An evaluation on a research paper using Pryczak model: 'Project Risk Assessment Using the Analytic Hierarchy Process' by Mustafa, M. A. and Al-Bahar, J. F.

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Ⅰ. Introduction

The *IEEE Transactions on Engineering Management* is a research-based, refereed journal in engineering management. Published quarterly since 1954 by the IEEE Engineering Management Society, the journal's worldwide subscription base is approximately 10,000. In 1991, the journal published an article about using analytical hierarchy process (AHP) methodology in project risk management. The article, "Project Risk Assessment Using the Analytic Hierarchy Process," was written by Mustafa and Al-Bahar (1991, see Appendix A for the article's abstract). Their study analyzed and assessed the risks involved during the bidding stage of a construction project. They then examined how AHP can be used as a decision making method in project management in order to overcome the limitations of the traditional approaches used by contractors. The AHP implementation steps were simplified by using the

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"Expert Choice" professional software that is available commercially and designed for implementing AHP (go to http://www.expertchoice.com).

The objective of this paper is to evaluate Mustafa and Al-Bahar's article on the potential of using AHP method in project management area. Subsequent articles by Ahmad et al. (2006), Al-Tabtabai et al. (2004) and Mahmoodzadeh et al. (2007) discuss actual cases where AHP was applied in project management. The other sections of this paper are to use the model developed by Pyrczak (2008) in evaluating research in academic journals with subjective view of author. All of the questions used to evaluate the article were taken from Appendix D of Pryczak's study (pp. 151-156).

Ⅱ. Evaluation

2.1 Evaluation of title

A good title helps readers identify articles of interest as well as to reflect on the contents of the article. First, the title of this article is sufficiently specific and the title is reasonably concise with exactly eight words. Two primary terminologies, i.e. Analytic Hierarchy Process and Project Risk, are specified in the title of this article but "Analytic Hierarchy Process" should be changed and expressed as an abbreviated word "Analytic Hierarchy Process (AHP)."

Questions for Evaluating the Title	5	4	3	2	1	N/A	I/I
Is the title sufficiently specific?			X				
Is the title reasonably concise?		X					
Are the primary variables referred to in the title?		X					
When there are many variable, are the types of variables referred to?			X				
Dose the title identify the types of individuals who participated?					X		

If a study is strongly tied to a theory, is the name of the specific theory mentioned in the title?						X	
Has the author avoided describing results in the title?	X						
Has the author avoided using a "yes-no" question as a title?	X						
If the main title and a subtitle, do both provide important information about research?						X	
If the title implies causality, dose the method of research justify it?						X	
Is the title free of jargon and acronyms that might be unknown to the audience for the research report?	X						
Are any highly unique or very important characteristics of the study referred to in the title?			X				
Overall, is the title effective and appropriate?			X				

* N/A: Not Applicable, I/I: Insufficient Information

Table 1. Evaluation of Title. *This table represents scoring of the "Project Risk Assessment Using the Analytic Hierarchy Process" (Mustafa and Al-Bahar, 1991, p. 46); the questions are based on Pyrczak's model (p. 151).*

It is often desirable that titles identify the population that was studied in the research (Pyrczak, p.15). The title of their study, however, does not show the types of individuals who participated. Moreover, the specific theory was not mentioned in the title because this article was not tied to a theory. The authors described results in the title, which is not a "yes-no" type of question, and they did not use a subtitle. In their paper, causal relationships were not examined because the title does not contain the word "effects." The title does not contain jargon and acronyms. The title does not refer to unique characteristics of the study. The title is effective and appropriate.

The Pyrczak model (p. 151) presents a scale from 1 (very unsatisfactory) to 5 (very satisfactory) which can be used to score journal articles. Using this scale, the title of their research received a score of 36 out of 50 points. Four questions were

deleted from the assessment as they were not applicable (N/A) (see Table 1).

2.2 Evaluation of abstract

The purpose of an abstract is to clearly and succinctly provide the reader with objectives of the specific article. In this paper, the author proposes that project risk assessment can be used as an example for using AHP in project management.

