Construction Project Management in Cambodia

The Referral Hospital Project

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Summary

After decades of civil wars in Cambodia, the integration of khmer rouge into society has created suitable condition for national reconciliation, peace, stability and opportunity to rehabilitate and to reconstruct the country.
A great deal of work has been undertaken while the country has adopted to a free market economy. Cambodia has recently practised a policy of incentive to attract foreign investment which has resulted in making the national economy more stabilised compared to the recent years.

Among the major activities in reconstructing the country, the construction industry in Cambodia nowadays plays a significant role in the national economy through its large and various investment scales . Meanwhile, in this area the performance of involving parties who are from the public and private sectors relies basically on their limited resource and management qualification.

In order to perform the work more efficiently, both sectors should adopt some alternative ideas to improve their qualification in terms of human resource and management system , and on the other hand they have to co-ordinate their activities among themselves to complete the work by time with good quality and at reasonable cost.

In recognition of this facts, this paper attempts to present a general overview on building construction projects management, which has been used in Cambodia, by giving a general aspect about design stage, production stage and property management stage and to analyse each stage based on the idea of how the three principle actors namely the client, the consultant and the contractor should perform their correlative tasks to influent the project goal that can be generalised as time, cost and quality.

As an example, the paper discusses some practical issues of a construction project of Referral Hospital in Cambodia. The project is a part of health coverage plan of the Ministry of Health and it has been organised by the Social Fund of the Kingdom of Cambodia under the loan obtained from the World Bank.

The conclusions and recommendations presented in this writing are mainly based on the writer experience and involvement in civil engineering field in his country over the last fourteen years.

It is hoped that this paper would contribute to provide experiences and lessons learnt particularly on construction management aspects in Cambodian context which would be useful for architects, engineers and practitioners, and others who are interested in this field of construction industry.

Introduction

Aim of the paper

The aim of this paper is to give an overview on current situation in the management of construction industry in Cambodia and to offer practical ideas and recommendations (on disadvantage or weakness encountered) as well as the way to improve some working method in this area in order to assist a successful and sustainable economic growth in the country.
The paper gives generally an example of one of the construction project in Cambodia by giving details of the following stages: design, production and property management.

Fact about the actors and the project

The Actors

The Actors involved in the project are:

- The Social Fund of the Kingdom of Cambodia (SFKC) - an autonomous public institution under the office of the Prime Minister. This institution has three main following objectives : (I) to respond the urgent need of poor communities and alleviate their poverty, (ii) to increase employment opportunity for local people, and (iii) to promote social welfare through the implementation of small scale projects for the rehabilitation of social and economic infrastructure and other socially productive activities. The SFKC has been created in December 1994 by the Royal Decree, its operation has been supported by the financial resource which is a long term loan that the Government borrowed from the World Bank. Refer to this project the SFKC plays an important role as the Client and the project manager in organising and managing the project starting from inception till works completion and project delivery to community at the final stage.
- The Ministry of Health – influents directly the project by issuing approval on the technical aspect of proposed project and its location in accordance with the Government health coverage plan and medical guideline. The MOH appointed also the experienced medical staff to provide technical advice to the RDE during the design stage.
- The World Bank – influents directly the project by initiating the policy, the guideline, the operating procedure which are strictly to be followed by the SFKC.
- The Ministry of Finance – acts as bridging institution on behalf of the Government to receive the loan from the World Bank and to control the budget disbursement.
- The beneficiaries – people living in the following provinces: Kampong Speu, Kandal, Kamport, Kratie, Siem Reap and Rattanak Kiri.
  They initiated their proposal , fulfilled application form and prepared other related documents to submit the SFKC after getting approval from the local authority.
- The consultant – Research and Design Enterprise (RDE), established in 1984, is an autonomous entity under the Ministry of Land Management, Urban Planning and Construction. For this particular project RDE is responsible for the project design. Neither the procurement of work nor the work supervision are included.
- The contractor – small local contractors.

The Project

The project presented in this paper is the construction of a typical project of Referral Hospital in Cambodia. This project comprises of component buildings such as:

X-ray and Operation Theatre	- 272 m^2 ;	Pharmacy Stock	- 190 m^2;
Ward General	- 291 m^2 ;	Maternity	- 231 m^2;
Ward Tuberculosis	- 291 m^2 ;	Blood Transfusion	- 89 m^2;
Administration Block	- 224 m^2 ;	Blood Test	- 47 m^2;
Washing Area	- 60 m^2;	Kitchen	- 50 m^2;

Emergency, Laboratory and Pharmacy – 224 m^2; and
Garage and Generator Shelter - 80 m^2.

Based on the available resource and suitable condition at the sites some buildings of this typical project were built at the following locations:

- Kampong Speu town; Udong , Kampong Speu province
- Saang and Koh Thom, Kandal province

This project will be constructed in this year also at the following locations:

- Angkor Chey and Kep, Kamport province
- Chlong, Kratie province; Kralanh, Siem Reap province; and Rattanak Kiri town Rattanak Kiri province.

The average number of beneficiary per one Referral Hospital is 100,000 persons. The World Bank loan is the main budget used for the construction of this project.

