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Research Article

Impact of Authentic Leadership traits in Engineering Sector using MCDM

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Abstract – This study aims to develop a conceptual model that establishes a connection between Authentic Leadership (AL), employee engagement, and organizational innovation within Pakistan's engineering sector. Employing a Multi-Criteria Decision-Making (MCDM) technique, the study investigates the interaction and impact of workers on organizational innovation, generating benefits for both industry practitioners and the academic community. The findings highlight the substantial influence of four key AL traits, namely balanced processing, internalized moral perspective, relational transparency, and self-awareness, on work engagement [8]. By applying the Analytic Hierarchy Process (AHP) and utilizing decision-making software, the study identifies the self-awareness as the most crucial criterion for AL outcomes, with a weight of 0.25891. Relational transparency Balanced processing (weight: 0.20894), Balanced processing (weight: 0.1220), and internalized moral perspective (weight: 0.0483) follow as subsequent priorities. These outcomes contribute to the development of theoretical understanding in the field. Furthermore, they provide valuable insights to the engineering sector, enabling the cultivation of employee engagement and the enhancement of organizational innovation.

The research focuses on elucidating the relationships between AL, employee engagement, and organizational innovation in the context of Pakistan's engineering sector. By adopting a comprehensive MCDM approach, the study offers a thorough analysis of the factors influencing employee engagement, with particular emphasis on the identified AL traits. The findings underscore the significance of balanced processing, internalized moral perspective, relational transparency, and self-awareness as drivers of work engagement [9]. Moreover, the application of the AHP technique reveals the priority weights assigned to these traits, highlighting the critical role of the internalized moral perspective criterion in achieving AL outcomes.

The results of this research carry implications for both practitioners and scholars. For the engineering sector in Pakistan, embracing and implementing AL practices can yield substantial benefits, fostering a work environment that stimulates employee engagement and drives organizational innovation. By prioritizing the identified AL traits, organizations can effectively channel their resources and efforts towards enhancing employee engagement and promoting innovation. From an academic standpoint, this study contributes to the existing literature by providing empirical evidence and a conceptual model that sheds light on the interplay between AL, employee engagement, and organizational innovation. The findings serve as a foundation for further theoretical development and future research endeavors in this domain.

Keywords – Authentic Leadership, Engineering Sector, Employee Engagement, Organizational Innovation, MCDM

I. INTRODUCTION

Authentic leadership theory emphasizes the importance of honest and ethical leader behavior, fostering trust, openness, and self-awareness among team members. Collaboration in the engineering industry is becoming increasingly important, as engineering projects often require teamwork. However, collaboration issues have been identified as a major cause of project failure. Selecting the right team leader is crucial for team performance, and authentic leadership has been found to positively impact team success. The Analytic Hierarchy Process (AHP) is a widely used decision-making approach that incorporates quantitative and qualitative methods.

II. OBJECTIVE

The research focuses on elucidating the relationships between AL, employee engagement, and organizational innovation in the context of Pakistan's engineering sector. By adopting a comprehensive MCDM approach, the study offers a thorough analysis of the factors influencing employee engagement, with particular emphasis on the identified AL traits.

III. LITERATURE REVIEW

Research has shown that authentic leaders have a significant impact on their followers through role modeling. Followers tend to adopt similar behaviors and moral conduct as their authentic leaders, which can lead to improved work attitudes and organizational effectiveness[1]. Authentic leadership is associated with positive outcomes such as increased trust, work engagement, and organizational [6] innovation.

Personality traits play a role in authentic leadership, as certain characteristics are more conducive to effective leadership than others. For example, agreeableness and openness to new experiences are qualities that may contribute to authentic leadership[2]. Understanding these personality attributes can help organizations identify potential authentic leaders and enhance their performance and interpersonal skills.

The importance of selecting an authentic team leader for effective job performance and job satisfaction and organization innovation[10], a potential gap that could be identified is the lack of specific empirical evidence or studies that directly investigate the relationship between authentic leadership and its impact on team performance and job satisfaction in the engineering sector. Conducting research that fills this gap by examining the effects of authentic leadership on engineering sector and exploring any potential challenges or barriers could provide valuable insights for practitioners and contribute to the existing literature.

In this study, the application of Multi-Criteria Decision-Making (MCDM) techniques helps in assessing the impact of Authentic Leadership (AL) on job satisfaction and organizational innovation. MCDM techniques provide a structured and systematic approach to evaluate multiple criteria and considerations when making decisions.

