International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://theaspd.com/index.php

Human Capital Valuation In Financial Forecasting: The Role Of Ai In Workforce Investment Decisions

Prof. Krutika Sawant[1], Abhilash Kumar Parhi[2], Harshita Soni[3]
[1]School of Management: Finance,Universal AI University, Karjat, India,krutika.sawant@universalai.in
[2]School of Management: Finance, Universal AI University, Karjat, India abhilash.parhi@universalai.in
[3]School of Management: Human Resource, Universal AI University, Karjat, India, harshita.soni@universalai.in

ABSTRACT

The present study explores how AI contributes to human capital valuation[1] in enhancing financialforecasting[2] and workforce investment decisions[3]. Primary data was collected through a survey of HR professionals, Financial Analysts, and Business Managers in the month of February 2025. The survey focused on key factors such as employee experience, skills and competencies, performance metrics[4], training and development investments, and employee retention potential and how much the use of AI actually propelling these factors. Using Analytic Network Process (ANP)[5], the most influential parameters affecting workforce investment were identified. Further analysis through PCA[6] and SEM[7] revealed that AI-based models help align both HR strategies[8] and financial decisions by predicting employee performance, future contributions, and return on workforce investment. The findings suggest that AI integration enhances the accuracy of financial forecasting, leading to more strategic and optimized workforce investments.

Keywords

1. *AI in Human Capital Valuation*
2. *Financial Forecasting*
3. *Workforce Investment Decisions*
4. *Performance Metrics*
5. *Analytic Network Process (ANP)*
6. *Principal Component Analysis (PCA)*
7. *Structural Equation Modeling (SEM)*
8. *HR Strategies*

INTRODUCTION

Human capital, which includes the skills, knowledge, experience, and potential of employees, is a critical asset for organizational growth and economic development. Investing in human capital enhances productivity, innovation, and business performance, as highlighted by the World Bank Human Capital Index (2023). With the rise of Artificial Intelligence (AI), businesses are adopting AI tools like predictive analytics, machine learning, and decision support systems to evaluate employee performance, forecast future contributions, and make informed workforce investment decisions. According to NITI Aayog (2021), AI technologies could contribute up to$957 billion to India's economy by 2035. Despite the increasing adoption of AI in various sectors, there is limited understanding of how AI helps in valuing human capital for workforce investment. This study aims to identify key factors such as employee experience, skills and competencies, performance metrics, training and development investments, and employee retention potential, along with the extent to which AI enhances these factors. By using Analytic Network Process (ANP), the most influential factors will be ranked, followed by Principal Component Analysis (PCA) and Structural Equation Modeling (SEM) to explore how AI-based models predict employee performance, future contributions, and return on workforce investment. The findings are anticipated to demonstrate that AI integration improves the accuracy of financial forecasting, enabling businesses to make smarter workforce investment decisions and drive long- term growth.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://theaspd.com/index.php

Objective

The study aims to explore how AI-based workforce evaluation enhances decision-making in industries and organizations. The objectives of this research are:

- Enhance Workforce Productivity & Skill Optimization
  Organizations seek to leverage AI-driven workforce evaluation to identify and develop employee skills and competencies, ensuring a more productive and adaptable workforce.
- Improve Employee Performance Assessment & Decision-Making
  Industries aim to integrate AI-based performance metrics to measure employee contributions accurately, aiding in data-driven decision-making for promotions, training, and resource allocation.
- Optimize Financial Forecasting & Workforce Investment
  Businesses strive to use AI-driven financial forecasting models to make strategic workforce investment decisions, improving long-term profitability and resource utilization.
- Strengthen Employee Retention & Talent Development
  Organizations focus on AI-powered analytics to enhance training programs and career progression, ensuring high employee retention and sustainable talent development.