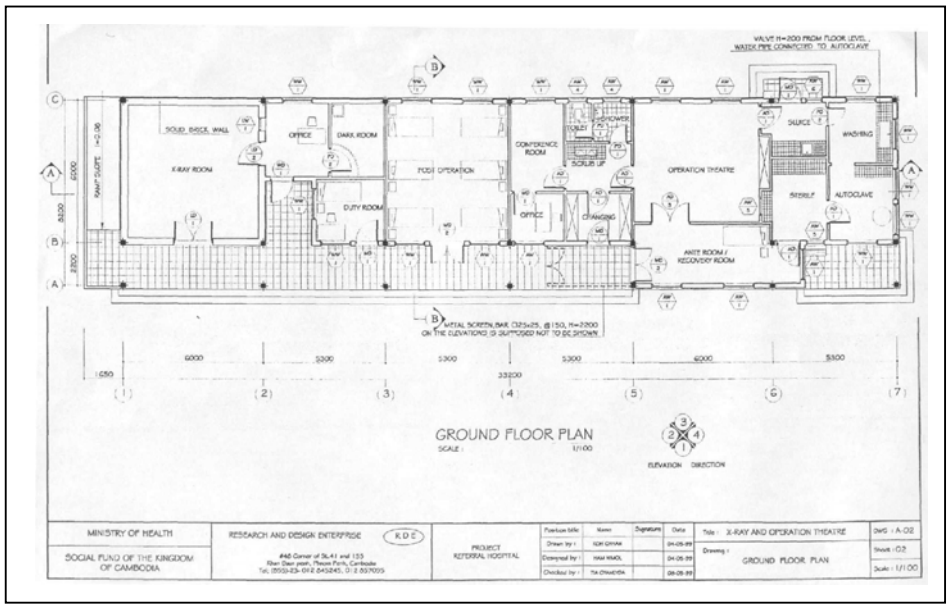

Fig.1 : The ground floor plan of X-ray and operation theatre of the Referral Hospital

Basic Information about Cambodia

General

Total population	11,4 million ;	Urban population	17%
Population under 15 years	42.8% ;	Annual population growth rate	2.5%
Total fertility rate	4.1% ;	Per capita income (US$)	249
Infant mortality rate (per 1000 lives births)	89		
Maternal mortality Rate (per 100,000 births)	473		
Life expectancy	male 50.3, female 58.6		
Literacy rate	male 79%, female57%		
Percentage of women in the total population	51.8%		
Government education expenditure (%GDP)	1.7%		
Government health expenditure (%GDP)	1%		
Cambodia's UN Human Development index ranking	153 (out of 175)		

(*source of information: Cambodian Population Census 1998 and National Health Survey 1998*)

Health

The leading causes of mortality are malaria, ARI (acute respiratory infection, for children) and tuberculosis. Currently the HIV epidemic has put Cambodia in a difficult situation. It now has one of the highest speed of HIV infection in the region. Each day about 100 Cambodian people are infected by the HIV virus. The cumulative (total) number of infection has now reached 200,000 cases.

Cambodia has one of the lowest rate of utilization of health service in the world. Rural people have limited access to the public services such as health and education. An average Cambodian has only 0.35 medical contact with organized health services per year. Only 16% of delivery take place in hospitals or health centre. Private sectors also

intervene in the provision of health care services. Right now the government has no mean in controlling the quality of those services. Rehabilitation and improvement of health services remain the key priority of the Ministry of Health. The World Bank and ADB loans are being used to rehabilitate the health system. HIV/AIDS response is highly depending upon foreign donors.
(*sources: National Review of the HIV/AIDS response in Cambodia and UNAIDS Country Profile*).

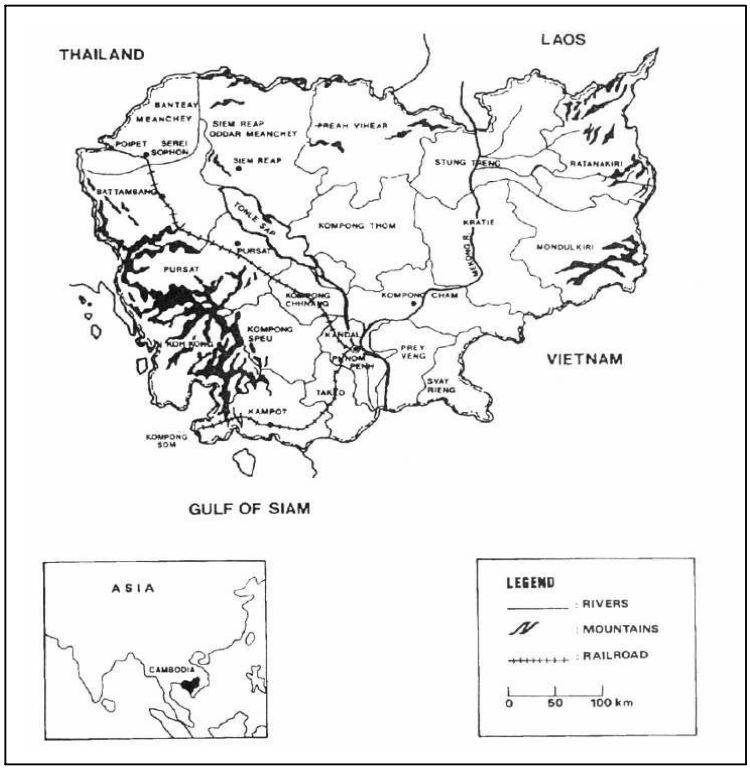

Fig.2 : The map of the Kingdom of Cambodia

Economy

Cambodia is one of the poorest country in the region and has some of the worst human development indicators in the world.
Recent economic growth has focused in capital city and surrounding area. The vast majority of population lives in rural areas. In two-third of the villages agriculture is the most important income-earning activities. Small trade comes in the second rank. Other economic activities include livestock raising, fishing, forestry and craft. Rural people depend largely on their land for survival. Rice yields are amongst the lowest in the region. Most households do not produce enough to eat. The land mine problem is the main concern that the government is now facing.

Design stage

Project organisation

The organisation of this project is a practical (standard) organisation expressing as line-staff form, it has been established within the Social Fund of the Kingdom of Cambodia (SFKC) not only for implementation of this Referral Hospital but for all kinds of projects financed by this institution.

The organisational structure of the SFKC

The Executive of the SFKC consists of the President , Board of Directors, Executive Committee and the General Director.
To provide advice and information to the Executive, the SFKC has Executive Support Units: Fund Raising, Internal Audit, and Management Information System (MIS). The day-to-day management of the projects is the responsibility of five operation Departments: Finance and Administration, Legal, Promotion, Appraisal and Supervision.

