

Iqra National University
Department of Civil Engineering

Final-Term Assessment

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Discipline: MS Civil-Engineering

Course Title: Risk and Disaster Management in Construction

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Q1) Define & explain the risk log/register in your own words. Develop a risk log/register for the construction project (you have worked in or you are working). Detail of each project must be unique and should be provided accurately to the best of your knowledge. Risk register is attached at the end of the paper?

Solution:- Risk-log:- The after effects of the meetings and surveys of the programme and financial plans should form the reason for a hazard log or hazard register that will list all the recognized dangers. It will likewise contain appraisals of their expected effect on the spending plans, programme and quality/execution parts of the venture. To help control the hazard log can be gone into a database framework to encourage recording putting away and arrangements under different headings.

These may incorporate,

- Project phase
- the owner of the risk
- location
- other user defined categories

- Project Programme and budget.
- A database encourages the positioning of dangers as indicated by subjective appraisal (high, medium, low). It likewise allows quantitative assessments regarding percent likelihood & cost away (permitting semi-quantitative examination also positioning). Some database applications will permit quantitative examination utilizing the monte-carlo reproduction.
- The hazard log will likewise contain the data on activities to evade, alleviate, or move hazard, the optional danger emerging and conceivable fallback plans. The hazard log will be equipped for being refreshed and will give a review trail. It is conceivable to utilize the hazard log as an administration instrument to brief hazard proprietors to make a move. Status reports can be likewise be created.

→ Main Categories of Risk

- The task constitution and hierarchical structure including the quantity of gatherings and the legally binding, or other connection between them.

- The task Supervisory crew including experience and accessibility of key staff, Lin house, Specialists, & Contractual workers).
- The board authority and endorsements required work to continue
- Site - explicit security methodology, licenses required and team.
- Ground conditions, including exceptional factors.
- Dangers emerging from the agreement / acquisition procedure, including left over danger, if the sub-contractor does not perform.
- Dangers emerging from interfaces.
- vulnerabilities and presumptions in the undertaking extension / structure.
- Transitory works for development / destroying.
- Potential for cost development due, to structure advancement, the expended degree of recognised dangers
- The recognition of possible temporary workers with particular kind of work, what is more, area.
- The degree of rivalry between likely contractual workers & providers.
- Conveyance time of materials and hardware

- Degree, assuming any. of novel work.
- Imperatives on the undertaking programme.
because of assets / staff deficiencies, perhaps
due to contending ventures.
- Precaution measure to secure staff, work
and the encompassing region.
- unique estimates required for the taking
care of and removal of waste, ruin or
debased material.

P.T.O

Using risk log to formulate risk management strategy:

Following from the making of a far reaching hazard log, a diagram of the complete likely hazard presentation of the venture can be planned, in light of the affectability of the spending plan and program to distinguished dangers and their likely effect as far as spending invade, postponement and effect on the task's exhibition goals. The point is to decide the most financially savvy system of hazard shirking, alleviation as well as move. The variables to be considered are:

the potential impact(s) of each risk;

- the possibility of avoiding the risk through management action, provided that any secondary risks are not too great (secondary risks are those that arise as a consequence of taking the mitigating action);
- the possibility of taking actions to mitigate the risk, for example, by carrying out more thorough ground surveys to provide better information to the project team, its contractors and consultants. In this case, the risk to the probable cost of the ground works must be more than the cost of the survey otherwise the additional cost of the survey is not worthwhile;
- risks may be passed (i.e. transferred) to other parties, for example, a consultant, supplier, contractor or insurance.

In the case of risk transfer, two tests must be applied:

(1) Cost-effectiveness. It is usual for a premium to be charged by the party accepting the transferred risk. The issue is whether or not the premium to be paid is significantly less than the probable cost of accepting the risk in the first place. There is, however, a second consideration.

(2) The ability of the transferee to manage and accept liability for the risk should it occur. This is particularly important when significant risks to which the project is sensitive are passed to others, for example, contractors or suppliers. It may be that the risk premium charged by the contractor or supplier for accepting the risk is inadequate to cover the cost of remedial action and the contractor or supplier is unwilling, therefore to carry it out. If this is the case, the project may suffer an adverse impact greater than the cost of retaining the risk would have been in the first place, bearing in mind that the premium paid to the transferee might be irrecoverable. (This is the residual risk of the contract procurement strategy.)