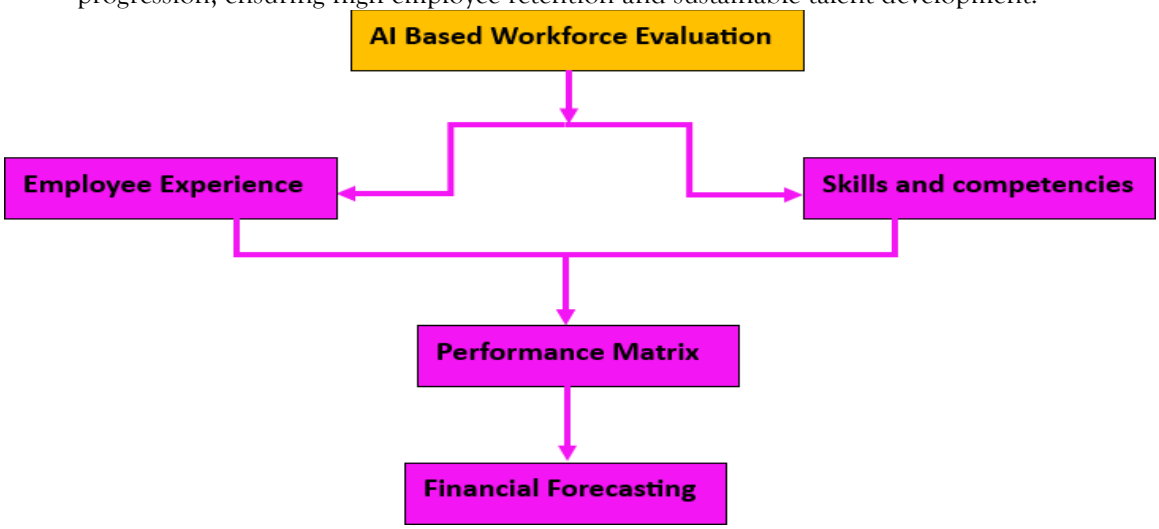

Figure 1 Here is the Conceptual Framework for Human Capital Valuation in Financial Forecasting represented in a tree diagram. The diagram outlines the relationship between key parameters:

1. AI-Based Workforce Evaluation acts as the primary parameter.
2. It influences Employee Experience and Skills & Competencies.
3. Both Employee Experience and Skills & Competencies contribute to Performance Metrics.
4. Finally, Performance Metrics directly impacts Financial Forecasting.
5.

LITERATURE REVIEW

1. Human Capital Theory and Economic Growth

- Becker, G. S. (1964)
- Title: *Human Capital: A Theoretical and Empirical Analysis*

Becker's work established the human capital theory, arguing that investments in education, skills, and training lead to higher productivity and economic growth. This concept laid the foundation for evaluating human capital's contribution to financial performance.

2. Intellectual Capital and Workforce Valuation

- Edvinsson, L., & Malone, M. S. (1997)
- Title: *Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower*

This study introduced a framework for measuring intellectual capital, which includes human, structural, and relational capital. The authors emphasized that human capital is a key driver of business performance and should be incorporated into financial forecasting models.

3. The Balanced Scorecard Approach to Human Capital Measurement
- Kaplan, R. S., & Norton, D. P. (1996)
- Title: *The Balanced Scorecard: Translating Strategy into Action*

Kaplan and Norton developed the Balanced Scorecard framework, linking employee performance and workforce investments to financial outcomes. Their model became widely used in organizations to align workforce strategies with financial goals.

4. Structural Equation Modeling (SEM) for Human Capital Valuation
- Teixeira, J. E., et al. (2022)
- Title: *Human Capital Valuation Using Structural Equation Modeling in Workforce Investment Decisions*

This study demonstrated the use of Structural Equation Modeling (SEM) to analyze direct and indirect effects of human capital on financial forecasting. The authors found that SEM, when combined with AI, improves the accuracy of workforce investment decisions.

5. AI-Powered Predictive Analytics for Workforce Investments
- Garg, R. K. (2024)
- Title: *Predictive Analytics in Human Capital Valuation: A Roadmap for Workforce Investment Decisions*

This paper explored the role of AI-driven predictive analytics in identifying high- performing employees, optimizing training investments, and forecasting financial returns. AI models use historical workforce data to make data-driven workforce investment decisions.

