RISK MANAGEMENT IN EDUCATIONAL PROJECTS

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Project Risk Management includes the processes concerned with identifying, analyzing and responding to project risk. It includes risk identification, risk quantification and risk response control.

For evaluation of the costs activities of project, it is used the PERT method (Program Evaluation and Review Technique). PERT uses sequential network logic and a weighted average cost estimate to calculate the project total cost.

The paper presents also the costs estimating as being quantitative assessments of the likely costs of the resources required to complete educational project activities. The costs must be estimated for all the resources that will be changed in the project. This includes - but is not limited to - labor, materials, supplies and special categories such as an inflation allowance or cost reserve.

Keywords: risk management, PERT method, triangular distribution, simulation, cost estimating

1. INTRODUCTION

Project Risk Management includes the processes concerned with identifying, analyzing and responding to project risk. It includes risk identification, risk quantification and risk response control.

For evaluation of the costs activities of project, it is used the PERT method (Program Evaluation and Review Technique). PERT uses sequential network logic and a weighted average cost estimate to calculate project total cost [1].

2. PRESENTATION OF THE CONCEPT

The process for application PERT method includes the next activities sequence [2], [3]:

- The project is decomposed in activities, a_i, $i = 1,2,\ldots,n$.
- Form a expert team of minimum three experts.
- For all the activities, each expert proposes 3 estimates values:
  - Low estimate, noted *a*, represents cost minimum for respective activity when the project unrolls properly.
  - Likely estimate, noted *m*, represents the probable value.
  - High estimate, noted b, represents maximum cost when the project doesn't unrolls properly.
- For each activity a_i:

- low estimate (a) is the minimum value propose of experts;
- likely estimate (m) is mean value propose of experts;
- high estimate notes b is high value propose of experts;

- In order to sum probability distributions, calculate:
  - the mean $\bar{x}_{a_i}$ and standard deviation s_{a_i} for activity a_i, in the functions probability distributions (Triangular or Beta distribution);
  - the standard deviation for the project $s_{proiect}$;
  - the trusted interval for project totals, with limitless: $\bar{x} \pm 2 \cdot s_{proiect}$. These limits are approximately 95% of static's proper distributions.

If the trusted limits exceed $\pm 20\%$ [4], the mean value estimate of the project takes again estimate values cost for all the activities.

2.1. The Triangular distribution

The general form for the density function of probability is illustrated in relation 1.

$$f(x) = \begin{cases} 0, & x \le a \\ \dfrac{2(x-a)}{(b-a)\cdot(m-a)}, & a < x \le m \\ \dfrac{2(b-x)}{(b-a)\cdot(b-m)}, & m < x < b \\ 0, & x \ge b \end{cases}, \qquad (1)$$

where $a \le m \le b$, *a* is minimum value, *b* is maximum value and *m* is probability value.

The mean is illustrated in relation 2.

$$\bar{x} = \frac{a+m+b}{3}, \qquad (2)$$

The standard deviation is illustrated in relation 3.

$$s = \sqrt{\frac{(b-a)^2 + (m-a)\cdot(m-b)}{18}}. \qquad (3)$$

The triangular distribution is a favorite distribution because to determine distribution parameter it isn't needed the historical information. It is enough to estimate minimum, maximum and probable value for simulation.

The simulation involves calculating multiple costs with different sets of assumptions. The most common is Monte Carlo Analysis [5] in which the distribution of probable results is defined for each activity and used to calculate a distribution of probable results for the educational total project.

For simulating a random triangular variable, we will use the inverse method, which use uniform variable.

The distribution cumulative triangular function is presented in relation 4.

$$F(x)=\begin{cases} 0, & x \le a \\ \dfrac{(x-a)^2}{(b-a)\cdot(m-a)}, & a < x \le m \\ 1-\dfrac{(b-x)^2}{(b-a)\cdot(b-m)}, & m < x < b \\ 1, & x \ge b \end{cases}, \quad (4)$$

It is obtained the generated relation for random triangular variable, as in relation 5.

$$x_i = \begin{cases} a+\sqrt{u_i\cdot(b-a)\cdot(m-a)}, & a < x_i \le m \\ b-\sqrt{(1-u_i)(b-a)\cdot(b-m)}, & m < x_i < b \end{cases}, \quad (5)$$

where $u_i \in (0,1)$ is a random uniform variable.

3. RESULTS: A SIMULATION MODEL FOR AN EDUCATIONAL PROJECT

The cost estimate may benefit from being refined during the course of the project to reflect the additional detail-available. In some application areas, there are guidelines for when such refinements should be made and what degree of accuracy is expected.

The cost estimating involves developing and costs estimation of the resources needed to complete the project activities. It includes identifying and considering various alternatives [4], [5].

The costs estimates for an educational project are expressed in hundreds €, as presented in table 1.

The estimated project totals are:

- 15.960 € (low variant);
- 17.820 € (likely variant);
- 18.890 € (high variant).

