FINANCIAL MANAGEMENT IN CONSTRUCTION

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Abstract

The paper in its introduction covers briefly the scope of Engineering Economics. It then goes on to show the need for Engineers, particularly those involved in construction, to have an adequate knowledge of financial management. The production cycle for construction is compared with those of other industries. The cash flow is then analysed with a view to identifying the causes of liquidity problems. Means of exercising financial control are then suggested.

Introduction

Engineering Economics concerns cost benefit evaluation and choice of projects, considering both tangible and intangible benefits, and return in the case of a private investment. This is the area of overall economic strategy, at the national level or for an organization. The other area is that at the stage of implementation, and primarily concerns the involvement in financial management of the implementing organization and deals with profitability (or whatever measure one uses to determine economic viability) and liquidity. This paper deals with the latter, and particularly for the construction industry.

The purpose of financial management in the private sector is to ensure a financially viable organization. The public sector organization has to work within the framework on which its existence was created. If it assumes a social function it was not intended to do, or if it assumes a function of providing intangible benefits to cover up bad management, that organization is not functioning as it was intended to in the context of the national economy.

The Need for Efficient Financial Management

We have had a number of discussions and seminars on various techniques of implementation planning for construction. But this however has not, up to now, extended to the dissemination of an adequate knowledge of financial management. One reason is that there is insufficient realization of the need for financial planning and control. If construction is done on estimates that can be modified as work progresses, there really is no need. This implies :—

(a) Output is not measured against cost, which could lead to lack of control over costs. (b) Input and output of cash into and out of the project are not planned which could lead to wasteful use of resources. But in the case of a construction enterprise that has to operate commercially, where the funds available are limited and the best possible use should be obtained from it, it becomes necessary to (i) measure output against cost so as to control costs. (ii) plan input and output of cash into and out of the project to ensure the returns and benefits desired. This becomes apparent if the production cycle that operates in the case of a normal commercial enterprise is analysed. If monopolising, profiteering and exploiting are non-operative factors, then the effectiveness of financial management would also determine the efficiency of construction.

A question that would arise is whether engineers should be involved in a function, or whether engineers should have extensive knowledge of a subject for which there are specialized personnel such as economists and accountants.

The management function in construction involves various aspects such as technical, labour, supplies and finance. Each one of these could be a specialized area. However, a construction manager has to have a sufficient degree of competence in all these if he is to be effective. The degree of competence should be such that he should, at least, be able to appreciate the specialized knowledge of those employed to assist him in the function of managing. It must be mentioned here that some construction organizations have found it better to place accountants with an acquired knowledge of engineering in topmost management positions, possibly because they have not been able to obtain engineers with a sufficient work-knowledge of financc.

The Structure of a Construction Organization

The total production effort of a construction organization is made up of a number of individual projects, located in different places; the equivalent of having a number of factories in various locations, subjected however to the vagaries of nature as the work takes place in the open.

The duration of a project in each place would be for a period of 1 to 4 years, during which the infrastructure for production must be developed, utilized and dismantled as against a manufacturing effort planned to operate for 30 to 40 years or more.

Tendering would imply a fixed price for the duration of the project; the equivalent of a forward contract.

Allowing for the degree of complexity, the time factor, and the uncertainty arising from forward contracting, the basic approach to financial management is not dissimilar to that in other production manufacturing efforts. The diagram of the production cycle in Fig. 1 would illustrate this point.

The financial position of an individual project is therefore necessarily reflected in the financial situation of the organization. A study of the financial management of a individual project is therefore relevant.

