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A Simplified Criterea-Based Martix for Weighting Project Activities and Phases

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Abstract

Purpose: The purpose of the current paper is to set the elements of an objective matrix that could be easily used by project teams to assign weights to the different phases and activities of a project with minimal individual variance between the evaluators.

Materials and Methods: In the recent study, a field research approach was followed. Six evaluators were first asked to subjectively assign weights to six activities of a project. Later the evaluators were asked to answer ten predefined closed questions which covered the financial, resources, time and dependency on activities and technology as well as the prerequisites of the project activity. The results of the answers were used to assign weights to the activities by calculating the percent of the YES answers from the total number of the questions answered. Statistical analysis was performed to check whether the use of predefined criteria significantly affects the weights of the project activities and phases compared to the subjective weighting approach.

Findings: The higher standard deviation of the subjective evaluation activities dataset in comparison to the criterial-based evaluation dataset indicates the variability between the evaluators. In practical terms, this means that the criteria-based evaluation provides more consistent evaluation results by the different evaluators. This has been further proved by the statistically significant t-test results of activity ONE and activity TWO despite the none-significant results of activities THREE to FIVE.

Unique Contribution to Theory, Practice and Policy: The findings of the current study showed the significance of the use of a predefined criteria in assigning weights to a project activities and phases. The author strongly recommends the adoption of the set criteria by the project teams for weighting project phases. The inclusion of these criteria in the commonly used project management software will indeed improve the project management process.

Keyword: *Project Planning, Criteria-Based Evaluation, Project Management, Project Phase*

INTRODUCTION

Weighing of phases and activities is a fundamental and critical step in planning projects. Mostly, criteria including the importance, duration, financial cost, and human resources requirements are used with other criteria in weighting approaches, however it is not uncommon that weights are assigned to phases and activities intuitively by the project team in the absence of clear agreed evaluation criteria in most of the cases. In addition to that, assigning weightages to activities and phases as percentages, and the use of numerical scales e.g., 1 to 9 are among the most used weighting procedures (Satty, 1977), however even these numerical weighting methods are subjectively implemented, and the rating depends momentously on the expert or project member opinion.

The outcomes of the weighting step provide the foundation for allocating resources, including human and financial, to the project. Further, the scheduled performance of a project is usually monitored by calculating the percent completion of each activity and subsequently incentives or financial penalties could be incurred if the results reveal lingering activities. This necessitates that weighting should be considerably and accurately done.

The objective of the current paper is to set the elements of an impartial methodology that could easily be used by project teams to assign weights to the project different phases and activities. The methodology will minimize and possibly eliminate the individual variation between the evaluators.

Problem Statement

Ready to use software and applications are commonly used to plan and monitor the implementation of projects, however in most of these software, activity and phase weights are not given considerate attention. Weighing will significantly improve the prioritization matrix of the project phases thence enables its successful execution and monitoring. Predominantly, assigning weights to projects activities and phases is done subjectively by the project team or experts, consequently considerable variation in the weighing results is not uncommon. Currently, many criteria weighing techniques are used, however, to date and to the best of the author's knowledge, there is no common evaluation matrix that could easily and flexibly be applied to any project despite the business area it covers, and results in sensible activity and phase weights while instantly diminishes the variance between evaluators.

Justification of the Research

The availability of a universal and adaptable standardized evaluation matrix minimizes the possible baize and subjectivity in evaluation. Moreover, the matrix will assure that all projects are evaluated in the same way with minimal discrepancies and result variances no matter where the evaluation will take place. Fostering fairness among the different stakeholders. This ensures that success criteria are unified and transparent. Furthermore, the relevance of the standardized evaluation matrix to any project will be ensured by its adaptability to the project regardless of its specific area of business. The adaptability of the matrix to any project will foster the continuous updating of the evaluation matrix rather than the reliance of the static, sometimes, outdated weighting methodologies.

LITERATURE REVIEW

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements (The Project Management Institute, 2017). As a

practice, project management could be back dated to the existence of mankind on earth, however the application of systematic tools and techniques to projects was not in place until the second half of the past century when the formulation and documentation of the principles of modern project management methodologies and techniques started Seymour and Hussein (2014).

Weighting approaches can be grouped into three categories: subjective, objective and integrated or combined approach Ginevicius and Podvezko (2005). It is agreed among researchers and project managers that subjective weight determination is based on expert opinion Satty (1977) and Olson (2008). Apparently, decision makers could influence assigning weight, to overcome this, Saaty (1977) proposed a numerical scale of "1 to 9" to transform qualitative data into quantitative by describing '1' as equal importance and '9' as extreme importance Abel et al (2018).

