RISK ANALYSIS AND MANAGEMENT IN TECHNOLOGICAL PROJECT

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ABSTRACT

The paper discussed the technological industry's perception of risk associated with its activities and the extent to which the industry uses management techniques. This was achieved on the basis of oral interviews conducted on a random sample of thirty (30) respondents comprising of technologists and contractors / suppliers in Oyo and Osun States.

The results showed that though, little is relatively known about risk management among the technologists and contractors, greatest priority is still attached to financial and contractual risk respectively in the technological industry. It then concluded that risk management is essential to technological activities in minimizing losses and enhancing profitability.

INTRODUCTION

A lot of risks are attached to technological projects. However, the enormity varies from one project to the other. Infact, the future is largely unknown and most business decision-making takes place on the basis of expectations about the future. While the future is not fully predictable, neither is it totally unpredictable. Making a decision on the platform of assumptions, expectations, estimates and forecasts of future events therefore involves taking risks.

In view of adequate precautions for risks in technological industry, organizations from many industries have recognised the increasing importance of risk management. Many organisations in the foreign countries and a few ones in Nigeria have established risk management departments purposely to control the risks they are or might be exposed to in the process of discharging/executing their duties. The technological industry and its clients are widely associated with a high degree of risk owing to the nature of technological business activities, processes, environment and organisation. Although, Healey (1982) have defined risk as an exposure to economic loss or gain arising from involvement in the technological process, Mason (1973) and Moavenzadeh and Rossow (1976) have regarded this as an exposure to loss only. Raftery (1996) expressed risk as an abstract concept. Asaolu and Nassir (1996) described risk as an option where the outcome is not known in advance with absolute certainty for which an array of possible outcomes and the probabilities are known. Oxford Advanced Learners Dictionary of English explained risk to mean the possibility of chance of meeting danger, suffering loss or injury.

This concerning technological projects, three areas of risk could be identified and these are enumerated below.

1. Physical Risks
   Damages to man, material and money.

2. Non - Physical or Ephemeral Risks

The effect of natural phenomenal such as storm, war demonstration, fire outbreak and other factors that affect the well being of the project.

3. Material Risks

Perhaps major risks could be derived in technological works if there were set-backs regarding materials not delivered or not even procurred or pilfered or on a large scale burgled.

As a matter of fact, mobilization of man, material and money for constructions involves a lot of risks.

Potential Risk Factors

Decisions relating to the appraisal of and allocation of resources to technological projects take place over a relatively long time frame. Apart from the three identified areas of risk, the following underlisted constitute potential risk factors.

- The complexity of the project
- Duration of the project
- Project location, and
- Level of understanding of technological requirements. Indeed most of the risk issues are revealed only after post development reviews on commisioning which compare performance with pre-determined targets.

In fact, in most cases, targets set are not attained owing to unforseen circumstances. Perhaps, this could be attributed to some variables. These variables could include the following.

- Industrial actions
- Late decisions
- Deregulations by government
- Changed ground conditions.

William (1994) on the other hand has categorised details of each risk factor into events, impact, actions and contractual.

Risk Perception and Research Survey

Risk perception is generally believed to be influenced by people's belief, attitudes, judgement and feelings. MacLcod and Akintoye (1997) claim that risk perception cannot be reduced to a single subjective correlace of a particular mathematical model, such as the product of probabilities and consequences because this imposes unduly restrictive assumptions about what is an essentially human and social phenomenon. Choffray and Johnson (1977) and MacLcod and Akintoye (1997) have identified some of the factors influencing the formation of risk perception as

- educational background,
- practical experience,
- an individual's cognitive characteristics,
- the availability of information, and
- peer group influence.

However, in order to obtain the view of the industry on risk in technological projects, a random sample of thirty (30) technologists and contractors/suppliers scattered around Oyo and Osun states were interviewed in this regard. The respondents were asked to describe risk in technological projects.

The respondents offered diversified opinions, some of which are quoted as follows:

- "Factors which can adversely affect the successful completion of a project in terms of budget and schedule which in themselves are not always identifiable".

- "The opportunity to make a profit on a contract whilst satisfying the client quality".
- "The likelihood of unplanned events occuring".
- "The probability of a contractual activity costing more than allowed for in the tender".
- "Risk is uncertainty with regard to events and their effects which affects the project outcome in terms of cost, time, quality and any other relevant performance criteria".

Risk Premium In Technological Projects

MacLcod and Akintoye (1997) have identified some risks sources central to both the construction and technological activities. These include physical, environmental, design, logistics, financial legal, political, contractual and operation risks. In view of the fact that these risk sources influence projects performance in terms of time, cost and quality, it is not uncommon therefore for these to be assessed individually and a premium placed on each of them.