The Purchase of Production Resources (Capital and Recurring Expenditure)

An individual project consists of a number of varied and different items of work put together to produce a

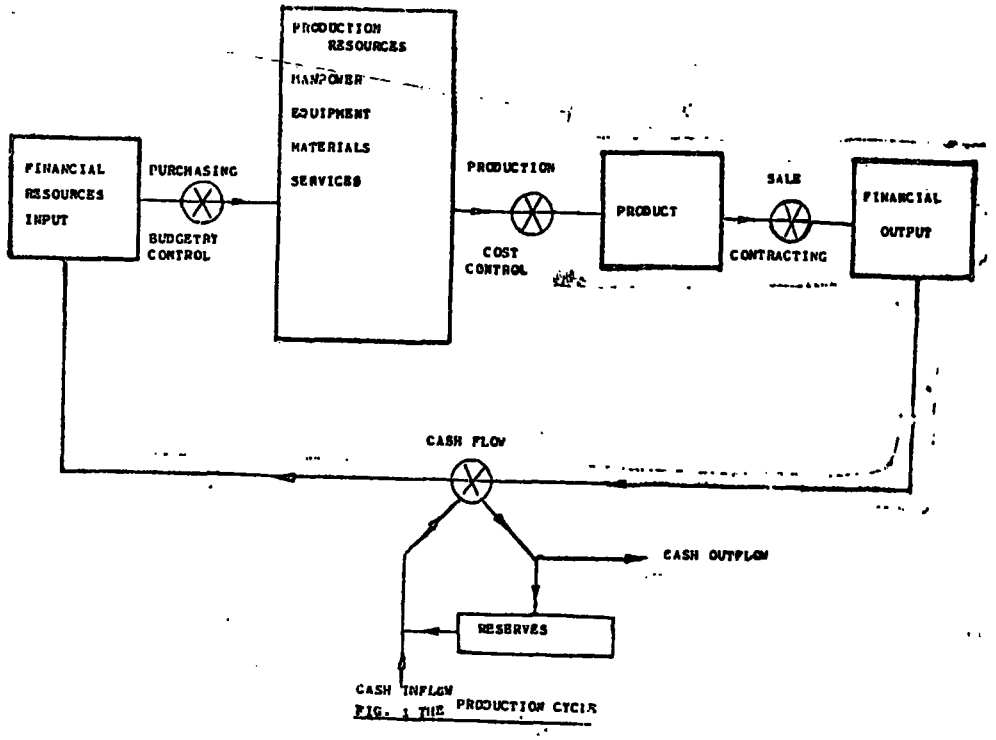

FIG. 1 THE PRODUCTION CYCLE

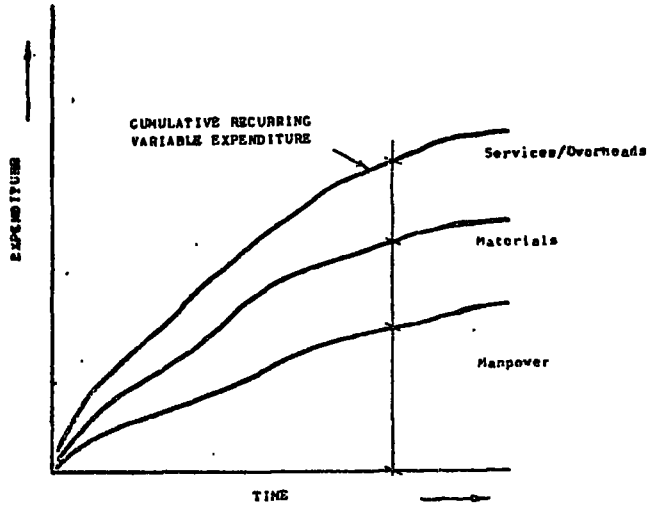

Fig. 2. Cumulative Recurring Variable Expenditure

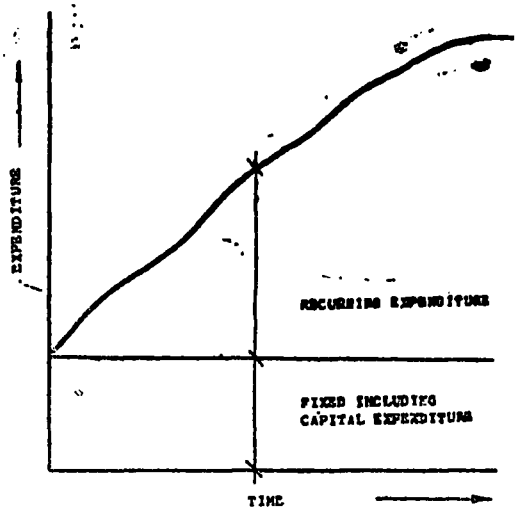

Fig. 3. Cumulative Expenditure

completed project. Each of these items would have its component of production resources that have to be purchased. They could be listed as follows :—

(1) Expenditure for wages, salaries, incentives, bonuses and contribution to provident funds—to provide manpower resources categorized as direct and variable.

(2) Purchase of materials incorporated into the works such as steel, cement, timber, finish fixtures—direct and variable. Consumable materials such as fuel lubricants, tyres, tubes, explosives—indirect and variable. Non-consumable materials with reusable value such as shuttering and pipes—indirect semi-variable. These would provide the material resources for production.

(3) Overhead expenditure such as insurances, bonds, taxes, communication, postage, rents and dues and other services.

(4) The equipment resource required for the project would be in various forms. The equipment purchased for the project from the project's financial resources, those deployed on a project from the organization's equipment holdings and equip.

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ment hired from outside. The first of these would be the capital investment on the project which would be partly or totally depreciated on the project. The second is a part of the organization's capital employed in the project and would be paid for as a hire or rental. The third category will be paid for as on hire service to an outside source.

The cumulative plot of the variable expenditure on a time-base would be as shown in Fig. 2. Added to the fixed including capital expenditure assumed to be incurred at the inception of a project the total capital and recurring expenditure is as given in Fig. 3.

Sale of Product (Income)

The income for a project would depend on the prices quoted and agreed in a tender document. Pricing is not merely a theoretical exercise based on what should happen, but an evaluation based on past performances as shown from cost analysis. It is in fact a prediction of the performance of the job, and on the accuracy of this prediction will depend the outcome of the project. However, being oversafe and pessimistic will not help in securing work if the bidding is competitive.

The prices quoted would also reflect the tendering policy and would in turn refer to the business policy of an organization. If there is a choice of work, would it give preference to already established lines, would it elevate its level of activity, would it take jobs for prestige ? If there is a shortage of work should it take on work with no prospects of profit, should it take whatever work that comes or should it shrink? These are all vital matters of policy that get reflected in quoted prices that would have repercussions on the finances of a project and the organization.

Where there is a choice of investment in different works discounted cash flow analysis could be used to determine the choice. However where there are restrictions in the market, or in the case of state organizations where other social considerations prevail, factors other than return on capital would predominate.