Several researchers have come up with different methods of determining the criteria weights of a multicriteria decision making problem (Diakoulaki et al, 1995; Ginevicius and Podvezko 2005; Aldian and Taylor 2005; Ginevicius, 2011; Dragan et al., 2018; Ayan et al 2023, and Dhafer et al 2024; and Shekhovtsov, 2025). Bridgman (1922) first described the weighted product method (WPM). Four decades later, Fishburn (1967) developed the weighted sum method (WSM) which is probably the most widely used among the methods of determining criteria weights. Saaty (1977) proposed the analytical hierarchy process (AHP) and it has recently become one of the popular methods in most multi criteria decision making (MCDM) techniques. Tofallis (2014) illustrated the advantages of the multiplication method over the simple additive weighting method in scoring and ranking multiple attributes. Megawaty et al (2025) proposed the Respond Weighting Criteria Method RECA to increase objectivity and accuracy in the evaluators' decision by determining the appropriate weight for each criterion.

Project efficiency, which is meeting time, scope, and budget goals, is not the only comprehensive measure of project success. Serrador and Turner (2015) reported the empirical relationship between efficiency and overall project success by showing that project efficiency correlates moderately strongly to overall project success and concluded that efficiency is neither the only aspect of project success nor an aspect of project success that can be ignored.

Shaukat et al (2021) examined the relationship between sustainable project management (SPM) and project success with the moderating effect of stakeholder engagement and team building on this relationship. The authors revealed that SPM has a positive impact on project success.

The intermixed processes of prioritizing phases and implementing actions and evaluating impacts has been widely implemented in different businesses. In transportation Aldian and Tylor (2005), in construction Yang et al (2007), in plant facilities maintenance Dong et al (2005) , in education Bekele and Ago (2022) , in information technology Dawood et al (2021) and in medicine Swinburn et al (1999) and Simmons et al (2009) and Glassman et al (2013) and Németh et al (2019).

Research Gaps

The reviewed literature clearly shows that in implementing the concept of project management, different approaches and theories were used for weighting the project phases, this could have resulted in variation in the outcomes of the evaluation of the same project upon using the existing different methodologies. The presence of a universal adaptable evaluation matrix was lacking, thence the need for the development of such a matrix is evidenced.

Research Theory

The current article argues that the presence of a universal and adaptable criteria-based evaluation matrix will minimize the variance between the evaluators and improves the consistency and integrity of the evaluation outcomes.

MATERIALS AND METHODS

The purpose of the current paper is to set the elements of the components of an evaluation matrix that represents the foundation of a simplified objective methodology that could be easily used to assign weights to project and business action plan different phases and activities with minimal individual variance between the evaluators.

Hypothesis

The pursued procedures of assigning weightages to the phases and activities of a project reveal different results in the absence of clear agreed evaluation criteria. Moreover, the larger the number of evaluators the more consensus the assigned weights. The current article hypothesis is that the precision and certainty of activity and phase weightage of a project are related to the predetermined evaluation criteria.

Weightage Evaluation Criteria

As in the point allocation method Odu (2019), a set of criteria is defined and used as the basis of the evaluation by the evaluators. In the current article the evaluation points are 10 and clustered into four major dimensions. Further, instead of giving the evaluator the choice to rank the points subjectively, the evaluator will provide a "YES" or "NO" answer to the contribution of the criterion in the evaluated activity of the project or business action plan**.** Table 1 depicts the evaluation dimensions and their sub-criteria.

Table 1: The Evaluation Matrix of a Project

Dimension	Criteria	Description
Finance	Budget Allocation	Budget availability for the activity
Resources	Human	More project team members are required
	Technology	Special software or technology is needed
	Machinery and Equipment	Machinery and equipment are required
Time and Dependency	Duration	More time is needed to finish the activity
	Dependency on Other Activities	Start and or completion relies on other activities
	Monitoring	Monitoring during the project execution is needed
	Third Party Dependency	An outsourcer is required
Prerequisites	Risk Level	The risks related to the activity are high or cannot be mitigated i.e., acceptable risk
	Licensing and Permits	A permit or license is required either to start the activity or test its outcome

The evaluators, who could be the project team members or external ones, should evaluate each of the project phases or activities using the evaluation matrix shown in Table 1. Activities that need more attention in any aspect or require more resources or time should be evaluated using a "YES" answer. Moreover, to avoid the subjectivity of evaluation of activities that require

more time for executing or monitoring, it is advisable to calculate the time required for each activity from the total project time. If the time required is equal to or greater than 5% of the total project duration, the activity should receive a "YES" evaluation.

