



Iqra National University, Peshawar

Department of Civil Engineering

Final-term Examination- 2020

Course title: Risk and Disaster Management in Construction

Paper Submitted By: Anwar Ul Haq

I.d:15252 (MS Transportation Engineering)

Q:1 Risk Log/register

A Risk Register, also referred to as a Risk Log, is a master document which is created during the early stages of a certain project. It is a tool that plays an important part in Risk Management Plan, thus helping to track issues and address problems as they arise.

The Risk Register is a document that contains information about identified project risks, analysis of risk severity and evaluations of the possible solutions to be applied. Presenting this in a spreadsheet is often the easiest way to manage things, so that key information can be found and applied quickly and easily.

The Risk Register will generally be shared between project stakeholders, allowing those involved in the project to be kept aware of issues and providing a means of tracking the response to issues. It can be used to flag new project risks and to make suggestions on what course of action to take to resolve any issues.

All corporate and organizational projects face risk at one time or another. Having a Risk Register in place simply provides a better means of responding to problems as they arise. The Risk Register is there to help with the decisions making process and enables managers and project stakeholders to handle risk in the most appropriate way. A risk needn't be a threat to your project, it is simply an issue that can arise during the project; if effectively managed, it shouldn't prevent your project from attaining its goals and objectives.

The risk register addresses risk management in four key steps: (1) identifying the risk, (2) evaluating the severity of any identified risks, (3) applying possible solutions to those risks and (4) monitoring and analyzing the effectiveness of any subsequent steps taken.

Risk Register, you can be proactive about managing certain projects and handling any risks associated with them. Any issues that are likely to impact upon the success of a project and the speedy completion of the project is categorized as risk. Implementing strategies to handle this, such as a risk register, will help to prevent risk from becoming an issue that may cause significant delays or even lead to the project failing.

Here data presented in Row_1 is of Peshawar BRT project in which proper Risk Log was not maintained and risks were not identified prior to its execution that's why these risks were without control and control actions were unable to be taken to control/reduce the risks. Rest the data is generalized and can be used for any risk management.

ID	Date raised	Risk description	Risk			Without controls			Controls	Residual risk
			H	M	L	Cost impact	Time impact	Other		
1	17 feb, 2018	Project design and duration change	Y			\$41billion-\$73billion	6months-24months	MMD Pakistan consultancy , Peshawar development authority and PTI lost their reputation	Project Duration extended, Funding Raised	Delay in completion
2	Prior to execution	Consultant or contractor delays	Y			4million	3months		Include late penalties in contracts. Build in and protect lead time in the schedule. Communicate schedule early. Check in with suppliers regularly. Query '90% done'. Ask again and again if they need anything else.	Trust deficient between consultant and client
3	Prior to execution	Delay in earlier project phases jeopardizes ability to meet fixed date. For example, delivery of just in time materials, for conference or launch date.	Y			2million	1month		Ensure the project plan is as accurate as possible using scheduling workshops and work breakdown structure. Use Tracking Gantt and Baseline to identify schedule	

									slippage early.	
4	During project Execution	Legal actions delay or pauses project		Y		5million	3months	Consultancy lost it reputation	Ensure customer decision maker with budgetary authority is identified before project start and is part of the Project Board. Communicate dates for sign-off points up front.	
5	During project	Theft of materials, intellectual property or equipment.	Y			1million	Varies as depend upon machinery	Sense of insecurity	Follow security procedures, ensure Non-Disclosure Agreements, & compliance certificates are in place. Verify all physical security measures in place. Secure insurance.	
6	Any time	Acts of God for example, extreme weather, leads to loss of resources, materials, premises etc.	Y			High cost impact dependent on severity of nature	Dependent	Fear	Ensure insurance in place. Familiarise project team with emergency procedures. Where cost effective put back up systems in place e.g. generators.	

Q:2 What is Cost Benefit Analysis?

Cost benefit analysis is a process used primarily by businesses that weighs the sum of the benefits, such as financial gain, of an action against the negatives, or costs, of that action. The technique is often used when trying to decide a course of action, and often incorporates dollar amounts for intangible benefits as well as [opportunity cost](#) into its calculations.

Although CBA can be used for short-term decisions, it is most often used when a company or individual has a long-term decision.

CBA is an easy tool to determine which potential decision would make the most financial sense for the business or individual. The process also takes indirect benefits or costs into consideration, like customer satisfaction or even employee morale. And opportunity cost often plays a big role when deciding between several options. When listing potential costs and benefits, companies or analysts will often factor in things like labor costs, social benefits and other factors that may not be immediately obvious.

Still, CBA is similar to [net present value \(or NPV\)](#), which is often used by investors.

So, what's the difference between CBA and NPV?

