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Project budget estimation using Bayesian validation belief network

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Abstract:

Cost estimation in the supply chain, is one of the important issues that each institution or a factory is facing in cost estimation cost more or less or equal to the budget .In case of equally or less we will not have any trouble but we should take measures to reduce the cost of condolence. The purpose of this issue is first budget estimation of the project and then showing greater the cost of the original budget using Bayesian network that in four different scenario of the company's final budget is calculated .Bayesian networks, is a very simple and fruitful solution to solve the case here in a one - way authentication method and the composition of the divided into two phases, and we reached to the answer with the simple method of solving the budget.

Key words:

Bayesian belief network, authentication, budget allocations, one source, the risk

Introduction and reviewing the literature:

Bayesian networks , which are also based on networks or Bayesian belief networks are called a powerful tool for showing data and they are concluded under conditions of non - deterministic Directionality cycle , which is not the graph with a series of nodes that are connected with vectors and the relations between them is possible and follow the law Bayesian and historical data , a method for Bayesian network, combined with the existing evidence beliefs and briefly linked networks to a circular chart probability a joint distribution networks , the hierarchical structure and effective possibilities on a particular subject under review into things that have recently been made in this field by researchers studies the issue of supplier selection .In recent studies they combined BN with other methods of supplier selection and optimization to make better choices .They did quantification for BBN tree in 2015 with little cost associated with each risk factor, and also within Nepal & Yadav Decision to calculate the metrics that are important consequences of the merger (1).Through (2) In 2012,presented a way to quantify the potential risk suppliers Archie Lockamy & Kevin MC cormack (3) In 2011 again to select suppliers through Lockamy

Bayesian presented networks for assessing the risk .Also to explore the risks still they use Bayesian networks. In 2012 (4) a new method based on fuzzy logic combined with Bayesian networks was used by Luciano Ferreira & Denis Borenstein .To do this they evaluate suppliers and provide a multi-criteria model to identify the strengths and weaknesses of each option in order to prioritize the different criteria .To identify Failure nodes used a design perspective FMEA, BN-based approach in 2001 (5) the method of Lee, however, with Engineering and for the first time this method was combined .The concept of credit answers to the question that the measurement tool to what extent measures the quality of characteristics .Without the knowledge of the measurement tool works with the accuracy of the data from the market to measure a special valid.there are various ways for the Evaluation of the validity of various project's credits with regard to their nature that there are some examples below :In 2015, the risks of planned construction projects, evaluation of activities and the estimated cost of construction combined to better understand the safety costs during a construction project construction (6). Gurcanli ICOR due to the lack of scientific solutions in 2015 in the literature review in conjunction with them offered the more detailed assessment. In 2015, they offered probability distribution of empirical principles and it was best able to assess its parameters (7), Jasivkevicius & Vasiliauskaite .The same year experience in the ICOR was based on the IOS former estimated values in the previous article (8) which evaluated the effect of their analysis

. Stavrakas & Xenidis searched the most widely used methods of budgeting for infrastructure projects in 2012.They include risks related to the total budgetary cost and capacity optimization, and stochastic processes in its general budget. (9) Idrus Arazi and colleagues in years 2011 presented the way to the development of a possible model which is used for building projects and infrastructure. (10) In every issue in any activity used resources play a key role in the existing problems in the real world .Resources with regard to the nature of the problem can be whether domestic or foreign and also in terms of a single source can be classified into two categories and multi – source. Below are a few examples of the single-source problems that have been expressed by the authors :Leob & Surysekar reviewed in 1994 optimal contracts to provide a unique resource that has the asymmetry of information between different parts of the contract. (11)Taj bakhsh and his colleagues in year 2010 developed a financial problem with a non - confidence supplier and they considered both the amount of the optimal order and the level of uncertainty, which are desirable simultaneously.(12)

Solution method:

In this paper we solve the problem in two phases. first phase in relation to validate the problem is that the costs and the first phase is deal with the ideal condition, naturally our organization are formed by three conditions which every state comprised of four parts of human resources , integration and testing

facilities, software and hardware - and integration has been formed to each section , according to data on the cost we obtain the costs for considered company ,the calculation cost for the human resources department is done by the possibility of fuzzy –that means we have a possible table that according to every day and probabilities and mathematical hope , we have a table of the fuzzy costs with the membership grade , that we have to make any fuzzy - degree of membership in the cost associated with which we beat together and in a total , membership degrees shall remain suspended … we are divided and at the end of this , in the hope that we beat math , but only to other parts of the fuzzy - we applied for each case at the end of the computation costs related to it and to obtain the total cost of the state budget all three together .We added 20 % of the cost as reserve funds to the final as the budget of more available to us, then we design scenarios to reach the target budget in order to address the issue of the added risks here and in the second phase we solve the problem .In this way first for any scenario BBN in the second phase we obtain