In other cases, the contractor/supplier may claim that the risk was excluded from his contractual responsibilities or was unforeseeable. When such claims are successful, the employer will effectively pay twice for the transfer of the risk:

- once through the premium charged by the contractor/supplier; and
- once through the successful claim.

It is particularly important therefore that the employer gives very careful consideration to risk transfer through contracts, the risk premium which contractors and suppliers are likely to charge and the types of contract available to achieve the optimum risk minimization strategy. It must be borne in mind that in competitive bidding, contractors may not be able to fully price the risks that they are expected to carry. If the risk occurs, there is in fact no funding for its consequences or mitigation. Whatever type of contract is chosen, it is essential that specialist contractors and suppliers who are best able to manage specific risks are used.

The following factors must be considered:

- the extent of overlap of design, procurement and construction, if any, to achieve the desired completion date;
- transfer of risk and the premium(s) to be paid;
- transfer of control; transfer of responsibility; and
- the number of interfaces between contractors/suppliers which must be managed.

It must be noted that theoretical advantages may be difficult to achieve (e.g. price certainty through fixed price contracts where risk is high or the scope is not well defined). The objective of any procurement strategy is to achieve the best VF Mat the least risk. Fundamental to this is the understanding of realistic cost levels for tenders so that unrealistically low bids are not accepted.

In so far as risk assessment by the employer is concerned, a detailed understanding of the risks to be carried by contractors and suppliers, or to be shared with them, will enable:

- tender documents to be drafted to ensure that appropriate information is elicited from bidders;
- tender assessments to include a full appreciation of the risk being carried, how they will be managed by the bidders and what the implications are for the employer.

This is achieved by:

- ensuring that risks are identified and clearly specified in the tender documents;
- that the allocation of risks and responsibilities in the contract documents is clearly defined;
- the risk log can be used as a checklist during the tender assessment.

As noted above, even when risks have been passed to a contractor or supplier, there is the residual risk that they will not manage or will succeeding passing it back totally or in part through claims. Contingent sums should be allowed in budgets for these residual risks.

Text in red and enclosed in [] is explanatory and should be deleted]

| ID | Date raised | Risk description | Risk | | | Without controls | | | Controls | Residual risk | Action |
|------|-----------------------------|--|-------------------|-------------------|-------------------|---|--|---|--|--|---|
| | | | H | M | L | Cost impact | Time impact | Other | | | |
| No.] | [Date mm/dd/yyyy] | [There is a risk that.... If this happens...] | [tick or enter Y] | [tick or enter Y] | [tick or enter Y] | [The cost if the risk occurs e.g. x man days] | [The time impact if the risk occurs e.g. x days delay] | [Anything else that would happen e.g. lost reputation] | [Actions that will be taken to reduce the impact of the risk] | [Any risks that remain once the controls are in place] | [Document any actions to be taken to implement controls or manage residual risks] |
| 1 | 24 th March 2020 | There is a risk that if due to Covid-19, the government lockdowns the country, construction work will be halted. | ✓ | | | If the risk prolongs for more than two months, it will affect the cost of project as due to halted sites, contractor may generate claims. In addition, ask for extension of time. | If the sites are halted for more than two months, the construction targets will not meet. As we have a target to handover sites before June 2020. However, this lockdown will prolong the project completion to August 2020. | Despite of Claims from contractor, the management cost of the project will also increase which includes staff salary, office rents, car rents, firms liabilities etc. | As it is an international risk and there is no other way to avoid or control it, the only action to be taken is to resume the sites following SOPs suggested by the government. To adjust the claims, EOTs from contractor due to this lockdown period, a complete project delay analysis to be done from start till date. And liquidated damages, penalties to be applied if any, So that the penalties and claims amount may balance out each other or may | Apart from the controls applied, there is a risk maintained that management cost of the project would be increased. As due to government instructions, staff will be advised to work from home, which may affect the pace of project towards completion. Secondly, if sites are not closed | Notices to be issued contractor or regarding controls taken. In addition, in order to control residual risks notices will be issued to contractor or to insure proper quality and follow standards and specifications of the firm, while performing activities in the absence of field staff. As at the time of taking over the sites |