- Medium cost $\bar{x}$ = 18.890 €;
- Standard deviation for project $s_{proiect}$ = 15.120 €.

The trusted limits result:

- the cost for inferior limit's estimation is 15.860 €. It represents a percentage of 83%.
- the cost for superior limit's estimation is 21.920 €. It represents 116%.

The estimates values integrate in the $\pm 20\%$, the determinist model is acceptable and becomes the simulation model.

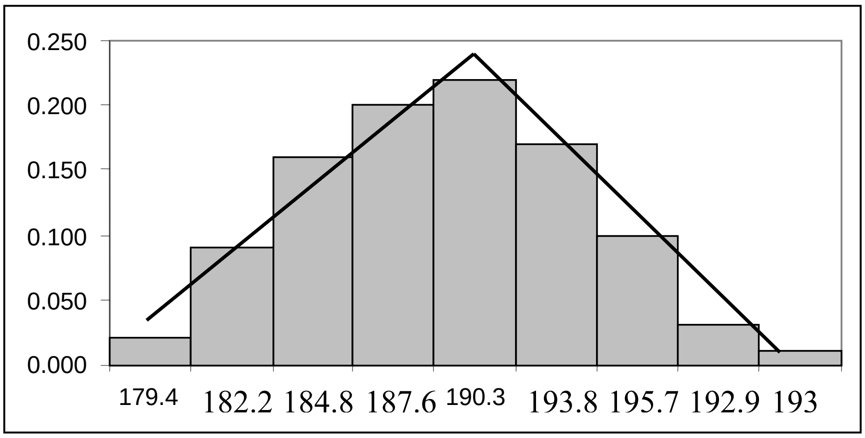
For each variable, a number of simulation values are obtained and the final simulation values vector is the sum on the line of the 8 columns elements.

Table 1. The parameters of estimates values

Activity Name		**Low** **a**	**Likely** **m**	**High** **b**	**Mean** $\bar{x}$	**s**
A. Administration and monitoring activities	*A1. Administration and monitoring activities*	8.1	9	11.7	9.6	0.76
	A2. Change of places and sojourn for small projects	0.7	0.8	1	0.8	0.06
B. Mobility	*B1. Change of places*	56	63	81	66.6	5.62
	B2. Assurance	9.9	11	14	11.6	0.86
	B3. Sojourn	68.2	75.7	98	80.6	6.32
	B4. Specific contribution for the participants with handicap	0.7	0.8	1	0.8	0.06
C. Other activity	*C1.Pedagogic, linguistics and cultural preparation*	15.2	17	21.9	18	1.41
	C2. Contribution at suggestions elaboration	0.8	0.9	1.2	0.9	0.08
TOTAL		159.6	178.2	229.8	188.9	15.12

The Relative Frequency histogram is presented in figure 1.

Relative Frequency



Costs

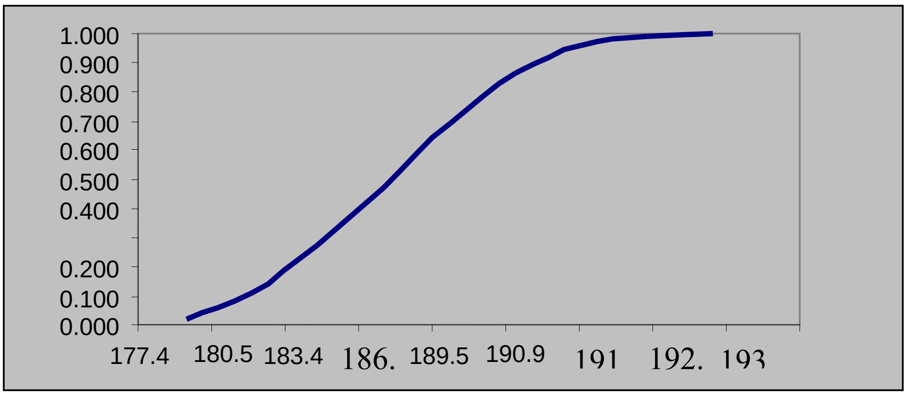
Fig. 1. Frequency Distribution

Conclusion: the form of the triangular distribution is relative symmetrical.

For distribution simulation, the static's are $\bar{x}$ = 19.070 € and s = 364 €.

The Frequency cumulate distribution for the simulations costs is presented in figure 2.

Cumulate Frequency



Costs

Fig. 2. Frequency cumulate distribution

Conclusion: the likelihood for the costs smaller than 17.820 € is approximately 5% and the likelihood for the costs bigger than 19.200 € is approximately 1%.

4. CONCLUSIONS

Costs estimating are quantitative assessments of the likely costs of the resources required to complete educational project activities. The costs must be estimated for all the resources that will be changed in the project. This includes, but is not limited to, labor, materials, supplies and special categories such as an inflation allowance or cost reserve.

5. REFERENCES

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