without quantities). For the donor-funded projects, the donor agencies might suggest their own form of contract.

Concerning tendering the tender documents have to be of such a nature that contains the relevant information for the contractor to calculate the cost of the project.

In Ethiopia this menace that the general drawings and the drawings of essential details, specifications and quantities as well as description of the project should be available.

Management education

To fulfil management needs of various aspects of construction it is clear that, good management is required. This immediately implies that staff with good management education is required. In Ethiopia, one of the problems that made the construction industry very costly is lack of enough trained staff on this particular field. However, higher education of Ethiopia continuously training professionals with their maximum capacities and it is recommended that farther effort should be made to strengthen the institution for higher education al and vocational schools to achieve the desire goals.

Production planning

It is of fundamental importance that projects are completed within the required time. It provides the basis for Project control and this is the only simplification of the real situation. The most common method of time scheduling is the Gantt chart. It is a condition in the contract that a contractor must provide and maintain a programme of work. This is done using Gantt charts. The forms of project time scheduling i. e. the critical path method and PERT are rarely used due to lack of qualified personnel. The use of computers by contractor is limited to accounts, preparation of payrolls and word processing only.

Quality assurance

In order to achieve safety and quality of construction works the following action could be relevant to the stakeholders:

- Building material producers and users should take measures to avoid the production of hazardous materials and ensure the safety and protection of works.
- Architects and engineers should specify safe materials and should design the in-door environment in a way that concentrations of hazardous of materials do not accumulate.
- The responsible parties should ensure that they use safer materials and processes in construction in order to avoid accidents, they should also ensure safety of on site construction workers by offering them protective cloth and other safety materials.
- The government should play a crucial role in controlling the health and safety hazards of construction adopting and enforcing regulatory measures and applying non-regulatory incentives.

Economic control-budget review and reconciliation

As efficient of management demands that my control the organisations work towards distinctive goals. Naturally these objectives must be shaped differently types of owners. It is important that the objectives are carefully design and are continuous updated to the current market situation. In Ethiopia, property management is a constantly proceeding process and it is continuously needed to check stated goals. To be able to guide the organisations work, it is often necessary to create a set of measurable conceptions. It is possible to do analyses on different levels in the organisation. The individual real estate is normally a part in a larger unit of organisation. It is not possible to fully separate the individual real estates from the organisation it is a part of. It is necessarily to start analysing each separate real estate and then determine how the organisations total economy is affected of and influenced by subordinated units. Through these measurements of the economical flows in the company, from bottom to top, it is possible to identify units, or divisions with problems. As in all management, the decision-maker must consider the factors of insecurity that are current on the studied market, at the given time. The properties economic prerequisites are continuously influenced by a whole set of external and internal factors. Examples of external factors are changes in tax regulations or changes of subsidise. Internal factors could be a change in use or the wear and tear of a component. The operations in the organisation are also controlled over different length of period. The basis of managing a property should be a carefully worked out long-term plan. From this plan, the strategic plan, it is possible to make several budgets, with shorter perspective, to guide the daily work, operational plans.

Experiences to use in future projects

In my country the main problem during construction period is lack of proper management, technology, and lack of skilled manpower. Therefore based on the experiences that I obtained I will do my best to increase application of cleaner technology in building construction to offer a sound management and leadership. Management in the

construction process includes overall project planing and scheduling, on-site material handling, effective use of resources i.e., labour, energy, equipment and machinery as well as by improving methods of construction activities.

Conclusion

The government must strengthen local training institution by provision of enough facilities and additional trainers to take in to account the changing technologies of the construction industry. In the features of construction technology local materials, labour intensive, self-help evolutionary housing designs should be promoted in urban areas.

Professional and technical training opportunities at Ethiopia and abroad must be increased and made available to all. This will enable them to increase the level of technology and the existing curricula in centuries of technology and professional education must be reviewed, upgraded, monitored closely and co-ordinated.

Property management

Research, professional training and technology transfer

Research in the construction industry is undertaken at the university, mostly as academic research with little or no practical relevance to the industry. In Ethiopia building research is done at the housing and building research institute at the University of Addis Ababa. Also some of these research works are performed in collaboration with foreign aid institutions like SIDA, urban social service development (USSD) etc. Even though several research works are on progress, it is obvious that a lot has to be done in the future and further more a lot is needed to be done in research and development to introduce and develop new construction technologies.

