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Risk Assessment Score (RAS) as an Indicator of Decision Making

MaushumiLahon
Assam Engineering Institute
maushumi28@gmail.com

Abstract:- Risk Assessment is considered to be an important indicator in decision making. Different methods are devised for assessing risk. This paperattempts to define a task in terms of certain factors and assess risk in terms of the three factors. The factors considered are: the number of activities, the duration of the activities and the resources required to complete the activities along with its availability. An algorithm is given to compute the contribution from each factor which ultimately determines the Risk Assessment Score(RAS). This score can form the basis of decision making or even can be used to identify the factors responsible for increased RAS and design measures to minimise the RAS which in turn can ensure reduced uncertainty. This model is more or less generic by not specifying any particular area of decision making and hence can be considered in any decision making condition where ever the three factors can be ascertained.

Keywords:- Risk assessment, task, plan, decision, activities, resources.

I. INTRODUCTION

It is a universally accepted fact that resources are scarce and there should be minimum wastage of resources. Risk assessment is a positive step in this direction as detailed risk assessment of a task, plan or act can minimise the failure rate and thereby wastage of resources. Roger Pressman [1] inhis book on software engineering mentioned that, there are different process models and in all the models, software building starts with the problem definition. This is addressed by the requirements collection task as the first step. If the problem definition and the requirements collection tasks are performed with maximum accuracy there is every possibility that the other phases of analysis, design, testing and implementation will proceed with minimum error.

Considering risk assessment of any project or task as the problem to be addressed we can consider that a detailed analysis of the tasks or activities involved needs to be done to identify the major sources of risk. This may provide better accuracy in the risk identification process and thereby contribute positively in the subsequent process of risk prioritization, monitoring and mitigation exercises. In this connection TORA (Task Oriented Risk Assessment) [2] is a proposed model to filter out the tasks/ events which contribute significantly towards failure of a project/task.

A task is a set of objectives, the current situation and other information, assumptions, requirements and constraints affecting the problem to be solved. For example, the requirement that a certain action must be in any acceptable plan would be a constraint on the task. A number of alternative plans can be produced for a given task. Each plan can be at multiple levels of abstraction and consists of the whole set of information about the plan. In particular, a plan is composed of a number of increasingly detailed action networks, and a set of assumptions. The basic unit of organization in the Act formalism is an Act. Each Act describes a set of actions that can be taken to fulfil some designated purposeunder certain conditions. The purpose could be either to satisfy a goal or to respond to some event in the world[3]. This definition of act fits in with that of task.

II. DEFINING A TASK

To define a task, we can consider a set of parameters which describes the task. In this case the help of the network diagram [4] created by the project managers can beconsideredfor the purpose of analysis.The network diagram represents the activities as well as the interdependence between the activities along with the time required for completing each activity [5]. This network diagram can provide a very important resource for performing the risk assessment exercise. As network diagram is prepared before the commencement of the project, it can be used for risk assessment which is also a proactive exercise.

In case of analysing the task, the activities under the task needs to be identified such that they are the primitive activities i.e. they cannot be further split into smaller activities and placed in a Hierarchical Task Network (HTN) [6,7,8]. Every activity now can be represented by the time required for the completion of the activity and the different types of resources required. For this paper we consider only those resources which are necessary in at least two activities. This is because, if a resource is specifically required for a particular activity,

then risk of non-availability of the resource is negligible and hence is not considered for risk assessment. A representation of a task could look like :

T (n,t, r_x)

Where T represents the task,

n represents the number of activities,

t represents the time required for the task,

r_x represents the contribution of the resource towards timely completion of the task

x is an integer denoting the resource number

III. PROPOSED ALGORITHM FOR RISK ASSESSMENT

Consideringthat there are multiple plans to complete a taskwithout failure, risk assessment can become an indicator to choose among the plans for completion of the task. So, risk assessment can become a valuable metrics for the project managers or anyone who is involved in the process of decision making. From this point i.e. after identifying the activities, their duration, the interdependencies and the resources required, the exercise is to develop an algorithm to assess the risk so as to choose the plan where Risk AssessmentScore(RAS) is least.The steps to calculate the RAS is as follows :

1: Calculate the contribution of number of activities (n) towards RAS.
2: Calculate the contribution of time required for the activities (t) towards RAS.
3: Calculate the contribution of availability of resources towards RAS.
4: Compute the final RAS.