Questions for Evaluating the Abstract	5	4	3	2	1	N/A	I/I
Is the purpose of the study referred to or at least clearly implied	X						
Does the abstract mention highlights of the research methodology?	X						
Has the researcher omitted the titles of measures (except when these are the focus of the research?)	X						
Are the highlights of the results described?		X					
If the study is strongly tied to a theory, is the theory mentioned in the abstract?						X	
Has the researcher avoided making vague references to implications and future research directions?	X						
Overall, is the abstract effective and appropriate?		X					

Table 2. Evaluation of Abstract. *This chart represents scoring of the abstract by Mustafa and Al-Bahar, (p. 46); the questions are based on Pyrczak's model (151-152).*

The usual length of abstracts is between 100 to 250 words (Pyrczak, p. 23). Because the abstract of the article contains 119 words, their abstract is appropriate (see Appendix A). The abstract usually provides important information about the research methodology as well as a description of the results of the research. As discussed in the previous section, Their's article is not tied to a theory so the abstract does not mention a specific theory. They did not make vague references to implications and future research directions in the abstract. Generally, the abstract of the article is effective and appropriate. Using the Pyrczak model, the abstract scored

28 out of 30 points. One question – "if the study is strongly tied to a theory, is the theory mentioned in the abstract" – was deleted because it was not applicable (see Table 2).

2.3 Evaluation of introduction and literature review

This section will determine if their study fulfilled five purposes: a) introduce the problem area; b) establish its importance; c) provide an overview of the relevant literature; d) show how the current study will advance knowledge in the area; and e) describe the researcher's specific research questions or purposes (Pyrczak, p.33).

They wrote a proper introduction (seven paragraphs less than one full page) and a separate literature review (13 paragraphs over three full pages). The authors began by encouraging the application of AHP method in the field of project management. They also stated that problem area is important because '*a number of systematic models have been proposed for use in the risk evaluation phase of the risk management process. Some of these models require detailed quantitative information which is not normally available in the real construction world.*' (Mustafa and Al-Bahar, p. 46).

Subheadings usually guide readers through long introductions (Pyrczak, p. 38). Their study, however, has a short introduction so there was no need for subheadings. Their article adequately described the theory with separate sections namely, the analysis hierarchy process, identification, and classification of project risks (pp. 46-47).

Questions for Evaluating the Introduction and Literature Review	**5**	**4**	**3**	**2**	**1**	**N/A**	**I/I**
Introduction Specific Questions							
Dose the researcher begin by identifying a specific problem area?	X						
Dose the researcher establish the importance of the problem area?	X						
Are any underlying theories adequately described?	X						
Dose the introduction move from topic to topic instead of from citation to citation?		X					
Are very long introductions broken into subsections, each with its own subheading?						X	

Has the researcher provided adequate conceptual definitions of key terms?	X						
Has the researcher cited sources for "factual" statements?		X					
Do the specific research purposes, questions, or hypotheses logically flow from the introductory material?		X					
Overall, is the Introduction effective and appropriate?	X						
Literature Review Specific Questions							
Has the researcher avoided citing a large number of sources for a single point?	X						
Is the literature review critical?		X					
Is current research cited?	X						
Has the researcher distinguished between opinions and research findings?		X					
Has the researcher noted any gaps in the literature?		X					
Has the researcher interpreted research literature in light of the inherent limits of empirical research?			X				
Has the researcher avoided the overuse of direct quotations from the literature?	X						
Overall, is the literature review portion of the introduction appropriate?	X						

Table 3. Evaluation of Introduction and Literature Review. *This chart represents scoring of the introduction and literature review by Mustafa and Al-Bahar (46-48); the questions are based on Pyrczak's model (p. 152).*

The authors also provided clear conceptual definitions of key terms. For example: "The AHP provides a flexible and easily understood way to analyze project risks. It is a multi-criteria decision analysis methodology that allows subjective as well as objective analysis methodology that allows subjective as well as objective factors to be considered in the process which is precisely what is needed"(p. 46). They presented the statements like "facts" along with their sources. The specific research purposes and questions upon which this study is based are stated in the last paragraph of the Introduction. Overall, the introduction of this article is very appropriate.

Their study cited a single source to support a point and refers to "well-designed" studies. The authors used words that help readers understand whether the cited literature presents opinions or research results. Overall, the literature review of this article is very appropriate. On a scale of 1-5 for each of the 17 questions which

evaluated the introduction and the literature review, this article received 72 points out of 80. One question was eliminated as it was not applicabile (see Table 3).

2.4 Evaluation of samples (when researchers do not generalize)

Their study presented the application of AHP to assess the risks in an international construction project, specifically the Jamuna Multipurpose Bridge in Bangladesh (Mustafa and Al-Bahar, p. 48). Six criteria - acts of God, physical, financial and economic, political and environmental, design, and job site-related - were described in y separate sections (pp. 47-48). The authors developed the hierarchy of problems as shown in Table 2 (p. 48). The AHP method uses purposive, rather than random, samples made by the relevant experts on any project. Therefore, the samples used by the research will be evaluated based Pyrczak's questions for articles "*when researchers do not generalize*" (p. 69).