The functional responsibilities of the SFKC

Board of Directors: - Establish and approve the operatíng policies and procedures,
- Approve the annual budget and financial regulation,
- Approve and ratify the agreements entered into by the SFKC with donors,
- Approve the administration, finance and operation manual,
- Propose the scope and content of the reports to be submitted to the Executive Committee.

Executive Committee: Approve application of project financing.

General Director: - Direct and administer the day-to-day operation of the SFKC,
- Represent the SFKC in negociation of agreement with donors,
- Submit to the Executive Committee proposed projects for approval and appoint the staff to the SFKC.

Fund Raising Unit: Publication, donor liason, international conference, public relation, technical assistance and mission liason.

Internal Audit Unit: Audit of finance, banking procedure, procurement procedure, Project costing MIS, and physical audit of projects.

Management Information System(MIS) Unit: Computer specification and installation, network administration, design and implementation of project MIS, financial MIS, project costing MIS, management of MIS's and training on how to use MIS's.

Administration and Finance Department:
- Personnel, equipment and vehicles, office supplies, communications, travel, project portfolio and filling system,
- Banking, procurement of office equipment and supplies, project payments, payroll, operation expenses, accounting statement and reports, request of fund and statement of expenditure.

Legal Department: Review procurement procedure, project contracting, warranties and guarantees, external supervisor contracting, personnel contracting, dispute resolution, legal compliance of SFKC, and agreement negociation.

Promotion Department: Develop and update targeting strategy, material for workshop and application forms, data collection for targeting policies, coordinate workshop and meetings, develop and implement promotion strategy, project registration, ranking and prioritising projects, liase with applicants, screen applicants, sectorial coordination at ministry level, submit project to appraisal department, and update eligibility criteria and special condition.

Appraisal Department: Site appraisal visit, sector coordination level, identify possible local supervisors, assist development and update project costing MIS, develop standard design and specification, cost project, prepare appraisal reports, coordinate donor approval as project required, submit appraisal report to the Executive Committee, and prepare detail works package to Legal Department.

Supervision Department: Appoint external supervisors, prepare detail works package, develop supervision schedule, initiate work at site, oversee technical quality of works ensuring compliance to contract, supervise external supervisor, calculate and authorise monthly

progress payment, prepare and submit variation to the Executive Committee, prepare and authorised practical completion certificate.

In general, the design for renovation or construction of submitted project proposal from applicants to the SFKC might have been prepared by one of the three following options:

- the applicant / beneficiary and local authority,
- the local or international non governmental organisations,
- either the SFKC hires /purchases private consulting firm, in case of technically complicated design, or SFKC prepares it by itself for the easy project designing such as those for primary school, water and sanitation system etc..

For this Referral Hospital project, after ranking and prioritising the proposal of the applicants, the SFKC starts the process by issuing the letter of invitation for bid to five local and foreign consulting firms. Through competitive bidding, the RDE has been selected as a consultant, whereas the SFKC plays a role as project managing director and is responsible for co-ordination of all activities related to the project, since this institution has its own operational Departments - their roles as described above.

This means that the SFKC has to find out consultant and contractor through work procurement procedure and to supervise the production until its completion to be handed to beneficiaries. The SFKC is responsible also for the payment to the RDE, contractors, and external supervisors.

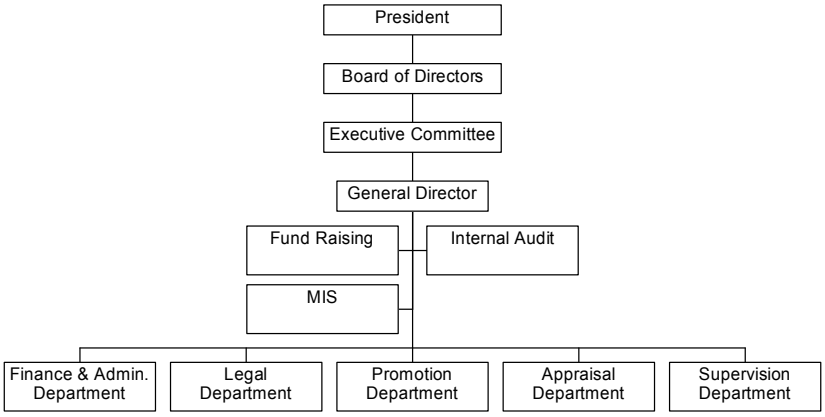

Fig.3 : The organisational structure of the Social Fund of the Kingdom of Cambodia

A simplified project organisation in which interested parties have been involved can be seen in the figure 4. This organisation structure was similar to that of the traditional method, but being as government project some differences existed in order to accommodate the procedure imposed by the World Bank.