| | | | | | | | | | |
|---|----------------------------|---|---|-----------|---|---|---|--|--|
| | | | | | | | reduce to some extent | and staff to monitor sites remotely may affect the quality of work. | quality will be utmost requirement. |
| 2 | 27 th July 2020 | There is a risk of sites closure due to Eid Ul Azha holidays. | ✓ | No effect | Although as per government policy, 'Eid holidays will be from 31 st July to 2 nd August. However, Labor take more holidays for such kind of events. Which extends up to 7 – 8 days. This break of labor may affect the timely completion of project | During 'Eid holidays, as sites will be closed so there will be chances of loss of Material & Equipment from site. For which the client will not be responsible and contractor itself will take precautionary measures. No such claim will be entertained by the client. | Notices will be issued to contractor to submit a complete Eid holiday schedule. In addition, government policies to be followed while taking 'Eid Holidays. Force majeure to be taken for completing the ongoing activities before 'Eid Holidays. Activities to be planned in such a way that major activities are not affected in 'Eid holidays. | During 'Eid holidays, as sites will be closed so there will be chances of loss of Material & Equipment from site. For which the client will not be responsible and contractor or itself will take precautionary measures. No such claim will be entertained by the client. | Notices will be issued to contractor or to insure controls and residual risks are encountered. |

Q2) Discuss how Cost-benefit-Analysis for a project? Support your arguments with example?

Ans) Cost-Benefit-Analysis :-

for the Decision making tool accounting for the Social Costs & Social benefits of a project over-time to establish a net present value.

CBA in Project management is one more tool in your tool box. This one has been devised to evaluate the cost versus benefit in your project proposal. it begins with a list as so many process also.

Benefit > Cost
→ Types There are three types from which we can analyze any project/system.

- Pay back analysis
- Net present analysis
- Return on Investment

Q1) Pay-back analysis :-

The number of years it takes including fraction of the year to recover initial investment is called Payback period.

$$\text{Formula} = \frac{\text{Investment required}}{\text{Net amount Cash inflow}}$$

→ Example.

The you invest \$ 100 in a business
Free cash flow is as follows:-

| Year | Cash Inflow | Collected Payback |
|--------|-------------|-------------------|
| Year 1 | \$ 40 | \$ 40 |
| Year 2 | \$ 30 | \$ 70 |
| Year 3 | \$ 30 | \$ 100 |
| Year 4 | \$ 24 | \$ 124 |
| Year 5 | \$ 15 | \$ 139 |

$40 + 30 = 70$
 $40 + 30 + 30 = 100$
 $40 + 30 + 30 + 24 = 124$

So, Payback Period is 3 year

→ Net Present Value

Net Present Value is the difference between the present value of cash inflows & present value of cash out flows over a period of time.

→ Example:-

| | Year 1 | Year 2 | Year 3 |
|-----------|--------|--------|--------|
| Project | | | |
| Benefits | 0 | 3000 | 4000 |
| Cost | 4500 | 2000 | -2000 |
| Cash flow | -4500 | 1000 | 2000 |

$$\text{year 1} = -4500 \times (1+1)^{-1}$$

$$\text{year 2} = -2250$$
$$= 1000 \times (1+1)^{-1}$$

$$\text{year 3} = 500$$
$$= 2000 \times (1+1)^{-1} = 1000$$

$$\text{NPV} = -2250 + 500 + 1000$$

$$\boxed{\text{NPV} = -750}$$

Net Present Value gives the current value of the project. where year project lies in the current year.

3) Return on investment:-

$$\text{R on Investment} = \frac{(\text{Est. Lifetime benefit} - \text{Est. Lifetime Cost})}{\text{Est. Lifetime Cost}}$$

Example:-

Lifetime benefits = 50000
Lifetime Cost = 30000

$$\text{ROI} = \frac{50000 - 30000}{30000}$$

$$\boxed{\text{ROI} = 0.66 \times 100 = 66.67\%}$$

assume ~~ROI~~ lifetime = 3 years.

$$\text{So, } \frac{66.67}{3} = 22.22\% \text{ return per year}$$

Purpose of Cost-Benefit-Analysis:

The Purpose of Cost-benefit analysis in Project management is to have a systematic approach to figure out the pluses & minuses of various paths through a project including business requirement & investment.