Cost Benefit Analysis vs. Net Present Value

When performing a cost benefit analysis, or CBA, it is generally helpful to weigh the [total benefits and total costs of a future project at their present value](#) - which is where net present value comes in. Given that CBAs are often done with a long-term view in mind, the value of money often changes due to inflation and other factors, making it helpful to factor in the net present value of the figures you are analyzing when conducting a CBA.

Net present value, as the name suggests, is a method used to determine the benefits of undertaking an investment by calculating the future benefits or costs in terms of their present value. If the net present

value is positive for the calculation (meaning the benefits outweigh the costs), the action or decision will generally be a good investment. If negative, the opposite is likely true.

In CBA, net present value is used to calculate net present costs and net present benefits.

How to Calculate Cost Benefit Analysis

For standard CBA, the formula, the benefit/cost ratio, is fairly simple:

Benefit/cost, simplified as b/c.

While there are slightly [more complex formulas](#), the benefit-cost ratio is essentially just taking into account all of the direct or indirect costs and benefits and seeing if one outweighs the other. Additionally, running a CBA often takes into account opportunity cost and is frequently used to compare different options by calculating their benefit-cost ratios.

The formula reflects the sum of all the benefits divided by the sum of all the costs, with consideration for the duration of the decision or action (or, analysis horizon).

Cost Benefit Analysis Steps

Cost benefit analysis is fairly simple to execute, and can be helpful when considering a new course of action or strategy.

Step 1: Compile lists

The first thing to do when running a cost benefit analysis is to compile a comprehensive list of all the costs and benefits associated with the potential action or decision.

Consider not only the obvious costs (like the cost of installation for new software, or for the software itself) but also possible intangible costs like the opportunity cost of picking one software over another, or over another option like hiring a new employee.

Additionally, consider all the possible benefits of the course of action or decision - how much might it add to your revenue? What other benefits may be inherent in the action that would make it outweigh the costs? For example, would a new software improve efficiency or capabilities that could promote new business or make current operations run smoother? Be sure to also consider intangible benefits as well as obvious, fiscal ones.

Step 2: Give the costs and benefits a monetary value

Once you have two comprehensive lists of costs and benefits for the action, assign monetary values to each individual cost or benefit.

For some, the values will be obvious - like the cost of installing the software might be \$500. However, it is also important to try to assign monetary values to direct or indirect and tangible and intangible costs or benefits if possible. For example, installing a new software may render an employee's computer inaccessible for a couple hours, costing that employee working time or productivity and therefore money generated for the company.

Once you assign monetary values for each cost and benefit, add all the costs and benefits respectively and set up the equation.

Step 3: Set up the equation and compare

Take the sum of the benefits (the sum of all the monetary values assigned to the benefits of the action) and the sum of the costs (all the monetary values of the costs of the action) and plug them into the b/c equation.

The equation should be a numerical equation, and if the numerical benefits (the sum of the fiscal values for the benefits of the action) outweigh the costs, it is advisable to proceed with the decision. If not, the company or individual should re-examine the potential action and make adjustments accordingly.

This equation can also be set up for multiple different options or projects and can help companies compare options side by side.

But, what are some actual examples of CBA?

Cost Benefit Analysis Examples

Example 1

[In our first example](#), a financial technology startup is expanding and adding two new programmers. The CEO of the company decides to run a cost benefit analysis to determine whether the decision will be beneficial to the company - and to what degree.

The company is analyzing a time horizon of one year, and estimates that revenue would increase some 50% if the two programmers were hired.

On the cost side of the equation, the CEO must examine the cost of the two programmer's salaries - estimated at \$75,000. Additionally, there is the cost of recruitment, which might be around \$3,000. Training could add an additional \$4,000.

Additionally, there is the cost of new work areas and computers, totaling \$5,000, and the cost of additional licensing for software and the like, around \$2,000.

The total direct and indirect costs would total around \$89,000.

When calculating benefits, the CEO would examine the benefit of additional revenue within a 12 month period, estimated around \$100,000. Additionally, the increase in product quality resulting from the new programmers (and therefore presumed customer satisfaction) would increase by 10%, adding an estimated \$10,000 in value to the company.

In total, the benefits would be \$110,000. Using the benefit-cost ratio equation, that would be $BCR = \$110,000 / \$89,000$, or 1.24. Given that the value is positive (and the total benefits are greater than the total costs), the cost benefit analysis indicates the decision to hire two additional programmers would be a beneficial move for the company.

Example 2

Still, another [example like that of ProjectCubicle](#) is that of a real estate developer considering several different investment options.

The assumptions for the investments are that option 1 would build 300 houses, renting 50 of them for 10 years at \$3,000 per year. The 50 rented units would be sold after 10 years for \$60,000.