Questions for Evaluating Samples	5	4	3	2	1	N/A	I/I
Has the researcher described the sample/population in sufficient detail?					X		
For a pilot study or developmental test of a theory, has the researcher used a sample with relevant demographics?					X		
Even if the purpose is not to generalize to a population, has the researcher used a sample of adequate size?							X
Is the sample size adequate in terms of its orientation (quantitative versus qualitative)?							X
If a purposive sample has been used, has the researcher indicated the basis for selecting participants?							X
If a population has been studied, has it been clearly identified and described?					X		
Has informed consent been obtained?							X
Overall, is the description of the sample adequate?					X		

Table 4. Evaluation of Samples. *This chart represents scoring of sampling by Mustafa and Al-Bahar (pp. 48-50); the questions are based on Pyrczak's model (p. 153).*

Their study, however, neither discussed the sampling process nor provided detailed information about their respondents. This is a very weak point in the article. The reason for this might be that the research was a pilot study or a developmental test for applying the AHP method. While the authors mentioned that they chose 10 experts on AHP, they did not discuss the exact criteria they used for selecting experts. The quality of the sample was more important point than sample size.

In conclusion, the description of the sample is not adequate. Due to this sample problem, their overall score is very low at 4 out of 20 points on the Pyrcak model. Four questions were deleted in the evaluation was they were either not applicable or there was insufficient information (see Table 4).

2.5 Evaluation of instrumentation

Their study used Expert Choice software (go to http://www.expertchoice.com) as an instrument to apply the AHP method. The authors proposed that Expert Choice can calculate the results manually or automatically. They also argued that using AHP to model and analyze real world problems can be made much easier using a microcomputer application such as Expert Choice. This software makes it simpler and quicker to structure and modify the hierarchy (Mustafa and Al-Bahar, p. 47).

Pyrczak suggests that it is desirable for researchers to indicate the response format (p. 79); however, their research did not describe in detail any specialized response formats including settings, or restrictions, or both. The authors did not the present multiple methods used to collect data/information on each variable. They also did not cite the sources for additional information. Instead, the authors classified the various potential sources of risk in construction projects with detailed explanations (p. 47). The authors also proposed the sensitivity analysis of the level of total risk for additional outcome. They also pointed out that while the AHP method can be susceptible to subjectivity in collecting and coding observations, it emphasizes the consistency of respondents. To avoid inconsistency and stability in the data, Consistency Ratio (CR) should be calculated. If the CR value for a matrix is less than 0.1, it is considered to consistently provide good consistency calculations of the weights of the factors. If the CR value is more than 0.1, the researcher should again

obtain a response through the same questionnaire until the CR value is less than 0.1 (Saaty, 1980). This paper shows the pair-wise comparison matrix and priority vector for the validity (Pyrczak, pp. 25-26). Although they do not discuss the obvious limitations of the instrumentation, the instrumentation section is somewhat adequate.

Questions for Evaluating Instrumentation	5	4	3	2	1	N/A	I/I
Have the actual items and questions (or at least a sample of them) been provided?	X						
Are any specialized response formats, settings, and/or restrictions described in detail?					X		
When appropriate, are multiple methods used to collect data/information on each variable?					X		
For published instruments, have sources where additional information can be obtained been cited?			X				
When delving into sensitive matter, is there reason to believe that accurate data were obtained?		X					
Have steps been taken to keep the instrumentation from influencing any overt behaviors that were observed?							X
If the collection and coding of observations involves subjectivity, is there evidence of inter-observer reliability?	X						
If an instrument is designed to measure a single unitary trait, does it have adequate internal consistency?	X						
For stable traits, is there evidence of temporal stability?	X						
When appropriate, is there evidence of content validity?	X						
When appropriate, is there evidence of empirical validity?	X						
Do the researchers discuss obvious limitations of their instrumentation?					X		
Overall, is the instrumentation adequate?		X					

Table 5. Evaluation of Instrumentation. *This chart represents scoring of instrumentation by Mustafa and Al-Bahar (pp. 47-48); the questions are based on Pyrczak's model (pp. 153-154).*

Using the Pyrczak model, the article scored 44 out of 60 points. One question was deleted because it was not applicable (see Table 5).

2.6 Evaluation of analysis and results (for quantitative research)

In an article, this section usually discusses the evaluation of quantitative research which often use descriptive and inferential statistics. The AHP method used in their study focused on calculating the relative weights of various factors through the quantitative method. AHP is composed of three main steps: (1) decomposition or structuring the decision problem; (2) comparative judgment or evaluating pairs of criteria at a hierarchical level; and (3) determination of priority or determining the weight of the alternative decision.