By utilizing MCDM techniques, the study can effectively handle the complexity of the research problem, which involves evaluating the relationship between AL, job satisfaction, and organizational innovation[11]. MCDM allows for the incorporation of various criteria and factors that influence job satisfaction and organizational innovation, considering both qualitative and quantitative aspects.

The use of MCDM techniques enables the researchers to compare and analyze different options or scenarios based on multiple criteria simultaneously. It helps in identifying the most suitable options that align with the objectives of the study, such as selecting the team leader with authentic leadership qualities that can positively impact job satisfaction and foster organizational innovation.

IV. METHODOLOGY

The methods used to carry out the suggested research activity was discussed. The study approach was broken down into four distinct phases, each of which is described below in detail.

Phase 1: Literature Review

- Conducted a detailed literature review on Authentic Leadership alternatives and Multi Criteria Decision Methods (MCDM) to understand the application of MCDM in authentic leadership alternatives.
- Identified research gap based on the literature review to determine the objective of the research study.

Phase 2: Case Study Selection and Determination of Parameters and Alternatives

- Selected a suitable case study that aligns with the research goals.
- Identified important parameters for the analysis through literature review and evaluated them using surveys/ questionnaires.
- Determined the alternatives or best possible solutions through surveys/ questionnaires.

Phase 3: Hierarchy Decision Model and Questionnaire Design

- Developed a hierarchy decision model based on the selected MCDM method (AHP) and the criteria and alternatives identified in Phase 2.
- Designed a questionnaire for data collection based on the AHP method, including pair-wise comparison of criteria and authentic leadership alternatives.
- Collected data through questionnaires and interviews with experts in the research area.

Phase 4: Data Analysis

- Analyzed the collected data using the AHP methodology.
- Utilized decision-making software such as Super Decision for data analysis.

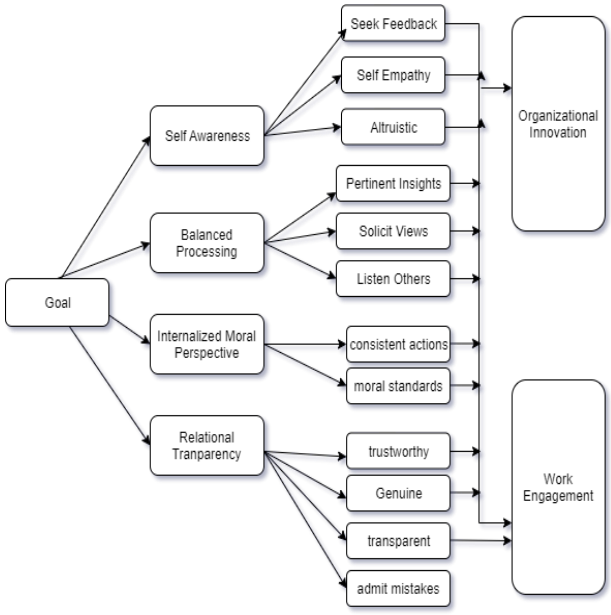

Fig. 1 Methodology

The AHP model is shown in Figure 1. Figure will illustrate the objectives, criteria, and alternatives in determining the AL Outcomes.

1. Goals, which are things that should be accomplished overall or criteria and alternatives. The goal of this study was to choose the best AL leadership choice for the engineering sector.
2. The criteria include self-awareness, relational transparency, internalized moral perspective, and balanced processing.
3. Organizational innovation and work engagement are alternatives.

A. Methods of Data Collection and questionnaire design

The data collection method used in this study was a questionnaire-based survey. The questionnaire

was designed to gather opinions and insights from the respondents who were experts in the selected case study research area, specifically in alternative energy development. The respondents were chosen based on their experience and skills related to the research work.

To ensure that the most suitable respondents were selected for data collection, a question was asked in the questionnaire to determine if they had experience in alternative energy development. The questionnaires were distributed to 15 respondents who were members of the Engineering Sector. The respondents included directors, deputy directors, and assistant directors, representing decision-makers in the field.