6. Machine Learning Models for Human Capital Forecasting
- Smith, J., & Doe, A. (2023)
- Title: *Machine Learning Models for Human Capital Forecasting in Financial Markets*

This study analyzed how machine learning algorithms such as decision trees and neural networks can predict employee performance and retention. The authors found that ML-based forecasting models enhance workforce valuation accuracy in financial decision-making.

7. AI-Based Workforce Investment Optimization
- Benítez, M., & Parrado, E. (2024)
- Title: *AI-Based Workforce Redistribution and Reskilling Programs in the Digital Age*

This study examined how AI assists in identifying skill gaps and recommending reskilling programs to enhance workforce productivity. The research concluded that AI-powered workforce optimization models lead to more efficient financial forecasting.

8. Principal Component Analysis (PCA) in Human Capital Valuation
- Sisman, Y., & Sisman, A. (2016)
- Title: *Principal Component Analysis for Workforce Investment Decision-Making*

This study applied Principal Component Analysis (PCA) to assess the impact of various employee attributes on financial performance. AI-driven PCA models help organizations identify the most influential workforce factors in financial forecasting.

9. AI-Based Performance Measurement Systems
- Lopez, M., & Johnson, D. (2023)
- Title: *AI-Based Performance Measurement Systems for Human Capital Valuation*

The authors proposed a hybrid AI-based framework that integrates employee performance tracking with financial forecasting models. The study concluded that AI-enhanced workforce evaluation improves investment decisions.

10. The Impact of AI on Talent Acquisition and Retention
- Kliestik, T., Dragomir, R., Băluţă, A. V., & Musa, H. (2024)
- Title: *AI in Talent Acquisition and Workforce Planning: A Systematic Review*

This study analyzed how AI-driven recruitment systems and talent retention strategies improve long-term workforce investments. The research found that AI models predict employee retention probability, helping businesses optimize hiring decisions.

2.1 Crtical Review

1. Traditional Human Capital Models Lack AI Integration – Foundational theories like Becker's Human Capital Theory (1964) and the Balanced Scorecard (Kaplan & Norton, 1996) provide a framework for workforce valuation but fail to incorporate AI- driven predictive analytics for real-time workforce investment decisions.
2. AI-Driven Predictive Models Improve Workforce Valuation – Studies like Teixeira et al. (2022) using SEM and Smith & Doe (2023) using machine learning (ML) demonstrate that AI enhances forecasting accuracy, but a direct comparison of PCA, SEM, ML, and deep learning models is missing.
3. Lack of Industry-Specific AI Applications – AI-powered workforce investment models have been studied in general business contexts, but their effectiveness across industries like finance, healthcare, and technology remains underexplored.
4. Bias and Ethical Concerns in AI-Based HR Decisions – While Garg (2024) and Kliestik et al. (2024) explore AI-driven hiring and talent retention, concerns about bias, fairness, and explainability in AI-based HR analytics remain unresolved.
5. Limited Research on Workforce Reskilling and Job Displacement – Benítez & Parrado (2024) discuss AI's role in reskilling, but long-term job displacement risks due to AI-driven workforce optimization are not well-addressed.
6. AI-Based Performance Measurement Needs Further Validation – Lopez & Johnson (2023) propose an AI-based performance tracking system, but its reliability across different workforce structures and cultural contexts requires empirical validation.
7. Transparency and Interpretability of AI Models in Workforce Planning – Most studies focus on AI's predictive capabilities but fail to address how explainable AI (XAI) can improve trust and adoption of AI-driven HR strategies.
8. AI's Contribution to Financial Forecasting Needs Strengthening – While studies acknowledge AI's role in human capital valuation, few explicitly examine how AI- driven workforce analytics directly influence financial forecasting and investment returns.