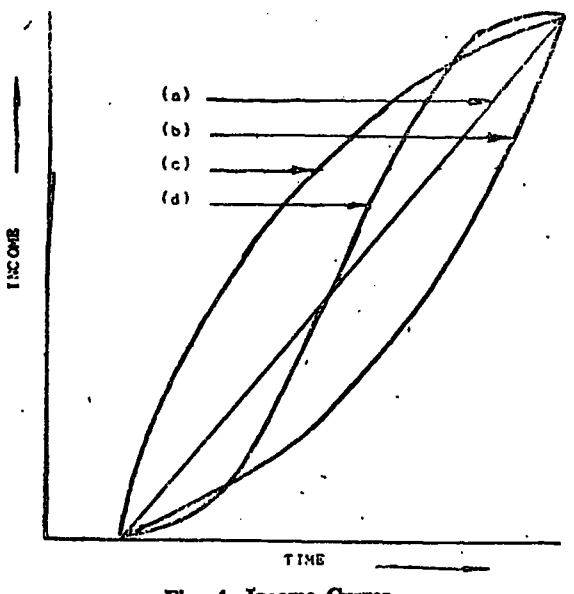

Fig. 4. Income Curves

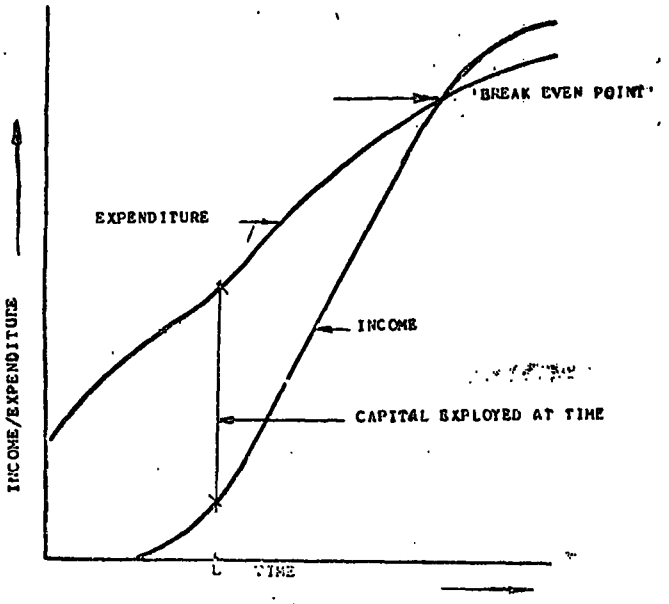

Fig. 5. Cash Flow

The income on a project would start some time after the commencement of a project. A cumulative plot of the income on a time-base would give an 'earning curve'. Possible type of earning curves are shown in Fig. 4. A purely repetitive excavation operation would, for instance, have a income pattern as in Fig. 4 (a) An income pattern such as (b) would indicate a progressively increasing rate of production, and pattern (c) would indicate a progressively diminishing rate of production. Generally the most realistic pattern would be as shown in (d), an S curve, which indicates a progressively increasing and then a diminishing rate of production.

The Cash Flow

A break-even chart is obtained by plotting total cumulative expenditure and income on a time-scale Fig. 5. In a normal manufacturing concern only part of the capital investment in equipment and fixed assets would be considered in a break-even chart. But in a construction organization where the capital investment in equipment is from project finances and has to be repaid during the contract period, that investment would become part of the expenditure. Under the circumstances a break-even chart could conveniently be considered as a break-even cash flow chart for the project.

The difference between the income and expenditure curves in Fig. 5 gives the total capital employed at any time on the project. This requirement has to be met from borrowings, the organization assets, and also from clients advances. Advances paid by the client for purchase of equipment and for mobilizing reduces the quantum of capital to be generated from other sources.

The interpretation of the 'break even' point would depend on what is included in expenditure. If the interest on borrowing, dividends on capital and taxes are included, then the point will signify that at which all borrowing and capital has been repaid and all interest, dividends and taxes on them also paid.

The total surplus of the income over expenditure plus the resident value of the equipment would constitute the nett earning from the project. If there is no break-even point, it would mean that the earning from the project is not sufficient to cover the capital invested. This does not necessarily mean that the project was executed at a loss as the residual value of the equipment, should be taken into account in determining this.

If there is no such point then at the end of the project there is yet capital employed with no return. Some of this capital would be in partly depreciated equipment, which could be utilized to generate returns elsewhere.

A percentage of payment is kept back by the client as a retention. In some projects this amounts to 10% of the total value of the project retained up to one year after the work is completed. In most cases the recovery of this money takes much longer. This is a very significant factor in the cash flow and must be considered in the financial planning.

Liquidity Problems

If the required capital is provided and utilized according to the financial plan and if the projected income is generated as planned the project will function. If however either of these do not materialize as planned the project will face liquidity problems that will demand solutions if the project is to continue to function.

The causes of liquidity problems can be itemized relating to the production cycle of Fig. 1.