Table 1 Demographics of the Respondents (N=15)

Gender	Male	13
	Female	2

Table 2- Demographics

Age	25-30	1
	31-34	5
	35-40	9

The questionnaire design focused on collecting demographic information as well. The demographic information provided insights into the characteristics of the respondents. In this case, the demographic information included gender, age, and experience. Out of the 15 respondents, 13 were male and 2 were female. The majority of the respondents (60%) were in the age range of 35-40 years, followed by 33.34% in the age range of 31-34 years, and 6.67% in the age range of 25-30 years. The respondents had varying levels of experience, with 6.67% having 1-2 years of experience, 26.67% having 2-3 years, 40% having 3-5 years, and 20% having 5-10 years.

Table 3- Demographics

Experience	1-2 Years	1
	2-3 Years	4
	3-5 Years	6
	5-10 Years	3

In Phase 1 of the research, an AHP-based questionnaire was designed. The questionnaire aimed to make comparisons between criteria using a pairwise comparison matrix and pairwise comparisons between alternatives based on each criterion using Saaty's scale of 1-9[3][4]

Relative Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to objective
3	Weak importance	Experience and judgment slightly favor one activity over another
5	Strong importance	Experience and judgment strongly favor one activity over another
7	Demonstrated importance	One activity is strongly favored and demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values	When compromise is needed between two adjacent judgments

Source: Saaty, 2008

Fig. 2 Saaty Scale

For data analysis, two popular Multi-Criteria Decision Making (MCDM) methods, Analytic Hierarchy Process (AHP), and Super Decision software were used. The data analysis was conducted using the Super Decision software, which facilitated the AHP methodology analysis.

The AHP analysis using Super Decision involved entering the hierarchical decision model's purpose, criteria, and policy alternatives. The AHP hierarchy determined the AL (Alternative Leadership) outcomes. The model included goals, criteria (self-awareness, relational transparency, internalized moral perspective, and balanced processing), and alternatives (organizational innovation and work engagement) in determining the AL outcomes.

B. *Data Analysis*

In this research work, the data analysis has done by applying the two popular MCDM methods Analytic Hierarchal Process (AHP). The AHP methodology analysis has done by using decision-making software Super Decision.

C. *AHP Analysis using Super Decisions*

Subsequent actions were taken in order to assess the data using super decision. Enter the hierarchical decision model's purpose first, criteria, and policy alternatives.

These super decision tools are put to the test in this phase. It will appear as seen in figure 2 once all Clusters have been joined to all Nodes.

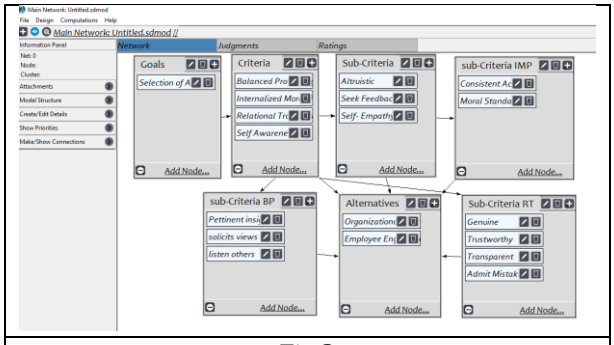

Fig.3

The initial judgement was to pick the component that would serve as the basis for the comparison; a select node is a parent node in a choose cluster that includes a child node when compared to the parent node in the system. The comparison of five potential modalities, including graphical, verbal, matrix questionnaire, and direct for inputting assessments, made up the second portion of the judgement. Except for the questionnaire, which rounds off judgements from other modes, judgments submitted in one method will show as comparable judgments in any other form. It is a crucial component of Super Decision, and its outcome is dependent upon it. Below is a discussion of the five components.

When all Clusters are connected, the following step is to compare the Clusters. To accomplish this, fill out the data on the Questionnaire box by selecting the Assess/Compare menu, then clicking Do Comparison.

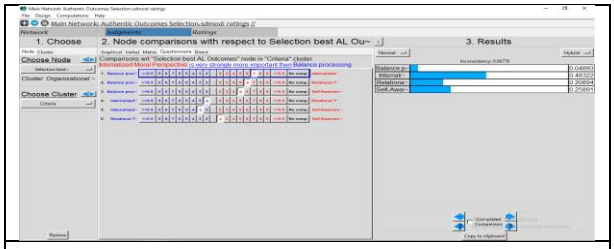

Fig.5

From the results of the weighting process of paired matrix values, the results of the comparison of priority weights are:

1. Self-Awareness is a top priority in choosing criteria for AL outcomes with a criteria weight of 0.25891.
2. Relational transparency becomes the second priority with criteria weight of 0.20894.
3. Balanced processing as the third priority with a criteria weight of 0.1220.
4. Internalized moral perspective as the fourth with a criteria weight of 0.0483.