Their study also presented sensitivity analysis which showed that the outcome of the analysis is highly dependent on the hierarchy established by the management and the relative judgments made about the various elements of the problem. Changes in the hierarchy or in judgments may change the outcome. The sensitivity of the outcome to different changes can be tested using Expert Choice. This article showed the calculations, including the percentages of the analyzed results, in Tables 12 (Mustafa and Al-Bahar, p. 50).

The authors also discussed the highlights of all of their tables in the narrative for explaining the process of calculation. Because the AHP method was not related to inferential tests, the authors did not present descriptive statistics. The presentation of this section is comprehensible and adequate. Using the Pyrczak model (pp. 103-109), this section scored 29 out of 35 points except. Three questions were not included (see Table 6).

Questions for Evaluating Analysis and Results	5	4	3	2	1	N/A	I/I
When percentages are reported, are the underlying numbers of cases also reported?		X					
Are means reported only for approximately symmetrical distributions?						X	
If any differences are statistically significant and small, have the researchers noted that they are small?						X	
Is the results section a cohesive essay?		X					

Does the researcher refer back to the research hypotheses, purposes, or questions originally stated in the introduction?		X					
When there are a number of related statistics, have they been presented in a table?		X					
If there are tables, are their highlights discussed in the narrative of the results section?	X						
Have the researchers presented descriptive statistics before presenting the results of inferential tests?						X	
Overall, is the presentation of the results comprehensible?		X					
Overall, is the presentation of the results adequate?		X					

Table 6. Evaluation of Analysis and Results. *This chart represents scoring of the analysis and results section in a research article by Mustafa and Al-Bahar (p. 50); the questions are based on Pyrczak's model (p. 155).*

2.7 Evaluation of discussion section

This section of an academic article can have different titles such as "Discussion and Conclusions," "Conclusions and Implications," or "Summary and Implications" (Pyrczak, p. 121). They used the heading "Summary and Discussion." The discussion of this article was comprehensive and, thus, adequate for reader to understand the intention of the article.

The authors showed that AHP provides valuable support for contractors in the decision making process. In addition, this article identified some limitations regarding the efficient use of the AHP. The first limitation is related to building the hierarchy so the authors recommended that certain elements under any node should be included in order to preserve consistency. The second limitation is the number of judgments required to derive relative priorities. The authors also suggested that future research should specifically address how AHP has been extended to deal with situations where

experts have conflicting judgments. Although their research did not discuss any relevant theories, they proposed using sensitivity analysis to distinguish between speculation and data-based conclusions.

Questions for Evaluating Discussion	5	4	3	2	1	N/A	I/I
In long articles, do the researchers briefly summarize the purpose and results at the beginning of the discussion?	X						
Do the researchers acknowledge specific methodological limitations?		X					
Are the results discussed in terms of the literature cited in the introduction?			X				
Have the researchers avoided citing new references in the discussion?			X				
Are specific implications discussed?		X					
Are the results discussed in terms of any relevant theories?		X					
Are suggestions for future research specific?	X						
Have the researchers distinguished between speculation and data-based conclusions?		X					
Overall, is the discussion effective and appropriate?		X					

Table 7. Evaluation of Discussion. *This chart represents scoring of the discussion section including summary in a research article by Mustafa and Al-Bahar (pp. 50-51); the questions are based on Pyrczak's model (p. 156).*

Overall, the discussion in this article is effective and appropriate. The score, based on the Pyrczak model (pp. 121-127), is 36 out of 45 points with all questions used (see Table 7).

Ⅲ. Conclusion: Overall Evaluation

The concluding section of academic articles provides an overall judgment by considering this article as a whole (Pyrczak, p. 129). Although some of the questions (e.g. "putting it all together") are subjective, table 8 can show the problems in this article.

The authors selected an important problem: Risk assessment and questions about the efficient use of AHP (p. 47). This article is somewhat reflective. There were no unavoidable methodological in the article. Although the research does not directly inspire additional research, the authors emphasized the use of AHP method in project management. That is, the paper proposes that the project manager may find AHP useful to support decision making in evaluating bids, selecting equipment, hiring staff, enabling corporate stability and competitiveness, among others. Their study is likely to help in future studies on decision making and, therefore, worth publishing in an academic journal.