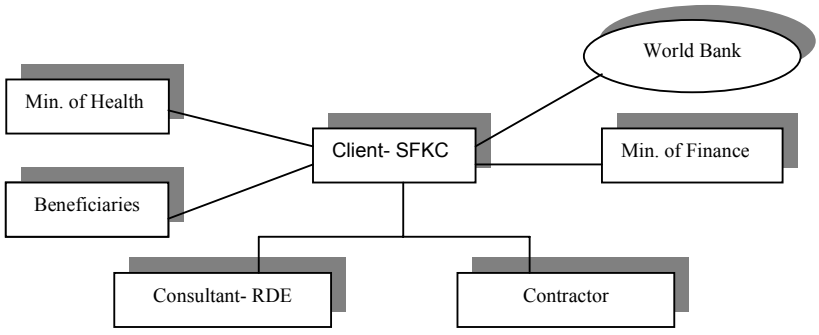

Fig.4 : The simplified project organisation chart

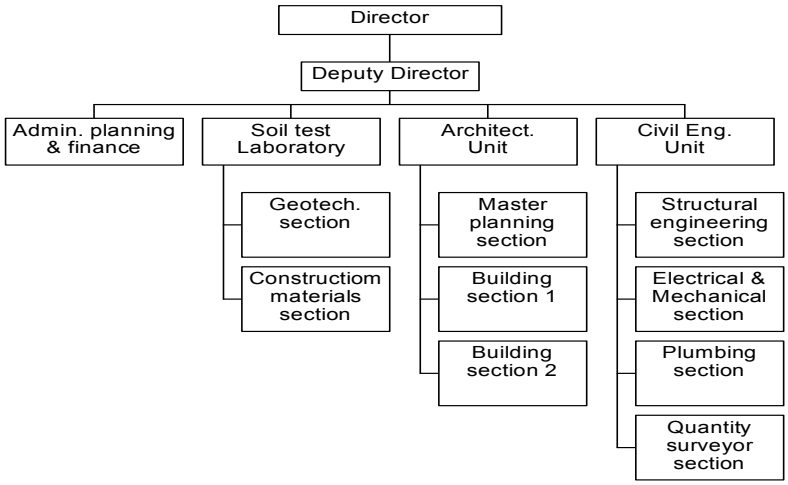

Fig.5 : The organisation chart of the Research and Design Enterprise

Procurement – Contracting

To obtain consulting service for this project, the SFKC followed a procurement procedure of the World Bank which is not much different to that of traditional procedure.

The letter of invitation for bid was issued by the SFKC to five consulting firms, local and foreign, whose were interested in providing consulting service for this project. A set of bidding document was given to these firm: instruction to bidder, form of bid and qualification information, condition of contract, contract data, and term of reference. To participate in this bid, the bidders were required to present their preliminary description of the proposed work method and work schedule including charts as necessary.

After evaluation and comparison of bid on technical and financial aspects of the bidders, a local firm, the RDE has been selected by the SFKC as a consultant for this project because this firm has offered a bid price which was not high compared to that of the other bidders and its bid document was confirmed to be most suitable to the project term and requirement.

A letter of acceptance issued by the SFKC to RDE stated also the sum that SFKC has to pay to RDE in consideration of service to be provided as described in the term of reference. To award this contract an agreement was signed between the SFKC and the successful bidder, RDE. Since the cost of the contract was not high and RDE has good record in consulting service over 14 years of experience, RDE was not required to delivered to SFKC a performance security in term of bank guarantee, which normally, it takes from 5 to 10 % of the contract price.

According to the contract, the payment of this consulting service was made in three steps.

Project planning

Planning is an important aspect with regard to control of any activity of the design process to achieve the required goal. This work plan prepared by the RDE comprised of the following steps: briefing, detailed design, working (shop) drawings, technical specification, and bill of quantities. A bar chart (Gantt chart) principle was used to make a work schedule defining activities involved and time frame for this project designing.

Normally, in the design process the architect starts the project first by initiating concept and drafting the project to get preliminary approval from the client. Once the draft is approved, the civil engineer then the electrical, mechanical and plumbing engineer/technician can start their specific designs.

For this project, due to some modifications based on technical aspect depending on limited budget, the RDE had to prepare this document twice in order to get final approval from the client and especially from the World Bank.

As per the agreed original schedule with the SFKC, the individual architect, engineer, technician, draughtsman, and quantity surveyor of RDE were paid according to the work performed.

In accordance with the contract agreement between the two parties reflecting to the work plan, the payment for design fee of 28,000 UD dollars to the RDE by the SFKC was done in three phases: 30% for each of the first two phases and 40% for the last phase.

Project financing

The World Bank loan is the main budget for the construction of this project. Under the loan agreement, the World Bank had to fund only 90% of the total project cost and the Government was obliged to secure 10% counterpart fund from its own resource.

As a condition to obtain this loan, in its operation SFKC had to follow strictly the guideline and procedure of the World Bank. Also, according to the World Bank's rule the overall operation cost taken by the SFKC, which includes mainly staff salary, site visit cost, and administration cost would take a maximum of 8% of the total cost of the project.

A budget of an amount 5.5 million US dollars, developed for two periods: from mid 1998 to mid 1999 and from mid 1999 to mid 2000, is being used for rehabilitation and reconstruction of health facilities including this Referral Hospital project and other project such as Health Center, Operational District and National Programme related to malaria, HIV and tuberculosis.

Budget and budget control

At the early stage in the SFKC operation , an overall financial disbursement program has been preliminary established and approved by the World Bank. This program defined the total estimated cost for all projects to be implemented by the SFKC and divided the project cost by sectors including: education, health, agriculture, public works, water and sanitation, and social welfare.

Since the cost of this project is limited, during briefing stage a total budget is investigated to be locked at the start of conceptual design and during design stage this budget is checked to ensure that the cost will not exceed the limit.

As a result of preliminary cost estimate, prepared in conceptual design stage, based on available information and unit cost database, it was found that the cost was high compared to the project cost limit as initially stated in the overall financial program of the SFKC. Therefore, the design was reviewed in term of technical, functional necessity and effectiveness by modifying the drawings and material and equipment to be used and omitting non essential items.

In this project, firstly the SFKC was requested to approve the conceptual design and preliminary cost estimate. To do this the SFKC proceeded the document requested by the RDE to the Ministry of Health for comment on technical aspect of this design concept, because this project is a part of health sector reform which is under the responsibility of this Ministry. Fortunately, there was no difficulty or objection to get approval from this Ministry, since the concept of design was referred to that of the existing functional concept document.

After obtaining preliminary approval from the Ministry of Health and then from the SFKC, the RDE continued to the next stage of detailed design, detailed cost estimate and technical specification preparation. In this stage, a cost check was carried out again, and it was revised three times at various intervals to ensure that the budget was not exceeded.

Before the SFKC forwarded the final design including drawings, bill of quantities, and technical specifications to the World Bank for approval, these document has been sent again by SFKC to the Ministry of Health to get approval.

Finally, the design and project cost have been approved by the World Bank. This approved budget served to the SFKC as a guide in implementation of the project.