Equation 1

$$\mathrm{P}\left(R_{\mathrm{low}}^{1,\mathrm{Mexican}}\right)=\mathrm{P}(R_{\mathrm{low}}^{1}/S_1,O_1,D_1)\times\left(\beta_{\mathrm{Sevirity}}^{1,\mathrm{Mexican}}\right)_1\times\left(\beta_{\mathrm{Occurrence}}^{1,\mathrm{Mexican}}\right)_1\times\left(\beta_{\mathrm{Detectability}}^{1,\mathrm{Mexican}}\right)_k+\cdots$$
$$+\mathrm{P}(R_{\mathrm{low}}^{1}/S_5,O_5,D_5)\times\left(\beta_{\mathrm{Sevirity}}^{1,\mathrm{Mexican}}\right)_5\times\left(\beta_{\mathrm{Occurrence}}^{1,\mathrm{Mexican}}\right)_5\times\left(\beta_{\mathrm{Detectability}}^{1,\mathrm{Mexican}}\right)_5$$

Example:

Arya company because of the sanctions had to produce the device itself and for this purpose, the contractors asked that the validation According to the initial budget be done, the validation project is done so that the final cost in four parts differently and in three cases is calculated and all the prime the final cost with each method and related risks in five level from too little to too many have two options and the rate of risk strongly related with the help of experts subjective probabilities that were in the example in Table 4 and to obtain the possibilities, according to the law should numbers be between 0 and 1, and total number of each row for each option should be equal 1.To achieve this, we normalized these subjective probabilities to reach a total of equal 1in each row. In example is normalized with the use of Table 5 that this table, with the help of experts and political conditions and environmental manufacturer is written. Then we put it in the formula 1, the marginal probabilities for any risk in three levels low, medium, and high are calculated and the following example of results are seen in Table 6 and eventually Table 6 and Table 7 . Which are costs of each risk are multiplied and the average cost of any scenario will be calculated. Table 8 Here we consider recognition option equal to 1, due to the obvious option and removed it.

numbers on calculations of numbers and figures that company has been extracted for each case separately are put in each sector (only part of the human resources to fuzzy face possible - and the rest is calculated only using fuzzy - formula) , and together they show the costs of that state. At the end we add the costs of three states to calculate the initial budget. we don't have to take into account the different scenarios to arbitrary budget that considering the scenarios risks ,

entered the issue and there are going to enter the second phase of the issue of the cost for each scenario to calculate separately and a scenario with the lowest cost is chosen . Information related to the first phase, as well as our calculations is given in Table 1. Formula risks in Table 2 and then in Table 3 information to calculate the risk of contracting by the company has announced .it is remarkable that to calculate the risk first we consider it in the average state and then to obtain the same amount of low - and high risk (20%) we add or subtract .all the prices are according to the dollar.in example all table of first scenario has been proposed, other tables are similar to the first scenario`s tables.

Table 1 - information and computations related to 1 phase

Human resource department information for all three modes					
20	19	18	17	16	Day
0.2	0.1	0.4	0.2	0.1	every day probability
5500	5000	4500	4000	3000	cost
0.1	0.3	0.5	0.2	0.2	The membership of each cost
All the hardware-software information for each mode					
S1 mode					
140000	130000	120000	110000	۱ cost	
0.2	0.3	0.4	0.2	۱ The membership of each cost	
70000	60000	50000	40000	۲ cost	
0.3	0.3	0.5	0.2	۲ The membership of each cost	
45000	40000	30000	25000	20000	۳ cost
0.3	0.4	0.6	0.2	0.2	The membership of ۳ each cost
.....					
Final cost	total %۲۰ costs	Total costs of 3 modes	Total costs of mode 3	Total costs of mode 2	Total costs of mode 1
4260312.789	710052.1316	3550260.658	910433.112	1947139.254	692688.292

Table 2- risk formula

Cost formula	Risk type	No.