Life cycle cost

Even though in Ethiopia the life cycle cost system is not yet developed to high levels, it is necessary to use it. Because cycle cost is the economy of a property in contrast to most other investments controlled by the time. Therefore a property must be analysed with methods that takes this dominating factor into consideration. Methods like pay-back method do not consider the effect of depreciation and methods like present value method or internal rate of return method tends to be complicated. Projects can generally seen in life cycle of the objective, which starts when the project is constructed and ends when it is demolished.

In another way the life cycle of the object that is depending the property to the owner. Therefore different owners can have deferent objectives for owning the property and deferent knowledge and this gives deferent views of investment during the life of the property.

Maintenance planning

Buildings are big investments. At the same times maintenance is the management of this resources. It is a requirement to have preventive, routine periodic maintenance. The concepts and cost effectiveness of routine maintenance of facilities imported on building sectors. As the house is maintained longer will be its life span, hence remains to be good investment.

In Ethiopia many buildings after completion the budgeted amount of maintenance cost is allocated with insufficient funds to maintain the building. Maintenance costs are sometimes incorrect and lack of feeling responsibility. Preventive maintenance can be used to avoid damages to a building and is the most economical alternative, e.g., checking and provision of preventive measures; rain gutters and down pipe must be maintained before rainy seasons. Experts should inspect any structural damages. Maintenance earns money. It reduces or eliminates costly repairs. It is recommended to use materials available in the area for maintenance. In addition my opinion is the following programmes are required to be implement by the government

- The best way to prevent is that, job description should be well defined from the beginning of the project decide who would be responsible, use materials available in that locality, educate people through means of media, communication, workshops and seminars.
- The concepts and cost effectiveness of routine maintenance of facilities will be imported to all sectors agencies and public bodies in particular, and to the peoples of Ethiopia in general.
- Guidelines should be issued to all relevant bodies on the planing execution and budgeting of maintenance requirements.
- Maintenance programmes will be established for all public facilities and their implementation financed Montreal and enforced.

Connection to the design stage: feedback

The design of building s in the formal sector is cooperative effort between the client and various consultants. The client provides a set of requirements and constraints that the consultants attempt to satisfy during the design process. To satisfy the client's brief, job description should be well defined and should clear, who would be decide and take responsible for the project. Guidelines should be issued to all relevant bodies on the planing execution budgeting of maintenance requirements the suppliers shall establish and maintain documented procedures to control and verify, the design of product in order to ensure that the specified requirements are met and of cores a design team is constituted which consist of all the consultants. The consultant or the project manager heads this in most cases in recent times. The project manager or the consultant is appointed by the client and takes care of the client's interest from preliminary design up to the working drawings, tendering and supervising the project con-

struction to ensure that the quality work and the final cost of the project does not exceed the budget.

Experiences to use in future projects

In order to improve the quality of property management in Ethiopia, the Ethiopian government and all parties concerned should

- Make a special training programme on the property management architects, engineers and other specialists concerned to deepen on their knowledge of this aspect.
- Include in the government-housing programme, the importance attached new entire construction repairing and upgrading of existing buildings.

The architects, designers and engineers at the appropriate level should have a competence to:

- Use a model of analysis for property management in the design stage of any project.
- Undertake the life cycle economy for the economic control during the designing of building.

Conclusion

In Ethiopia even though the government and the people are deeply involved and have started reconstructing the country, the housing construction activities are limited.

As such this sector has not yet developed General recommendations could however be proposed with respect to housing, design of building and management of construction. One of the priorities would be to develop public and private sector institutions that can contribute to this end. Institutional capacity needs to be strengthened through continuous training of the existing manpower and impute of qualified professionals.

Programs for creating a national capacity in management of construction need to be introduction. Special emphasis should be put on strengthening the capacity of small and medium scale contractors.

Labour force in rural areas must be utilised by labour intensive method of construction.

Housing policy, planning legislation and building codes should aim at health, safety and preservation of the environment