Information technology

Generally speaking, in Cambodia the information technology is relatively new. There are very limited applications of this modern technology in construction industry. Most of the office works in both of public and private sectors are carried out manually.

Fortunately, the RDE and the SFKC have experienced in using computer to perform their routine works in the last few years. Consequently, it has proved that the application of information technology helped to make the work more efficient.

For this Referral Hospital project, Auto CAD software was used for preparation of architectural, structural, electrical, and plumbing drawings. This program has helped the architects and engineers to change and to modify their designs much easier and faster. With these tools in the briefing stage several options of the project design has been proposed to the SFKC. The drawing files on disks were also available to the SFKC for easy preparing the "as built drawings".

The quantity surveyor of RDE ,meanwhile, has also estimated the project cost using Microsoft Excel which was helpful and efficient for cost analysis and budget control, with this program the rate of activities in the bill of quantities can be revised and applied for other similar project.

In view of the above situation, although there has been sign of efficiency in the drawing process, there are still many things to be improved in this design process because the design is not always perfect, some details may not be practicable or may not be suited to the site condition. Therefore, in order to reduce these defects, one should accurately check the drawings and technical specifications.

Conclusion

Main concerns and issues worth to be considered in this conclusion are as follows:

- The organisation of the project must be formulated in an efficient way that makes all involved actors to be responsible for their tasks. This means that a detailed right, competency and working procedure (manner) amongst the client, the consultant, and the contractor have to be clearly defined and spelled out right from the beginning. They are obliged to work together with an mutual understanding to make an common smooth operation, avoiding any defect due to the shortage of efficient co-ordination or good relationship.
- The selection of consultant is a key task to start the project. The client, hence, has to analyse and to assess carefully the following aspects of potential consultants: experience, technical and financial capability, and references. Moreover, to have more chance in getting the best consultant one should establish a procurement procedure which will give more opportunity to various consultants and facilitate them to participate in the bid.
- In order to avoid any delay in the consulting service due to any ambiguity or change in the project proposal, both of the consultant and client must be given sufficient time to review carefully the term of reference which stated the details of the project requirement, and make it clearer before the designing is started.
- Since in construction industry there are many projects experienced cost overrun, attention must be given to the briefing stage of the design process. In this stage the designer should enable the client to redefine his wishes which will be limited by the budget capacity.
- The design process needs adequate consultation amongst concerned parties. Before releasing the document to tendering, the verification to make more clear and to minimise mistake on the drawings, technical specifications, and cost estimate is a must.
- One should employ in the design stage technical persons who are experienced in construction of the work in hand, because the lack of "buildability" is usually a consequence of the designers and detailers having insufficient experience in construction.
- The problem of lack of construction standards and regulations in the country has affected the efficiency and ability of the design process. In connection with this, the Ministry of land management, urban planning and construction and other concerned Ministries are required to make effort toward an urgent formulation and adoption of unified building codes and regulations to be implemented in the whole country. A long with this, also a standardisation of building elements, prefabricated components, and other fixture must be made.
- The use of information technology in the construction industry such as computer support programme, CAD software with two and three dimensions libraries, and other models is very important. It has proved to help more efficient the project execution and analysis, especially in designing, planning as well as cost estimation. A unit cost database using for cost estimation must be regularly updated.

The information technology used in Cambodia is very traditional and old, most of office works in both of private and public organisations are prepared manually on the paper, such a work is time consuming process. Therefore, despite of lack of fund, the information technology must be introduced and encouraged it use widely in the country. Moreover, the information technology is an area where Cambodians need more training and research for the future development.

Production stage

Tendering and contract

In Cambodia, depending on the project owner who is private or government and on the financier's guideline, the procurement of works might have to follow one of the following approaches:

- appointment and negociation
- close invitation – selective tendering which based on pre-qualification
- open invitation – open tendering which all contractors who are interested are invited for bid.

In most of the cases, however, the contracts are awarded through bid competition, which allows the client to have more chance in selecting the competent contractors whose qualifications meet the project requirement.

For the project under discussion, depending on different site locations and number of qualified contractors who were interested in the projects, the close invitation and the open invitation approaches have been used for the procurement of works after completion of project designing. This procurement implemented by the SFKC has to follow the guideline initiated by the World Bank.

For the open invitation, and advertisement in the local newspapers was prepared by the administration and finance department of the SFKC for invitation for bids and for selecting the pre-qualified contractors. The pre-qualification criteria were focused on financial ability, technical capacity based on past experience and annual turnover of the contractors. If pre-qualification is required, only the pre-qualified contractors will receive the invitation for bids.

The bidding documents in this case include:

- instruction to bidder,
- form of bid and qualification information,
- condition of contract and contract data,
- technical specifications, drawings and bill of quantities, and
- form of performance security and bid security.

To propose the price and works schedule in the bid, each bidder had to perform site visit in order to make himself aware of condition related to the contract and other requirements including access routes, delivery of materials and equipment necessary to complete the works.

A tender committee, of which members selected from the operational department of the SFKC, is responsible for the conduct of pre-qualification, evaluation of bids and recommending award of contracts to be submitted for approval to the Executive Committee of the SFKC. The bids were open on the assigned date at the SFKC office by the tender committee in the presence of all bidders' representatives. The bids that were not committed with the tender condition and instruction without explaining the reason were rejected. The bid proposal that has been judged by this committee as offering the best combination of quality, clarity of offer and cost effectiveness was selected as the successful contractor.

The letter of acceptance, which stated also the sum that the SFKC would pay the contractor in consideration of the execution of works by the contractor as prescribed, was forwarded to the winning contractor who was invited to sign the contract and submit a required performance bound.

The contract documents included:

- agreement,
- letter of acceptance,
- contractor's bid,
- condition of contract and contract data,
- technical specifications, drawings and bill of quantities, and
- other document listed in the contract data as forming part of the contract.