(Delays in product availability * Price stoppages)	out of reach Facilities	1
((Setup fee + (delayed on the design * delay penalty)	Design and Implementation Facility	2
The number of defective product (inspection fee + guatantee + * (the cost of a late penalty warranty	Poor inspection of products	3
Difference between the percentage of internal and external quality) (* Fine	Poor quality characteristics of the design and development	4
(Elapsed time * Price per Day)	Non-standard development and design process	5
(Improving project time * Cost per Day)	planning and Poor design of the device	6
Time taken to select the ideal contractor with regard to the) (restrictions * Price per Day	constraints of Supply contractors	7

Table 3. Information required to calculate risks

Change in device philosophy	reduction of management storage budge	Using hardware-software in critical components	Reduce manufacturing time for device	parametrs	N0
60 day	30 day	50 day	30 day	Delays in product availability	1
10000	10000	10000	10000	Price	2
800000	300000	600000	500000	Setup fee	3
15 day	5 day	10 day	5 day	delayed on the design	4
5000	5000	5000	7000	delay penalty	5
500	500	500	500	inspection fee	6
3000	3000	3000	3000	the cost of a late penalty warranty	7
20% of 100 product	10% of 100 product	30% of 100 product	10% of 100 product	percentage	8
40%	60%	50%	60%	the percentage of internal	9
90%	90%	90%	90%	the percentage of external	10
50000	30000	40000	30000	quality * Fine	11
25 day	15 day	20 day	15 day	Elapsed time	12
15000	15000	15000	17000	Price per Day	13
20day	10 day	15 day	10 day	Improving project time	14

Table 4. Subjective probabilities of risks

	Reduce manufacturing time for device									
	Severity					Likelihood				
	Very low	Low	Medium	high	Very high	Very low	low	Medium	high	Very high
out of reach Facilities	0.1	0/2	0/5	0/5	0/4	0/6	0/4	0/3	0/1	0
Design and Facility Implementation	0	0/1	0/6	0/7	0/8	0/1	0/2	0/5	0/8	0/8
Poor products inspection	0	0/1	0/7	0/8	0/9	0	0/2	0/5	0/8	0/8
Poor quality characteristics of the design and development	0	0/1	0/7	0/5	0/4	0/7	0/6	0/4	0/2	0
design process and Non-standard development	0/1	0/3	0/6	0/6	0/5	0/1	0/2	0/5	0/6	0/6
Poor planning and designing of the device	0/7	0/6	0/5	0/2	0	0/2	0/4	0/6	0/6	0
Supply contractors constraints	0	0/7	0/6	0/5	0/4	0/1	0/2	0/4	0/7	0/8

Table 5.belief probabilities

Rule Number	Severity	Occurrence	low	Medium	High
1	Negligible	Highly Unlikely	1	0	0
2	Negligible	Unlikely	0.95	0.05	0
……	……	…….	…….	…….	…….
25	Catastrophic	Frequent	0	0	1

Table 6. Marginal probability risks

Reduce manufacturing time for device			
	low	medium	High

out of reach Facilities	0/234	0/544	0/215
Design and Facility Implementation	0/060	0/493	0/437
Poor products inspection	0/053	0/504	0/453
Poor quality characteristics of the design and development	0/164	0/615	0/231
design process and Non-standard development	0/165	0/529	0/316
Poor planning and designing of the device	0/561	0/401	0/029
Supply contractors constraints	0/220	0/532	0/248

Table 7. Calculate the cost of each risk

Reduce manufacturing time for device				
high	medium	low	Risk type	N0
360000	300000	240000	out of reach Facilities	1
642000	535000	428000	Design and Implementation Facility	2
42000	35000	28000	Poor inspection of products	3
10800	9000	7200	Poor quality characteristics of the design and development	4
306000	255000	204000	Non-standard development and design process	5
204000	170000	136000	planning and Poor design of the device	6
60000	50000	40000	constraints of Supply contractors	7

Table 8. Final costs of each scenario

Total Cost	Scenario	No
1380022.6	Reduce manufacturing time for device	1
1884014.8	Using hardware-software in critical components	2
1246449.8	reduction of management storage budge	***3
2526998	Change in device philosophy	4

Conclusion:

In this article we combined approach with the validation of project and we solved the project in 2 phases with these two methods .In the BBN example we estimated the main cost of the company using authentication method and because our budget was not in limit of this cost, we forced to define scenarios to measure the consumption expenditure by any scenario .With adding each scenario to the problem, some risks appeared that each risk has its own related cost, and in order to calculate the scenarios we used Bayesian networks and ultimately we selected the scenario of managerial budget reduction because it had less cost than other scenarios, as well as the initial estimated cost. In general method of Bayesian network can be combined with other different methods and for future issues we can use from the other methods such as data envelopment analysis in our calculations

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