The premium placed on each of these sources of risk may be a function of the risk exposure faced by individual firms from each of the sources, the likelihood of occurence, the experience of the firm in dealing with the particular type of risk, the attitude of the firm to risk, the extent of impact posed by the sources and the likes.

The respondents were also asked to indicate the extent of importance their organizations attached to each risk source earlier identified. It must stressed that most of these things sound alien to the respondents. Responses were however forthcoming after further explantion was given in this respect.

Their responses pointed to the fact that financial and contractual risks are respectively ranked the most important. These are recognised as having most adverse effect on the successful completion of any technological projects. Contractual risks are those associated with flaws in contract documents, inappropriate documents, or improper contractual relationships. The risk consequences of contractual risks include claims and disputes, disruption of work, stoppages of work, lack of co-ordination, delays and inflated costs. Financial risks on the other hand include whether the client has enough money to complete the project, financial failure of the client or subcontractors, availability of money to the contractor or supplier in a suitable manner and time to enable the contractor/supplier to progress with the work. Environmental (e.g. weather) and project (design information) risks are respectively ranked the lowest in this regard.

Risks in Budgeting and Estimating

It is often said that during the bidding process, the contractor is attempting to assess the correct market price for a project not yet built, to a design which is subject to revision, on a site about which there is little information, and with a labour force not yet recruited. The financial implications of changes of this sort can be minimized by appropriate contractual arrangements. On the other hand, it is very unrealistic to expect that the precise details of the project as designed or constructed will be exactly as they were envisaged at the budget or tender stage, except in rare cases.

Table 1 explains some of the risks inherent in the clients budgeting decision.

Table 1: Risks and Uncertainties Affecting Technological Budgeting Decisions.

S/N	Risks of Uncertainties
1.	Precise ground conditions of site
2.	Substructure design/availability of materials to be supplied
3.	Detailed superstructure design/availability of transportation for the procurred materials.
4.	Timing of project/procurement
5.	Type of contract arrangements
6.	Inflation
7.	Market conditions (anticipated)

In budgeting and forecasting for technological projects, we should be mindful of believing that the more precise a figure is, the more accurate it is.

It can also be expressed that two contractors bidding for the same project on the basis of the same information are likely to produce quite different estimates of cost and, ultimately, of market or bid price. The reasons for this are elucidated in Table 2.

Table 2: Same Project, different contractor, different estimates of cost.

S/N	Variables	Reasons for the difference
1.	Cost of materials	Discounts, different suppliers, speed of payment, vertical integration.
2.	Labour Productivity	Skill, standard of workmanship.
3.	Labour costs	Wages, overtime, good staff
4.	Wastage	Materials, labour, theft
5.	Plant	Amount, type, own/hire
6.	Site Techniques	Different sequence of operations

S/N	Variables	Reasons for the difference
7.	Allowance for fixed price	Future increased costs
8.	Effect of design team	-
9.	Deliberate distortion	Cash flow, anticipating variations.
10.	Overheads	-
11.	Profit	-

Project Planning

Projects can usually be defined as a series of related tasks directed towards a major output. A new organisation form, developed to make sure that existing programmes continue to run smoothly on a day to day basis while new projects are usually completed is referred to as PROJECT ORGANISATION. A project organisation is an effective way of pooling the people and physical resources needed for a limited time to complete a specific project or goal. It is basically a temporary organisation structure designed to achieve results by using specialist from the start throughout the form.

Planning can also be described as the thinking which determines what course of action shall be taken to achieve a sepcific purpose. That is to complete a particular project at the lowest possible cost and within the given time available. Planning is therefore concerned with making the best use of resources. The resources are often referred to as the five Ms of management and they include money, materials, machines, manpower or labour and lastly, management expertise or methods.

The use of Critical Parth Method (CPM) could assist in achieving the project demand. Before CPM can be applied to a given project, four major conditions must be met and they are highlighted below.

(i) Work can be defined with a specific goal and deadline.

(ii). The jobs or tasks are independent in that they may be started, stepped and conducted separately with a given sequence.

(iii). The jobs or tasks are ordered in that they must follow each other in a given sequence.

(iv). A job or task once started must continue without interruption until completion.

Project Scheduling

Project scheduling is determining the project's activities in the time sequence in which they have to be performed. Materials and people required at each stage of the project are computed in this phase, the time each activity will take is also set. Charts can also be developed for scheduling materials.

A very popular scheduling approach is the Grant Chart, named after the inventor, Henry Grant. Grant chart reflect time estimates and can be clearly understood as in the case of CPM/PERT.

Grant charts assist managers in ensuring that:

(i). all activities are planned for;

(ii). their order of performance is accounted for;

(iii). the activities are recorded; and

(iv). the overall project time is developed.

All these activities serve the primary purpose of eliminating to the bearest minimum the risk that are likely to occur in the project.

Project scheduling serves the following purposes.