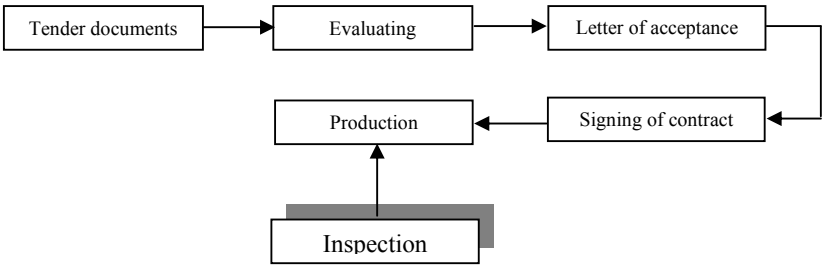

Fig.6 : The contracting process flow chart.

Production planning

For a good work implementation in the production process, the production planning has to be prepared thoroughly in order to achieve successfully the project goal which is known as time, quality, cost, and safety. The materials, plants, equipment and manpower and production methods are the main elements to be forecasted and programmed in the work schedule ensuring their optimum use. For smooth operation this schedule should cover the entire construction period and activities by establishing the sequence and priority of action to be followed.

In Cambodia, the commonly used techniques for production planning are the bar chart (Gantt chart) and the Network Analysis consisting of the Critical Part Method (CPM). These charts show the sequence of works, allocation of resources and date by which the contractors is proposed to complete the works.

For the above mentioned project, the bar chart was adopted, since it is widely used and easy to be understood for small local contractors. This chart shows clearly the relationship between the start and finish of each activity. The time frame given for this project varied from four to six months depending on different site locations and construction times during wet or dry season.

For each building component the main activities incorporated in the bar chart were site work, concreting, masonry, metal work, carpentry, water proofing, electricity, plumbing and finishing.

As stated earlier the contractor was responsible for determining his planning showing the general method, arrangement, sequence of all activities in the work within the duration as stipulated in the contract document. Therefore, to avoid any failure that might disrupt the entire production planning, the contractor had conducted survey at the site to get enough information on the availability of workmanship in the community, materials and equipment to be delivered, the temporary shelter and other working condition at the site etc.

The site supervision schedule of the internal supervisors of the SFKC was also made based on this production planning. The site meetings were held regularly between the contractor and the supervision department staff of the SFKC in order to monitor and review on site works - in comparison with the anticipated production planning - and to control the works quality.

It is to notify that during the works implementation of contractor, an external supervisor assigned by the supervision department of the SFKC was permanent at the site. In accordance with the work progress, the contractor prepared weekly and monthly reports, and submitted monthly payment certificate attached with revised bar chart for approval.

This production planning have been further updated showing the actual progress achieved on each activity and the effect on the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

Quality management

By definition quality management means the aspect of overall management function that determines and implement the quality policy.

As discussed earlier, the Supervision Department of the SFKC bears responsibility in checking quality of work implemented by the contractor ensuring compliance to the contract requirement. This department has appointed external supervisor who is civil engineer by profession to conduct permanently the works supervision at each site

during the construction process. A continuous judgement was made by this person as whether material properties, workmanship, construction methods and all the works comply with the drawings and technical specification or not. Any change in materials to the extent that it fails outside the specification limits or construction method that result in poor work quality must be rejected.

The site manager was required to report the work progress and any technical problem encountered during construction work at each site on a weekly basis to the Supervision Department. The officer of this Department had to control the site work every two weeks and usually after the work completion of each phase's work. He had to check the work and notify the contractor any defect founded, and then the later had to correct it within a set period. This inspection is always followed by check list fulfilling.

A main hold for the supervision officer to control the work progress and quality is authorisation of bill. If the contractor has not corrected defect within the time specified in the officer's notice, the payment for that part will be postponed till its achievement or otherwise deducted.

Although there has been a working procedure or methodology in the SFKC in quality management, it has proved that there has been still many inevitable weak points which resulted in poor work quality in some aspects. The work inspection sometime could not help efficiency to improve the quality of product due to multitude factors that, amongst other, include:

- the lack of efficient policy on quality control and lack of enforcement of clear building codes, standards, rules, and regulations to be implement in the construction industry.
- the lack of testing equipment and laboratory – absence of material quality control by testing its property in the laboratory before it is used. Most of basic materials available in local market such as cement, steel bar, brick or tile are of various kinds and sometime failed out of standard quality. The visual inspection that is often done by the supervisor is absolutely unreliable or unacceptable, because in this case neither contractor nor supervisor is able to know the material property without proper testing.
- the lack of practical and technical awareness of small local contractor and its skilled labourers in work quality performance. Sometime, their negligence may affect on work quality, for example, negligence in material handling, storage, concrete mixing etc,.
- the poor remuneration of external supervisor that always leads to corruption and shoddy works concealment.
- the lack of participation from independent supervisory body to be selected from the Government or private and lack of motivation opened to the beneficiary and the public in quality critic on the final product. Since the level of quality of works is always connected with the interference of competent body of the SFKC who makes decision on budget disbursement, it is believed that there must be a black screen of corruption behind this non transparent disbursement process.

Amongst the factors described above, the building codes, standards and regulations are the pre-requisite legal documents in quality management for both the consulting service and the construction works. It is to mention that in Cambodia, during 1960's, most of public works and building works have strictly followed the French standards and regulations. Since that time the construction industry of the country has been influenced by many other countries' standards and regulations. For instance, in 1970's – USA; in 1980's – Russia; and in 1990's mixed standards and regulations from France, Japan, Australia, UK, and USA. The influence has been that the consultants and contractors from these countries came to Cambodia to implement their projects along with their respective Government's aids or grants during that time.

Moreover, it is expected that in the near future the standards and regulations in the construction industry will be influenced by ASEAN countries, since Cambodia has recently became a member of this Association.

Up to now the country has not yet any clear standard and regulation at national level due to the lack of fund and human resource.