(1) Inefficiency in conversion of financial resources into production resources caused by—
   (a) Employing surplus manpower.
   (b) Purchasing or deploying excessive equipment.
   (c) Purchasing excessive materials or at high prices or not purchasing all the necessary materials.
   (d) Unnecessary overheads.

A simple example would illustrate the magnitude of the effect caused by diviations from planned expenditure.

If for example a 10 million contract of two years duration is made up as follows :—

Man Power	—	3 m.	30%
Material	—	2.5 m.	25%
Equipment Investment	—	1.5 m.	15%
Service and Overheads	—	1.5 m.	15%
Contingency and Profits	—	1.3 m.	15%

If the manpower increases by 10% from the planned input from say 500 to 550 persons, the extra expenditure on wages would be 0.3 m.

If the duration of a project increases by 10% from 24 months to 26.4 months, at the higher level of employment the additional cost to the project would be 0.33 m.

The total cost of manpower would then be 3.62 m., the increase in cost amounting to 6.3% of the contract value.

A 10% increase in the cost, and or wastage of materials would be 0.25 m. or 2.5% of the contract value.

A 20% inflation in the prices of equipment which could occur due to delays in the award of a contract or other delays would cost 0.3 m. of 3% of the contract value.

A 10% increase in service costs and overheads due to extension of contract period would amount to 0.225 m. or 2.25% of the contract value. The total of these would then be 14.05% of the contract value which would very nearly wipe out the 15% provision made for contingency and profit.

(2) Inefficiency in the conversion of production resources into the product due to :
   (a) Underutilization or underproductivity of manpower.
   (b) Underutilization of equipment.
   (c) Wastage.

(3) Inefficient conversion of the product into cash—
   (a) Bad tendering.
   (b) Non-receipt and delays in receipt of payments.
   (c) Delays in the receipt of reimbursable extra costs.

(1) and (2) above elevates the expenditure and (3) depletes the income. The aggregate of the above mentioned adverse factors results in an unplanned deficit resulting in a liquidity problem. This has to be resolved if the entire production cycle is not to stall. What is likely to happen here, is that whatever cash available will be used to pay the wages of non-productive labour that cannot be easily discharged. The other essential production resources will remain unsupplied and the income from the project will diminish and stop unless action is taken to prime up the system again. If early action is not taken to avoid such a situation the contract may have to bear heavy losses.

Controls

What a contractor would have at the inception of a project would be a detailed break-down of cost of each item in the schedule of items tendered for. A programme of work would have been worked out. Based on these a predicted expenditure and income would be available. Hence the cash flow and the extent of financing required for the project. A cost control system suitable for the project can therefore be drawn up. The tools available for control are :

(a) The programme of work.
(b) The schedule of prices.
(c) The expenditure budget.
(d) The cash flow.
(e) The cost control system.

The programme of work can be directly related to the schedule of prices and depending on the extent of detailing required smaller items can be grouped to form larger units.

The expenditure budget is however a combination of the breakdown of different items of work in a schedule into the major production resources, and is not as such directly connected to the items in a schedule of prices. It serves to follow up the predicted patterns of expenditure and income as given in the cash flow, and would indicate that at a given time with the expenditure incurred a corresponding income has been generated. The expenditure budget serves to control the conversion of financial resources into production resources.

The cost control system serves the purpose of controlling the efficiency of converting the production resources into the product. The system would identify items or groups of items in the schedule of prices and would follow up direct and indirect costs to compare with predicted costs.

Whereas the expenditure budget would control and indicate general trends, cost control figures will help to determine the cause of such trends whether favourable or unfavourable. It follows that such information should be available fast if it is to provide a means of control. The scheme for feed-back of information must be simple and efficient if this is to be achieved. It may be desirable to be flexible on the degree of accuracy required in order to obtain information faster.

The Balance Sheet

The annual Profit and Loss Account and Balance Sheet of an organization would reflect the financial performance of the organization for that year and capital asset structure as at date and would necessarily reflect the aggregate performance of different projects in operation during the year.