(i). It shows the relationship of each activity to others and to the whole project.

(ii). It encourages the setting of realistic time and cost estimates for each activity.

(iii). It assists in making better use of people, money and material resources. This is achieved by identifying critical bottle - necks in the project.

MANAGING RISKS

Methods of risk allocation may take any one on combination of risk retention, risk transfer, risk reduction and risk avoidance.

Risk retention, according to MacLeod and Akintoye (1997), becomes the only option where risk prevention or transfer is impossible, avoidance is undesirable, possible financial loss is small, probability of occurrence is negligible and transfer is uneconomic. Risk avoidance in technological projects is generally regarded to be impracticable as it may lead to projects not going ahead or a contractor submitting an excessively high bid for a project. Risk reduction techniques include the use of alternative contract strategies, different methods of project execution, project redesign, more detailed and further in-depth site investigations, etc (Thompson and Perry, 1979).

Sources of risk may also be internal or external to the project. Major (internal) sources of project risk include size, complexity, novelty, speed of design and material delivery and location. Table 3 summarized the internal and external sources of risk.

Table 3: Sources of Risk

SOURCE OF RISK			
INTERNAL	- Size	EXTERNAL	- Inflation
	- Complexity		- Market condition
	- Novelty		- Escalation on input resources
	- Intensity		- Political uncertainty
	- Physical location		- Weather

The risk management cycle of figure 1 below is also a useful way of dealing with project risks.

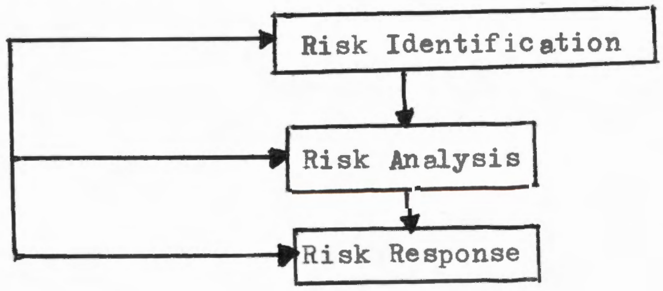

Fig. 1: Risk Management Cycle.

On large and complex projects, the identification stage is the most time consuming. Systematic and creative approaches such as formal brainstorms are useful in risk identification. Once the identification stage has been completed, a decision them needs to be taken on whether a formal analysis stage is needed and if so, which technique to adopt. Frankly speaking, it is only worth spending time and money on risk analysis if the identified risks are greater than the cost of the analysis. The general guiding principle of risk response is that the parties should seek a collaborative and a mutually beneficial distribution of risk. The starting point for the distribution of risk is the contract. In the words of Raftery (1996), responses to risk are usually summarized as retention, reduction, transfer and avoidance.

Risk Management Techniques

Techniques of risk analysis in technological projects include risk premium, risk adjusted discount rate, subjective probability, decision analysis, sensitivity analysis, Montecarlo simulation, stochastic dominance, Casper and Intuition. Methods of decision analysis also include algorithins, mean end analysis, bayesian theory and decision tree. These provide decision-making tools in an uncertain environment.

The decision trees depicts sequence of known choices (a number of alternatives) and their possible outcomes graphically in a tree form in such a way that the decision maker can identify best alternatives that achieve the objectives of a major project. The decision tree method is very useful in contractual problems such as whether to proceed with a claim and assessing the likelihood of a claim succeeding.

Monte Carlo analysis is a form of stochastic simulation. With the use of this method, the probability of project outcome is obtained by carrying out a number of interactions, with special consideration to the degreee of confidence needed. Caspar is a computer aided simulation for project appraisal and review. It is also a project management tool designed to model the interaction of time, resources, cost and revenue throughout the entire life span of a project and it has capacity to evaluate the consequences of factors such as delay and inflation, and changes to the [illegible] market or to production rates.

CONCLUSION

The responses to the strategies for dealing with risks in technological projects suggest that the industry is mostly risk averse. For example, the clients transfer most of the risks to the contractors. The contractors on the other hand, transfer risks to their domestic and specialist sub-contractors and through insurance preminums.

A few of the respondents are aware of what is involved in risk management but they hardly apply it due to lack of familiarity. The implementation of project risk analysis and management, in view of the implications for technological business profitability, may demand education and training of the technologists and other professionals in risk management techniques to bridge the gap between theory and practice.

Some of the several options for dealing with this could be in the form of formal and/or informal education and training. Formal education could be either diploma or postgraduate studies in risk management which managers and other categories of staff could undergo on a part-time basis. Informal education and training could be in the form of Continuing Professional Development (CPD) programmes organised by academic establishments or interest groups within professional bodies. Also, legal contracts should be ensured so that every party knows his rights and obligation during performance and also potential liabilities that could determine whether project can be completed successfully as established.

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