In response to the construction industry growth in the country, which becomes day by day more and more active, an urgent needs for the Government is to formulate and adopt an international unified building codes and standards - such as ISO 9000 series of standards - as National series of standards. There is also an obligation for the Government, especially the Ministry of Land Management, Urban Planning and Construction and other concerned Ministries, to prepare a clear policy on quality control and specific measures to be widely implemented in order to gain the standard

quality in the construction industry, even though the responsibility for managing and promoting the work quality rests primarily with all the actor involved.
Currently, no one of the big local construction company or consulting firm is ISO certified. Facing to the future market, these firms must have at least a similar ISO certification.

Economic control – budget review and reconciliation

The cost monitoring, the review on production planning and schedule are essential for economic control of each project. These tasks are supposed to be performed by both the project manager and the contractor.
In this economic control, the cause of delay, the discrepancies between the final expense and cost estimated in the bill of quantities or the non conformity between the bill of quantities and the drawings, and other affected issues can be found. These facts have to be analysed and solved out and must be used as experience for successful completion of future project.

In general, the greatest simple cause of delay and extra expense in most of projects is *change*. For that reason, all construction contracts very often contain provision for change which can be in design or in construction methods. For example, the unpredictability of ground condition is one of the reason for this. The accumulative effects of many small changes may also disturb the regular process of the works and may lead to considerable delay and expense. On the order hand a project may cost more because of additional works or lower productivity than initially planned or of inflation factor.

For this Referral hospital project the Supervision Department and the Administration and Finance Department has to maintain economic control and budget review. These Departments recorded and checked invoices, contractor's monthly statement of the estimated value of work executed and performed quantity measurement before certifying the amount to be paid to the contractor. Usually, the contractor was paid for the quantity of the work done at rate in the bill of quantities for each item. However, if the final quantity of the work done differs from what stated in the bill of quantities, the Supervision Department has to make adjustment on the rate which will not exceed 15 % of the initial contract price, based on the World Bank's guideline.
As the result of this review on construction project of the first site, some deficiencies were found as the following:

- *drawings*: small mistakes in the drawings observed by the contractor and supervision officer and insufficiency of some architectural details, which needed to be rectified and provided by the consultant RDE.
- *bill of quantities:* some quantities presented in the BOQ did conform to the drawings or did not reflect to the actual volume of work executed at site; and some items of sub-activities were not included in the BOQ.
- *change :* change in quality of material for foundation to fit the ground condition at the site; and change in materials due to their availability in the local market.
- *additional works:* removal of reinforced concrete structure for landscaping work.

Consequently, the adjustment and rectification on the drawings, technical specifications and bill of quantities were elaborated by the consultant RDE. These documents were reviewed by the Appraisal Department before tendering this project for the next site.
In overall, it can be said that the final account figure is not seriously affected, only the first construction site was over budgeted, about 10 % of the initially fixed budget. For the other site the discrepancies were less than 5 %. To compensate the project of overrun cost, the SFKC used the money taken from two possible alternative:

- the money left over from other projects which were under run of the budget limit.
- the contingencies of other projects that were within the budget.

The work completion dates for most of the sites have been delayed from one week to four weeks due to various reasons. This was accepted by the SFKC without any penalty, this complied with the SFKC's policy in helping local people to have job opportunity with reasonable payment.

Conclusions

The ability of all actors involved in the project in performing their tasks which refers to the quality of: project design, production planning, budgeting, working procedure and management method can be seen starkly after production stage. This ability is assessed based on deficiencies in their performance which always happen at different levels, some of which could be high (serious)and some could be low (neglected).
Therefore, the following ideas shall contribute to lower this deficiency level in order to achieve successfully the project goal which relates to the quality, cost, time, and safety of the final product:

- The project manager, the site manager, and the consultant are the key persons to be competent, they must have sufficient knowledge in both of technical and managerial skills which allow them to work closely in an efficient way.
- The meeting attended by involved actors should be held regularly at the site, because it would allow co-ordination problems to be resolved and could be very effective means of putting pressure on any whose performance in the recent past has been unsatisfactory.
- An emphasis should be put on the arrangement of professional training for manpower development to both of consulting firm and construction company which enables their personnel to have sufficient theoretical and practical knowledge in their field of responsibility. This training is intended to be intensive and realistic which responds to the market demand in construction industry of the country. The safety remains an important aspect among others.
- Introduction of scientific, advanced tools of modern information technology such as special software for production planning, economic control, and budgeting process is very important and it must be encouraged to use it. Although expensive, these tools would contribute to a more effective and more efficient work which will generate a lot of resource saving.
- Cambodia is obliged to develop its own standards of building components or elements such as door, window, tile, brick etc. made from available local resources and these standards should be revised over time in order to keep in line with internationally recognised standards. Meanwhile, the use of these local standardised products would give advantage on both aspects in design and in construction, and on the other hand it facilitate the quality control since these products must be guaranteed by original factory.
- By the time that the country has not yet a clear quality assessment system, ISO 9000 which is an internationally recognised set of standards on quality management and assurance system are preferably to be adopted. The control on quality must be implemented accurately, regularly as the project progresses till its completion, and be argumented throughout by all the parties concerned.

Property management

In general, to obtain the best possible economy and quality in the property management an analysis should be focused on the following factors which affected the property during its life : (1) financing, (2) running cost, (3) maintenance cost, (4) building techniques and building economics, and (5) taxes regulation.
These factors are influencing the cost of the property and they are also important to value the income of the property. In connection with this, the property manager who is government or private must have a concentrated knowledge in the great importance of this analysis.

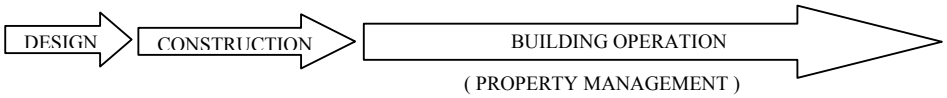

Fig.7 : The property management as part of construction process

Life cycle economy

Generally speaking, the life cycle of the property starts when it is erected and ends when it is demolished. During its life a proper management and a certain level of investment are needed. The management system together with various types of

investment put on the property such as investment on construction, maintenance or operation etc., always have great influence on the life cycle economy of the property, attention, hence, must be paid.