Questions for Evaluating the Research Article ("Putting it all Together")	**5**	**4**	**3**	**2**	**1**	**N/A**	**I/I**
In your judgment, has the researcher selected an important problem?		X					
Were the researchers reflective?		X					
Is the report cohesive?		X					
Dose the report extend the boundaries of the knowledge on a topic, especially for understanding relevant theories?		X					
Are any major methodological flaws unavoidable or forgivable?		X					
Is the research likely to inspire additional research?	X						
Is the research likely to help in decision making?	X						
All things considered, is the report worthy of publication in an academic journal?	X						
Would you be proud to have your name on the research article as co-author?	X						

Table 8. Evaluation of the Research Article. *This chart represents scoring of the full research article by Mustafa and Al-Bahar (pp. 46-52); the questions are based on Pyrczak's model (p. 156).*

The overall score (Pyrczak, pp. 129-133) is 40 out of 45 points, with all questions applicable to this article (see Table 8).

Consequently, based on all evaluation tables, figure 1 presents the percentage (%) of evaluation scores for all sections of their study. This chart does include questions that were not applicable or those where the article contained incomplete information.

One can see that of all the sections in the article, the section on samples was the weakest.

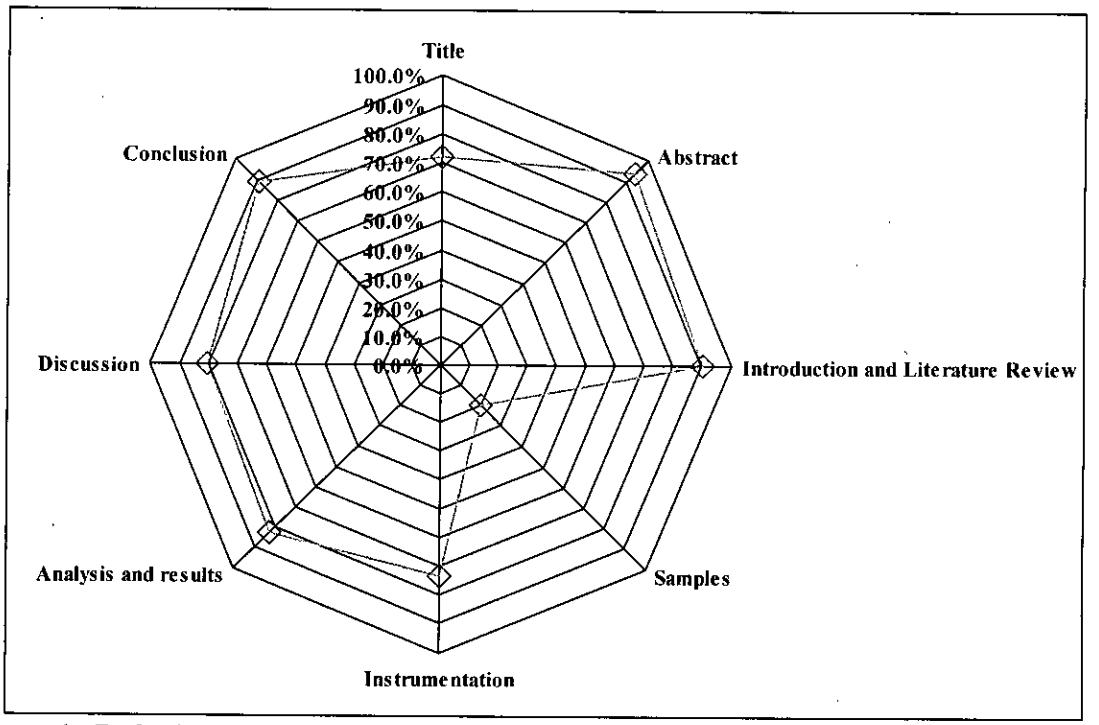

Figure 1. Evaluation scores by section. *This chart represents scoring of all the sections from the full article by Mustafa and Al-Bahar (pp. 46-52); the questions are based on Pyrczak's model (p. 156).*

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Appendix A

Abstract from "Project Risk Assessment Using the Analytic Hierarchy Process" by Mustafa and Al-Bahar (1991)

Often, construction projects fail to achieve their time, budget, and quality goals. This is frequently due to the failure of the contractor to analyze and assess unanticipated risks. The analytic hierarchy process (AHP) is a new approach that can be used to analyze and assess project risks during the bidding stage of a construction project and to overcome the limitations of the traditional approaches currently used by contractors. The AHP presents a flexible, easily understood way to assist the decision-maker in formulating his problem in a logical and rational manner. The paper also includes a review of the AHP and its application in the assessment of the riskiness of constructing the Jamuna Multipurpose Bridge in Bangladesh (Mustafa and Al-Bahar, p. 46).

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