There are two main purposes in using CBA.

- 1 → To determine if the project is sound, justifiable and feasible by figuring out if its benefits outweigh cost.
- 2 → To offer a baseline for comparing projects by determining which projects benefits are greater than its cost.

Advantages of Cost-Benefit-Analysis:

- Makes explicit the economic assumptions that might otherwise remain implicit or overlooked at the design stage.
- useful for convincing policy makers & funders that the benefits justify the activity.

→ good quality approach for estimating the efficiency of programmes & projects

→ Importance of Cost-Benefit-Analysis

→ CBA facilitate meaningful comparison

→ CBA is conducive to good programme management.

→ CBA and distributional impact.

→ CBA as integral to an evaluation strategy

→ CBA can help to meet legislative requirements

→ Process of Cost-Benefit-Analysis:-

CBA as a process consists of three basic activities.

- 1) identification of cost & benefit.
- 2) Evaluation of cost & benefits
- 3) choice of system.

1) identification of Cost & Benefit:-

identify the cost & benefits associated with task/operation, or investment project.

② Evaluation of Cost & benefit:

Variable direct & indirect (long term, intangible, fixed) & benefits associated with each task (operation) investment.

③ choice of system:

involves select the best system which yields least cost & yields maximum benefits.

Cost-benefit Ratio:

$$\text{Cost-benefit Ratio} = \frac{\text{Benefits}}{\text{Cost}}$$

Example:

Suppose we have a three possible solution

| | Solution A | Solution B | Solution C |
|--------------------|------------|------------|------------|
| Total cost | Rs 10,000 | Rs 15,000 | Rs 20,000 |
| Total benefits | Rs 12,000 | Rs 19,000 | Rs 23,000 |
| Cost-Benefit ratio | 1.20 | 1.27 | 1.15 |

In this example the solution A has lowest cost (Rs 10,000) but that solution C generates the highest benefits (23,000) however we compare the cost-benefit ratio we see that the solution B offer the best

Cost-benefit ratio (1.27). So we will normally select the base of these figures at the solution which give highest cost benefit ratio. we will chose solution B.

Example: 2

An example of cost-benefit analysis includes cost-benefit ratio where suppose there are two projects where project one is incurring total cost of \$8000 and earning total benefit of \$12000 whereas on the other hand project 2 is incurring cost of \$11000 & earning benefits of \$20000, therefore by applying cost-benefit ratio

Project 1

Total cost = \$8000

Earning total benefits = \$12000

$$C-B-Ratio = \frac{8000}{12000} = 1.5$$

Project 2

Total cost = \$11000

Total benefit = \$20000

$$C.B. Ratio = \frac{11000}{20000}$$

$$= 1.81$$

So, project 2 is feasible having high Cost-Benefit Ratio.

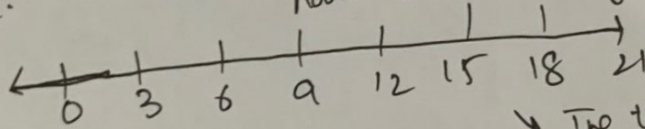
Q3) what is normal-probability distribution?

Ans): Normal distribution,

normal distribution, also known as the Gaussian distribution, is a probability distribution that is symmetric about the mean, showing that data near the mean are more frequent in occurrence than data far from the mean. In graph form normal distribution will appear as a bell curve.