Due to the nature of the industry, stock and asset verification could pose problems. Large construction organizations here, tend to, by necessity, carry large stocks of spares as they are not otherwise available locally, and these would be dispersed in a number of locations even on one project. Similarly, equipment assets would be dispersed.

The usual ratios used to interpret the balance sheet should be compared with those applicable to the industry, if the correct observations are to be made from the balance sheet.

Important ratios to be considered are :—

(a) Primary Ratio—Return to Capital employed

$$= \frac{\text{Profit}}{\text{Capital}}$$

There are variations in determining the capital employed. Where projects are partly financed by advances from clients, the equity capital is total assets less all liabilities. The above ratio should be interpreted in conjunction with other financial ratios.

(b) Profit Margin $= \dfrac{\text{Profit}}{\text{Value of Work Performed}}$

(c) Capital Turnover $= \dfrac{\text{Value of Work Performed}}{\text{Capital}}$

A reduction in the Capital Turnover ratio will affect adversely the return on Capital even with the profit margin ratio remaining constant. The current or liquidity ratio provides a quick guide to the liquidity of the undertaking.

(d) Current or Liquidity Ratio $= \dfrac{\text{Current Asset}}{\text{Current liabilities}}$

These and a number of other ratios are used to interpret a balance sheet. But as stated earlier, the peculiarities of the construction industry should be considered when comparing the values of these ratios with those considered correct for other industries.

Acknowledgement

The writer expresses his appreciation to Mr. K. Balasingham, Management Accountant, Ceylon Development Engineering Company Limited, for reading through the paper critically and for the useful suggestions made by him.

තැනීමේ කටයුතුවලදී මුදල් කළමණාකාරිත්වය

මෙල්වා පෙරේරා

මෙම පත්‍රිකාවේ ඉන්ජිනේරු ආර්ථිකය ගැන ඇති යෝග්‍යතා පිළිබඳව හැඳින්වීමෙන්, විස්තර ආවරණය වේ. අනතුරුව, විශේෂයෙන් තැනීමේ කටයුතුවල නිරතවන ඉංජිනේරුවන්ට මුදල්මය පාලනයක් ගැන දැනීමක් ඇතිකරන පරිදි එහි අවශ්‍යතාවය විස්තර කර ඇත. තැනීමේ ක්‍රියාවලියේදී නිෂ්පාදනය, අදල කර්මාන්තය අනුව සසඳා ඇත. මුදල්මය ගැටළුවලට ඇති හේතු දැනගැනීම පෙරදැරිව මුදල් ප්‍රභවය ගැන විශ්ලේෂණය කර තිබේ. ඉන්පසු මුදල් පාලනය ක්‍රියාත්මක කිරීම ගැන යෝජනා ඉදිරිපත් කර තිබේ.

நிர்மாணக் கைத்தொழில்—நிதி நிர்வாகம்

மெல்வா பெரேரா

இக்கட்டுரை ஆரம்பத்தில் பொறியியல் பொருளாதாரத்தின் நோக்கத்தை சுருக்கமாகக் குறிக்கின்றது. பொறியியலாளர்கட்கு — குறிப்பாக, நிர்மாணத் துறையில் ஈடுபட்டுள்ளோர்க்கு போதிய நிதி நிர்வாக அறிவு எவ்வளவு தேவை என்பதை அறிவுறுத்துகிறது. நிர்மாணத் துறையின் உற்பத்திச் சக்கரம், ஏனைய கைத்தொழில் உற்பத்திச் சக்கரங்களோடு ஒப்பிட்டுப் பார்க்கப்பட்டு, பணத் தட்டுப்பாட்டிற்குரிய காரணங்களைக் கண்டுபிடிக்கும் நோக்கத்துடன் பணப் புழக்கம் ஆராயப்படுகின்றது. இறுதியில் நிதிக் கட்டுப்பாடு ஏற்படுத்துவதற்குரிய வழிவகைகள் பிரேரிக்கப்படுகின்றது.