Activity Weight Calculation

After completing the evaluation of the criteria, the activity weight (*Wt.*) is obtained from calculating the percentage of the "YES" from the total evaluated criteria as follows:

$Wt. = (n\text{Y}/N) * 100$

Where:

Wt. : the percent weight of the activity

*n*Y : the sum of the "YES" results

N : the sum of all the results "*n*Y" and "*n*N"

The more "YES" evaluations an activity receives, the greater its relative importance in the project or business action plan.

FINDINGS

Six evaluators were asked to first assign weights subjectively to the six activities of a project. Afterwards the evaluators used the criteria-based evaluation to assign weights to the same activities of the project. The results of both the subjective and criteria-based evaluations are shown in Table 2. Visualization of the results clearly shows that the evaluators reconsidered their evaluation and assigned more weights to the activities which require more attention and resources. This re-examination of evaluation was not purposely done, rather it was an outcome of the use of criteria-based evaluation matrix. Moreover, looking at the standard deviation values for each Activity and comparing them across the two evaluation approaches, it is clearly illustrated that subjective evaluation has higher standard deviations, meaning the presence of more variability in the evaluation results. In practical terms, this could be interpreted in that the criteria-based evaluation reduced variance and increased subjectivity, thence providing more consistent evaluation results by the different assessors.

Table 2: Subjective and Criteria-Based Evaluation of a Six Activities Project

Activity	Subjective Evaluation (%)							Criteria-Based Evaluation (%)						
	A	B	C	D	E	F	SD	A	B	C	D	E	F	SD
ONE	10	15	15	15	12	20	0.031	6.5	3.1	7.4	11.4	4.2	8.0	0.027
TWO	20	15	15	14	15	15	0.020	22.6	25.0	22.2	22.9	25.0	20.0	0.017
THREE	15	10	10	27	18	10	0.062	19.4	15.6	11.1	11.4	16.7	12.0	0.031
FOUR	15	25	25	20	24	15	0.043	19.4	21.9	25.9	14.3	25.0	16.0	0.043
FIVE	20	25	10	12	22	30	0.070	25.8	21.9	22.2	22.9	20.8	32.0	0.038
SIX	10	5	15	8	5	5	0.037	3.2	6.2	7.4	11.4	4.2	4.0	0.028

The evaluation results of both the subjective and criteria-based evaluations are expressed in geometric mean ± standard deviation SD in Table 3. The results of the student t-test revealed high p values for Activity ONE and TWO meaning that the criteria-based evaluation significantly impacted the evaluation, however, regardless of the nonsignificant statistical results for Activity THREE, FOUR, FIVE and SIX, the depicted results show the variability in the evaluation results between the evaluators

in the absence of predefined evaluation criteria, this is evidenced by the high standard deviation of the subjective evaluation activities.

Table 3: Paired t-Test of Subjective versus Criteria-Based Evaluation

Activity	Subjective Evaluation	Criteria-Based Evaluation	p Value
ONE	13.2 ± 0.031	5.9 ± 0.027	< 0.011
TWO	15.7 ± 0.020	23.5 ± 0.017	< 0.005
THREE	14.9 ± 0.062	14.5 ± 0.031	< 0.775
FOUR	21.4 ± 0.043	20.8 ± 0.043	< 0.786
FIVE	16.8 ± 0.070	22.7 ± 0.038	< 0.187
SIX	7.9 ± 0.037	5.9 ± 0.028	< 0.390

CONCLUSION AND RECOMMENDATIONS

Conclusion

The aim of the current paper is to develop a standardized and easy to adopt evaluation matrix with flexible and amendable criteria for weighing the activities and phases of projects. Despite the nonsignificant statistical findings between four out of six of the means of the subjective and criteria-based evaluations, the findings of the current paper strongly support the conclusion that the developed criteria could straightforwardly and submissively be adopted and used by project teams to assign weights to the different phases and activities of any project regardless of the area of specialty of that project. Furthermore, the simplicity of the evaluation matrix renders it easy to adopt using the available free web survey forms.

Recommendations

The author strongly recommends the adoption of the developed criteria-based weighing matrix to assign weights to the phases and activities of project with no limitation of modification and twisting to suit the requirements of any project. The results of the current article clearly showed that the criteria-based evaluation matrix reduced the variation between evaluators when using subjective evaluation approaches. Additionally, the segmentation of the developed matrix into four main dimensions makes it adaptable and flexible to evaluate any project no matter its area of specialization.

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Conflicts of Interest Declaration

The author declares that the information and data in this manuscript are original and has not been formerly submitted to any other journal or publication for consideration. No conflicts of interest are associated with this work.

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