Compute weights of the Balanced Processing Sub Criteria with respect to goal as shown in the Fig.5

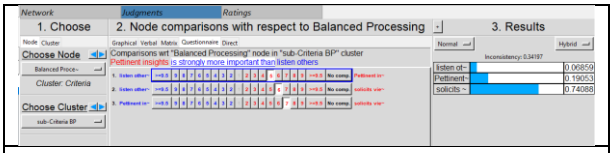

Fig.5

Compute weights of the Internalized Moral Perspective Sub Criteria with respect to goal as shown in the Figure 6

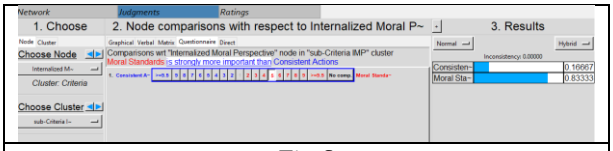

Fig.6

Compute weights of the Relational Transparency Sub Criteria with respect to goal as shown in the Figure 7

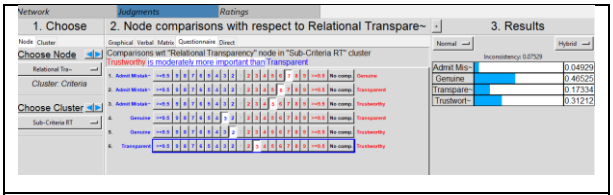

Fig.7

Compute weights of the Self Awareness Sub Criteria with respect to goal as shown in the Figure.8

Fig.8

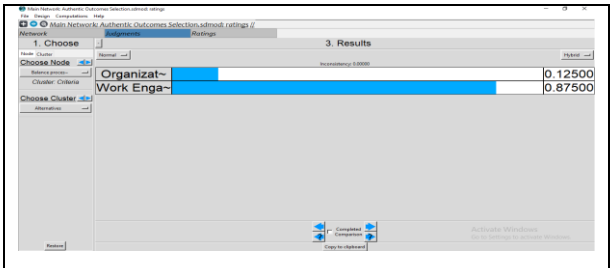

Fig.9 Results of Priority Weight Comparison of Alternatives by Balance Processing

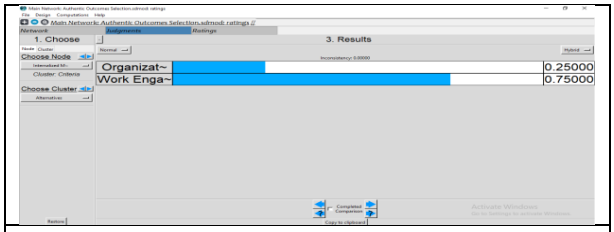

Fig.10

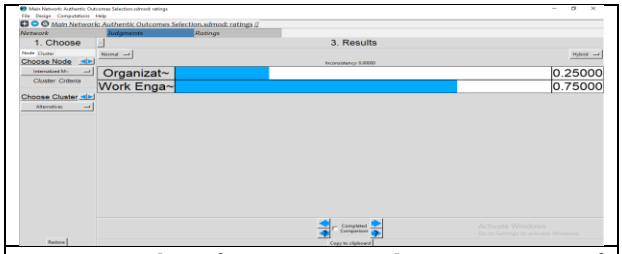

Fig.11 Results of Priority Weight Comparison of Alternatives by Internalized moral perspective

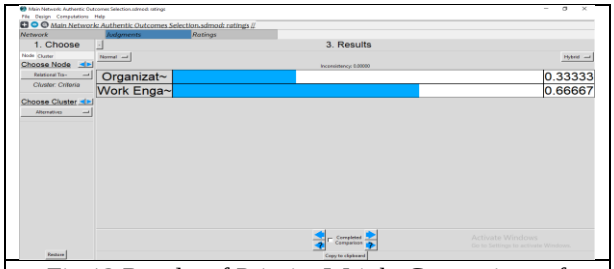

Fig.12 Results of Priority Weight Comparison of Alternatives by relational transparency

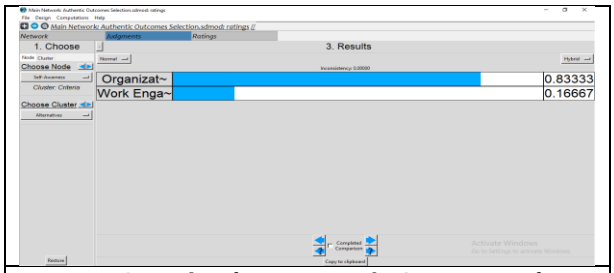

Fig.13 Results of Priority Weight Comparison of Alternatives by self-Awareness

D. Priority Rating

The ranking of the options came after determining the weights for the criterion. There were generally three processes taken to rank the alternative choices. Choosing the grading criteria was the subject of the first section. The criteria

used in this study to evaluate two options are depicted in the image below.