Construction costs for option 1 would be \$80,000 per house, which would sell for \$100,000 each. The cost of a sales office would be \$1,000,000 and the salaries of sales staff would be \$200,000 each year. The project would last 2 years, with a financing cost of \$2,000,000 per year.

For option 2, the construction company could build 200 houses, renting 25 of them for 5 years at \$3,500 per year. The 25 units could be sold after 5 years for \$70,000.

Construction costs for option 2 would be \$70,000 per house, and the rest of the homes would sell for \$110,000 each. The cost of a sales office would be \$2,000,000 and sales staff salaries would be \$150,000 each year. The project would last 1 year, with a financing cost of \$1,500,000 per year.

For option 1, costs would include:

Construction cost = \$24,000,000

Sales office cost = \$1,000,000

Cost of sales staff = \$400,000

Financing cost = \$4,000,000

Total costs would therefore be \$29,400,000.

For option 1, benefits would include:

Income from rentals = \$1,500,000

Income from sales = \$25,000,000

Income from sales after rental = \$3,000,000

Total benefits would therefore be \$29,500,000. Using the cost benefit analysis formula b/c, the ratio would be $29,500,000/29,400,000$, or 1.0. Since the equation is possible, the benefits for option 1 outweigh the costs. However, since the developer is trying to decide between two projects, the same analysis needs to be performed for option 2.

For option 2, costs would include:

Construction cost = \$14,000,000

Sales office cost = \$2,000,000

Cost of sales staff = \$150,000

Financing cost = \$1,500,000

Total costs would therefore be \$17,650,000.

For option 2, benefits would include:

Income from rentals = \$437,500

Income from sales = \$19,250,000

Income from sales after rental = \$1,750,000

So, the total benefits for option 2 would be \$21,437,500. The b/c ratio for option 2 would therefore be $21,437,500/17,650,000$, or 1.2.

Comparing both options together, it is clear that option 2 has a higher benefit-to-cost ratio (and costs less to execute) and would therefore be the most fiscally resourceful option for the developer to pick.

To help facilitate performing a CBA, there are [several templates available online](#).

Advantages and Disadvantages of Cost Benefit Analysis

Cost benefit analysis can be a helpful tool for businesses or individuals to undertake when considering a new course of action.

Running a CBA for a potential decision can help visualize the implications and impact of that course of action, and is often very helpful for smaller or medium-sized decisions that are more immediate in scope of time.

However, there are some disadvantages to practicing a CBA in certain circumstances. For bigger decisions with a longer time horizon, CBAs can sometimes fail to take into account other factors that might not be significant in the short term but would impact the long term, like inflation, interest rates and other larger, more long-term factors. For these calculations, net present value or [internal rate of return](#) are often better methods to use.

Additionally, performing a CBA can often put projects or decisions in a purely numerical point of view, which may fail to take into account unforeseen events or circumstances that might affect the action.

Question NO#3

Normal probability distribution

It is the most important probability distribution in statistics because it fits many natural phenomena. For example heights, blood pressure, measurement error, and IQ scores follow the normal distribution. It is also known as the Gaussian distribution and the bell curve.

The Normal pdf: $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ where

μ = mean

σ^2 = variance

$\pi=3.14159$ =ratio of the circumference to diameter

$e = 2.71829$

Important things about the normal distribution

- (1) There are infinitely many variations of the normal distribution differentiated by μ and σ^2 .
- (2) The highest point of a normal is at the mean which is also the median.
- (3) The normal distribution is symmetric. This implies that

$$F(x) = 1 - F(-x)$$

(b) Suppose that the data concerning the first-year salaries of employees is normally distributed with the population mean $\mu = 60000$ PKR and the population standard deviation $\sigma = 15000$ PKR. Find the probability of a randomly selected employee earning less than 45000 PKR annually. Hint: To answer this question, you have to find the portion of the area under the normal curve from 45 all the way to the left. Find Z-Score table at the end of the paper (Table 2)

Ans:

Given data :

mean $\mu = 60000$ PKR-----1

standard deviation $\sigma = 15000$ PKR-----2

$x \leq 45,000$ -----3

Required:

The portion of the area under the normal curve from 45 all the way to the left?

Z-Score table at the end of the paper (Table 2)?

SOLUTION:

normally distributed with the population mean $\mu = 60000$ PKR and standard deviation $\sigma = 15000$

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

PKR What is the probability of a randomly selected employees earning less than 45000 PKR annually This is a tougher one. Now we can form a z score.

$$Z = \frac{(x - \mu)}{\sigma} \text{-----} 1$$

Put value in equ 1

$$Z = \frac{(45000 - 60,000)}{15,000}$$

$$= -1.00$$

What is $P(Z = -1.00)$

$$P(X < 45,000) = P(Z < -1.00) = .15866 = 16\%$$

From table 2 we have (**.15866**)

-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414
Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024

-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465

-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414
-------------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