By referring to the project discussed above, it can be said by another way that after the completion of production stage for an efficient use or operation of the property during its long enough life span, it is required a proper management with an sufficient supporting budget.

However, the life cycle economy of this property was not analysed in details during the design stage, as this procedure is not being carried out particularly for this small project. There was only a rough estimation on annual administration cost, maintenance cost, running cost, in terms of expenses on medical staff's salary, water fees, electricity fees, drug supplies, and medical equipment repair etc,. But this estimation was unreliable because it was prepared based on inadequate information as references. However, when the Referral Hospital is put in use later on, the estimation of all kinds of expenses and incomes during operation of the hospital is to be prepared by the Ministry of Health's provincial Department together with the administration office of this hospital. In overall, the financing for property management activities is mainly responsible by the Government.

Maintenance planning

Without proper maintenance the property used will not survive over the required life span because it will reduce the frequency of failure and the risk of unexpected problem to the property. Therefore, a knowledge of expected failure rates is fundamental to the maintenance planning. Whereas, obtaining failure rate data requires testing of many components over long period of time.

A maintenance program must be able to respond to unexpected failures which may have to be dealt with immediately or scheduled into the daily plan. In formulating this programme it is required to know as the following:

- what maintenance task is to be performed,
- what resources are needed to undertake the task,
- what structure is needed to support the maintenance.

Actually, the Government is facing with the shortage of budget. Even the budget to be used primarily for running operation which covers the expenses on staff's salary, medical equipment, drug supplies, electricity and water consumption etc., is still not affordable enough. Due to this lack of budget, most of the Government properties have not been properly treated in maintenance. In fact, a minor physical damage of building at the beginning left over time until serious damage is occurred later on. This case is occurred very often for the Government property. As a result, most of them have reached their scrap value long time before their life expectancy period. On the other hand, when the maintenance is supposed to be, it is often carried out in an unplanned way or reactive way.

As the Referral Hospital is belong to the Government, its maintenance is the responsibility of the Ministry of Health's provincial Department to prepare program to be submitted to the Ministry of Health and further proceeded to the Ministry of Economic and Finance for funding.

Meanwhile, the Referral Hospital is allowed to charge fee from patients for health service and some part of this income are expected to be used for the operation of the hospital as well as for maintenance purpose.

Connection to the design stage – feed back

Decisions made in the design stage are obviously of great importance for future property management. For instance, a project may cost less to construct but a large amount of money will be needed for maintenance, if it is not properly designed or poor quality of materials are used. In this respect, the designer has to gather all relevant information and data, which generally are referred to the economical, technical and environmental aspects of the whole project as well as its detailed components.

A sufficient information and data would enable him to conduct correct analysis on various options of design before he could make decision to select which one is the most beneficial to the investor and the user.

A part from his " in-house" work, the designer/consultant should have enough time to visit construction site where he would gain more practical experience such as

applicability of functional concept of architechtural design, variety of construction techniques, buildability, , or the way to reduce maintenance cost in the long term etc., It is necessary to mention that when some mistakes happened in the design, the cost of design is minimal compared to the cost of delays consequent upon a redesign once the work is underway.

There are a lot things about bringing back of experience from the operation stage to the design stage. This feedback information regarding to the positive and negative aspects of design on property management should be given not only to the designer but also to the builder, so that they could use them for better economy and quality for future project.

Conclusion

Since the property management takes its longest period in the construction process and it is unlikely to be much considered for most of the Government projects, it is important to give some ideas in this conclusion as the following:

- the structure and the functioning policy of property management must be reviewed and redefined clearly in order to find out the efficient way on how to secure current deterioration of the Government's property.
- the failure rate data record and economical statistics data which are useful for the life cycle analysis and maintenance planning in the property management must be performed regularly.
- the lack of accurate and realistic analysis on the life cycle economy of a project during design stage or even during the operation stage will result in poor quality of property management which may lead to inefficient capital investment or take it into a risk of loss. In order to avoid this, however, a proper management system with a certain financial capacity must be considered as important and must be clearly defined earlier, at the design stage.
- it is also a big mistake of not taking care on the property maintenance, because a scheduled maintenance will enable the property to survive over the required life span. After the completion of construction work the "as-built drawings" must be made available for the project, in order to facilitate the future maintenance work.

Experience to be used in the future

Although the project in question is small and technically not too sophisticated compared to other projects, there are many points that can be taken as experience to be used for future projects. All these points have been already presented in details in the conclusion of each stage, namely design stage, production stage and property management stage.

Recommendations:

By referring to the current situation in Cambodia and compared with the knowledge obtained from the International Construction Management course in Sweden, the writer once again intends to emphasise on three following points in order to improve the working condition as well as economy, quality and safety in the construction industry in his country:

- the lack of legal aspect is the key factor that affects the overall efficiency in the management of construction industry. Any irregularity happened in this area mostly comes from the inconsistency of legal aspect which is supposed to be used as basic law and to be followed by all involved actors. Therefore, an urgent task of the Government would be to review all existing legal documents, reformulate them and put them in effective implementation. These documents would mainly include: construction law, standards / building codes / codes of practice, regulations and other guidelines which are commonly used in both of the Government and private institutions for procurement work, design work, construction work and property management.
- to educate regularly the members of involved entities (actors) in the construction industry a sufficient knowledge about these standards and regulations as well as other technical and practical skills relating to their field of responsibilities.
- to strengthen the implementation of law that means the effective measure must be taken to organisations or individuals in case of law violation - in proportion to the seriousness of their violation they must be prosecuted and disciplined, fined or accused of criminal charges.