⇒ Properties of Normal distributions:

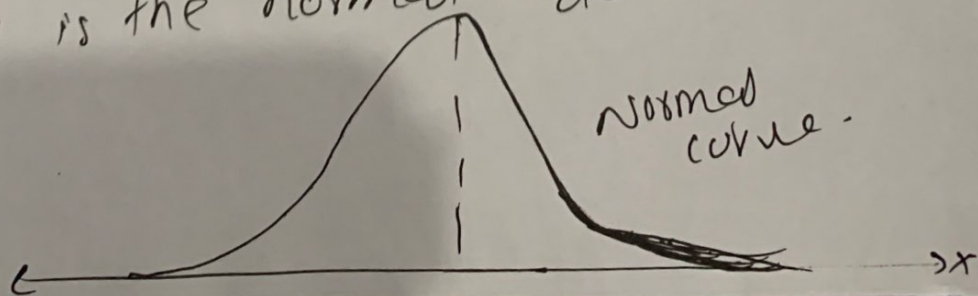
A continuous random variable has an infinite number of possible values that can be represented by an interval on the number line.



→ The time spent studying can be any number btw 0 & 24

The ~~properties~~ probability distribution of a continuous random variable is called continuous probability distribution.

The most important probability distribution in statistics is the normal distribution.



A normal distribution is a continuous probability distribution for a random variable, x .

The graph of a normal distribution is called the normal curve.

Properties,

- The mean, median & mode are equal
- The normal curve is bell shaped & symmetric about the mean
- The total area under the curve is equal to 1
- The normal curve approaches, but never touches the x axis, as it extends farther and farther away from the mean
- Between $\mu - \sigma$ & $\mu + \sigma$, the graph curves downward. The graph curves upward to the left of $\mu - \sigma$ & to the right of $\mu + \sigma$
- The points at which the curves change from curving upward to downward are the called inflection points.

Q3)
b)

data:

$$\mu = 60000 \text{ PKR}$$

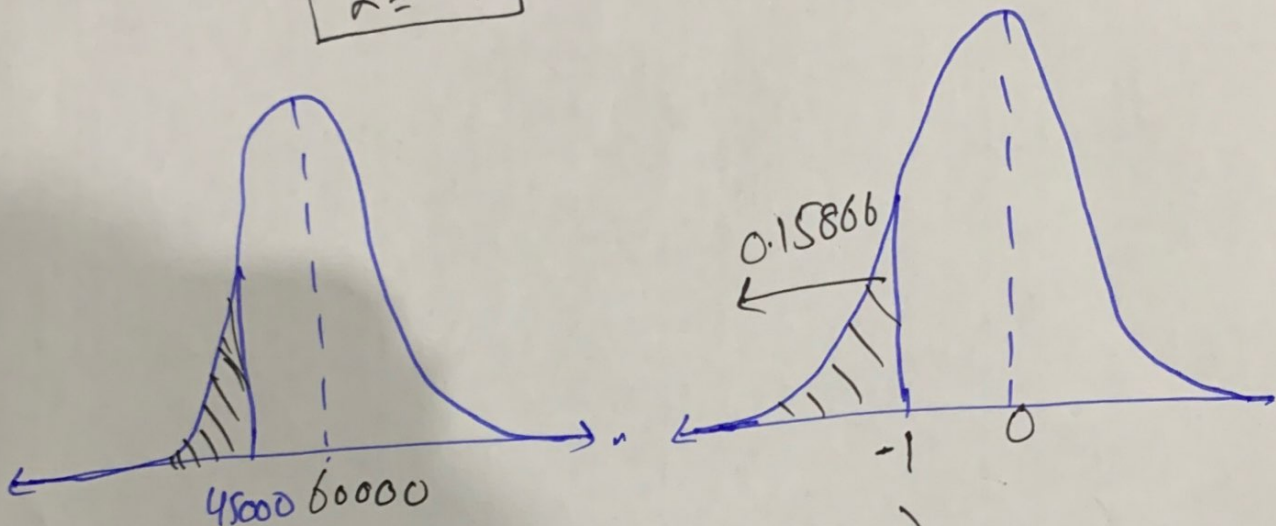
$$\text{standard deviation, } \sigma = 15000 \text{ PKR}$$

Solution.

$$\mu = 60,000$$
$$\sigma = 15,000$$

$$Z = \frac{x - \mu}{\sigma} = \frac{45,000 - 60,000}{15,000}$$

$$Z = -1$$



$$P(x < 45,000) = P(Z < -1)$$
$$= 0.15866$$

This also mean that 15.86% of employees earning less than 45,000 per annum.