The next step is to decide on the percentage of contributionof each of the threefactors towards computation of RAS. For the purpose of this study the percentage of contribution towards the total assessment is considered as shown in Table I.

Table I: Contribution from different factors

Factors	**Contribution (%)**
Number of activities	20%
Time	20%
Resources	60%

The number of activities required to complete a task plays a significant role in successful completion of the task i.e. completion of the task in scheduled time and within the estimated cost. More number of activities, more is the uncertainty in completion and more is the contribution towards RAS. Here a contribution of 20% is assumed towards RAS. This is represented in table II.

Table II: Contribution from activities

No. of Activities	**Contribution towards RA Score (%)**
0 – 5	5
6 -10	10
11 – 15	15
16- 20	18
>20	20

In this computation it is accepted that there is a positive correlation between the number of activities and the RAS. According to the given model, the time required for completion of the task contributes towards RA score to the extent of 20%. It is assumed that longer the duration / estimated time for completion of the task, more is the uncertainty and hence more contribution to RAS. The relationship is considered to be directly proportional and the contribution is represented in table III.

Table III: Contribution from duration

Estimated Time (days)	**Contribution towards RA Score (%)**
0 – 15	5
16 – 30	10
31 – 45	15
46 – 60	18
>60	20

IV. CONTRIBUTION OFRESOURCE AVAILABILITY TOWARDS RAS

The data that is crucial is the contribution of the resources towards the completion of the task. There is another aspect which needs to be recorded which is necessary for risk assessment according to this algorithm is the uncertainty in the availability of the resource. This failure of availability of resource is represented in this paper in language terms as Very likely (VL), Likely (L), Unlikely (U) and No Possibility (NP). This availability of resources are expressed in language terms using table IV which represents the terms with its equivalent percentage of chances of non-availability. The judgement of availability of a resource is to be based on previous experiences and records of past projects.

Table IV:Terms with equivalent percentage of non-availability

Term	Chance of non-availability (%)
Very likely	Above 70
Likely	41 - 70
Unlikely	21 - 40
No possibility	0 - 20

A numeric value is assigned to each of the language terms which is represented in table V. This numeric value is necessary to compute the contribution of the availability of resources towards RAS.

Table V: Numeric value assignment of availability

Term	Numeric value
Very likely	1
Likely	0.75
Unlikely	0.5
No possibility	0.25

AnActivity-Resource table is created as shown in table VIwhere all the resources required for the task according to all the alternative plans are listed horizontally and all the activities vertically. According to the example considered here, two plans are considered with four activities altogether in both the plans.Each of the cell contains the extent of the contribution of the resource towards the completion of the activity in percentage and also the uncertainty in the availability of that resourcein language terms.

Table VI:Activity – Resource table representing contribution of resource and uncertainty in availability

Resources / Activities	R1	R2	R3	R4	R5	Contribution towards RA Score (%)
A1	10 – L		30 - VL	40 – U	20 – NP	7.5 +30+20+5=62.5
A2	20 – L	30 – VL	10 - VL	10 – U	30 – NP	15+30+10+5+7.5=67.5
A3	30 - L	40 – VL	20 - VL	10 – U		22.5 +40+20+5=87.5
A4		30 – VL		50 – U	20 – NP	30 + 25 + 5 = 60