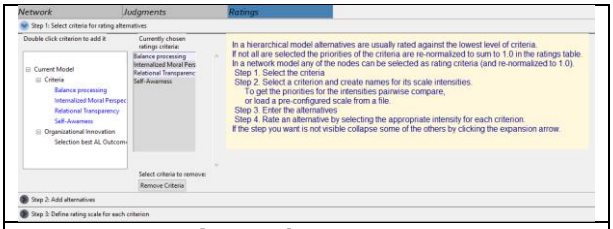

Fig.14 Selecting the Rating Parameters

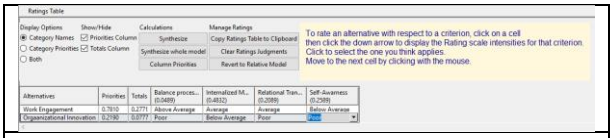

Fig.15 Rating of Alternatives based on Criteria

The hierarchical approach often assigns precedence based on the lowest criteria. However, the criteria were applied for priority rating in this study. The intended objective is said to be influenced by the criteria. Since the criteria were previously pairwise evaluated, the Super Decision Software recalculated and normalized the matrix weights to yield 100% or sum to 1. For each sample road fed into the Super Decision Software, the new recalculated and normalized matrix weights are applied with the related data.

The image below displays the overall summary of the two chosen alternatives, with three columns of priority and a visual format (i.e., ideal, normal, and raw sum). It provided great value for organizational innovation and employee engagement.

The summary of the entire model demonstrates the significance of the goal-related choices. Figure 14 illustrates the study's two choices and prioritized maintenance based on calculations and synthesized data. There were three priorities, each with a different value for the same priority rank.

This study considered how the priorities of the alternatives changed when it varied the importance of a criterion in the sensitivity analysis. The aim was the subject of a sensitivity analysis for the chosen alternatives, as indicated in the figure, and there was no change when the parameters changed. The final ranking indicated that the most important factor for work engagement was placed first.

E. Alternative Rankings

Table 4

Name	Ideals	Normal	Raw	Rank
Organizational Innovation	0.701629	0.412328	0.206164	2
Work Engagement	1	0.587672	0.293836	1

V. RESULTS

The methods used the finding of this study shows that the selection AL traits alternatives highly depends on the parameters. From the literature review and analysis of a questionnaire based balanced processing, internalized moral perspective, relational transparency, and self-awareness data, it has been found that the main four traits have high impact on work engagement.[7] The policy alternatives have been evaluated by applying popular MCDM techniques AHP to select the best policy alternatives for selection of Authentic Leadership Outcomes in the Engineering Sector. The analysis of research work has been performed by using decision-making software called super decision Software. Self-Awareness is a top priority in choosing criteria for AL outcomes with a criteria weight of 0.25891. Relational transparency becomes the second priority with priority weight of 0.20894. Balanced processing as the third priority with a priority

weight of 0.1220. Internalized moral perspective as the fourth with a priority weight of 0.0483.

VI. ORIGINALITY AND CONTRIBUTION

The research work has contributed to literature in the following ways.

1. It has identified the criteria and alternatives for the selection of authentic leadership outcomes in the Engineering Sector.
2. It has proposed a hierarchy decision-making model based on MCDM for the best alternative.
3. It has been selected as the best possible alternatives organizational innovation and work engagement.

VII. CONCLUSION

There are different methods which can be used to conduct this research. In MCDM there are techniques like TOPSIS, Fuzzy AHP, Promethee etc. Analytic Network Process (ANP) can also be used which is more adequate, this area in research can be explored. Secondly, the criteria included in this research from literature may be changed if opinions of experts change or other factors. This risk assessment can be applied on other industries by obtaining the factors and alternatives accordingly.

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