The contribution from the resources towards the activity is expressed in terms of percentage and so the contribution from the resources required for an activity that is represented in each row sums up to 100. The value in the 7th column which gives the uncertainty in completion of the activity from the resource point of view is computed as follows :

$$r = \sum_{i=1}^{n} (p_i * a_i)$$

Where

r -represents the contribution of an activity towards RAS

n - represents number of resources required for that activity

p - percentage of contribution of the resource towards the activity

a - chances of non-availability of the resource in numeric terms

According to the entries in table VI the value in the 7th column of the table is calculated as follows :

r_1 - 10*0.75 + 30*1 + 40*0.5 + 20*0.25 = 62.5 %

r_2 - 20*0.75 + 30*1 + 10*1 + 10*0.5 + 30*0.25 = 67.5%

r_3 - 30*0.75 + 40*1 + 20*1 + 10*0.5 = 87.5 %

r_4 - 30*1 + 50*0.5 + 20*0.25 = 60 %

The values are represented in terms of percentage i.e. out of 100.
To compute final RA Score, the contribution from all the three factors are to be combined. Before that, the activities in each of the plan needs to be considered. For the purpose of this paper, two plans are considered P1 and P2 and the sequence of activities are as follows :
P1 : A1 - A3 - A4 and P2 : A1 - A2 - A4
The duration of each of the activity is considered to be as follows:
A1 - 20 days, A2 - 32 days, A3 - 15 days, A4 - 42 days

V. COMPUTATION OF FINAL RAS FOR EACH PLAN

To compute the contribution from factor 1 ,the total number of activities under each plan is considered and converted into respective percentage using table II. In this case number of activities in both the plans are 3 and hence the contribution is 5% in both the cases.

For factor 2 the sum of the duration of all the activities under each plan is calculated and converted to percentage using table III. In this case the summation of duration of activities according to both the plans is greater than 60 and so the contribution is 20% in both the cases.

For factor 3 the RA score for each activity according to the Column 7 of table V is considered and the summation according to each plan is computed and average is taken which represents in terms of 100%. Finally to bring the value to match 60% contribution the sum is multiplied by 0.6 to get the value for factor 3.
The value is computed as follows :
For Plan P1 :

P1 - A1 – A3 – A4

From table VI the RA Score values respectively are 62.5, 87.5 and 60. To give equal weightage to every activity and come to a single figure, average of the RA Score for each activity related to the respective plan is considered. In the given case the average is given as :

62.5+87.5+60 /3 = 70

To get the contribution towards final RASthe average is multiplied by a factor0.6 .

70 * 0.6 = 42

For Plan P2 :
P2 – A1 – A2- A4
From table VI the RA Score values respectively are 62.5, 67.5 and 60.

The average is 62.5+67.5+60 /3 = 63.3

Contribution towards final RA Score = 63.3 * 0.6 = 37.99 ~38
The final RAS from the three different factors are represented in the table VII. The contributions from each factor is obtained from the respective tables and performing required calculations. The final RA Score is in terms of percentage.

Table VII: Final RA Score computation

PLAN NUMBER	Factor1 (20%)	Factor 2 (20%)	Factor 3 (60%)	RA Score (100%)
P1	5	20	42	67
P2	5	20	38	63

The final table suggests that the RAS lies more or less in the same range and so the decision to choose among the plans may depend on other aspects.

VI. CONCLUSION

The concept of risk management includes risk identification, risk assessment, prioritization and finally designing of mitigation strategies. In this paper risk assessment is considered as an indicator to decide on as to which plan faces more uncertainty in terms of completion. For this a Risk Assessment Score(RAS) is calculated on the basis of three factors. This is an aim to make the decision makers aware of the uncertainties associated with each plan considering number of activities, duration of activities and the resources required for each activity. This approach demands a thorough study of the various activities related to each plan which ensures a detailed study of the plans. This detailed study can finally contribute to minimise uncertainty in successful completion of the task which is the purpose of every project.As decision making forms an integral part of every activity whenever there are more than one alternative, a detailed analysis of each alternative is essential. RAS can form one factor to assist the decision maker before taking any decision. Moreover, as this is a proactive exercise it is to be incorporated in the planning phase of the different phases in ‘Systems approach to

management'. Finally, it can be considered that risk assessment can form a valuable measure for decision makers as better planning gives better results.

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