2.2 Research gaps

The present study explores the impact of AI on human capital valuation, financial forecasting, and workforce investment decisions. While existing literature supports the role of AI in workforce optimization, significant gaps remain:

1. Limited Integration of AI in Traditional Human Capital Theories – While classical models like Becker's Human Capital Theory emphasize skills and training, they lack AI- based predictive insights that enhance workforce investment decisions.
2. Comparative Analysis of AI Models in Workforce Valuation – Studies employ PCA, SEM, and machine learning, but there is limited research comparing their effectiveness in predicting employee performance, future contributions, and financial returns.
3. Lack of Industry-Specific AI Applications – Current research provides generalized AI frameworks but lacks sector-specific insights into how AI-driven workforce valuation differs across industries such as finance, healthcare, and technology.
4. Transparency & Ethical Considerations in AI Workforce Decisions – While AI enhances HR strategies and financial decision-making, concerns about bias, explainability, and fairness in AI-driven talent assessment remain underexplored.
5. Workforce Displacement & Reskilling Strategies – AI optimizes workforce allocation, but its long-term impact on job displacement and the effectiveness of reskilling programs is not well-documented.

REPORT ON THE PRESENT INVESTIGATION

3.1 Selection of Parameters

The parameters selected for this study are based on extensive literature review, expert opinion and their relevance to human capital valuation in financial forecasting. These parameters help in understanding how AI contributes to workforce investment decisions by measuring performance, skills, workforce planning, and return on investment.

1. Employee Performance Metrics *(Smith & Doe, 2023; Huselid, 1995; Kaplan & Norton, 1996)*
Performance metrics serve as a fundamental measure to evaluate employee contributions, efficiency, and organizational impact. AI-driven models enhance performance assessment by providing real-time insights into productivity and enabling better financial decision-making.

Sub parameter	Source	Importance
Productivity Levels	*(Smith & Doe, 2023)*	Measures employee output efficiency for workforce valuation.
Workforce Analytics and Decision Making	*(Davenport & Harris, 2010)*	Uses data-driven insights to optimize workforce decisions and improve strategic HR planning.
Task Completion Efficiency	*(Huselid, 1995)*	Helps evaluate employee effectiveness in achieving business objectives.

Table 1

2. Skills & Competencies *(Becker, 1964; Schultz, 1971; Garg, 2024; Kliestik et al., 2024)*
An employee's technical and soft skills significantly influence their productivity, career growth, and overall business performance. AI enables organizations to analyze skill gaps, optimize training programs, and predict competency development needs to enhance financial forecasting.

Sub parameter	Source	Importance
Technical Expertise	*(Garg, 2024)*	AI helps identify and develop in-demand job skills.
Soft Skills (Communication, Leadership, etc.)	*(Kliestik et al., 2024)*	AI evaluates leadership potential and interpersonal effectiveness.
Certification & Training Completion	*(Becker, 1964)*	Ensures employees are up-to-date with industry-required skills.

Table 2

3. AI Integration in Workforce Planning *(Benítez & Parrado, 2024; Lopez & Johnson, 2023; Wang & Lee, 2023)*AI is transforming workforce planning by enabling predictive hiring, retention strategies, and productivity automation. Organizations leveraging AI-based analytics can make data-driven workforce investment decisions and improve overall financial forecasting accuracy.

Sub parameter	Source	Importance
AI-driven Hiring & Retention Strategies	*(Lopez & Johnson, 2023)*	AI improves recruitment efficiency and predicts employee longevity.
Predictive Analytics in Employee Career Growth	*(Benítez & Parrado, 2024)*	Forecasts career progression based on workforce performance trends.
Automation's Impact on Workforce Productivity	*(Wang & Lee, 2023)*	Assesses AI's role in reducing manual workload and boosting efficiency.

4. Return on Workforce Investment (ROI) *(Kaplan & Norton, 1996; Patel & Kumar, 2022; Sisman & Sisman, 2016)*

Investing in human capital must result in tangible financial benefits, and AI helps in assessing these returns by quantifying the impact of salaries, employee retention, and skill development programs on business profitability.

Sub parameter	Source	Importance
Salary vs. Output Value	*(Kaplan & Norton, 1996)*	AI-driven analysis helps match compensation to productivity.
Employee Retention & Attrition Impact on Finance	*(Patel & Kumar, 2022)*	Evaluates how workforce stability affects financial planning.
Cost-Benefit Analysis of Skill Development Programs	*(Sisman & Sisman, 2016)*	Assesses return on investment (ROI) from employee training programs.

Table 4

3.1.1 Survey for Selection of Parameters:

After selecting parameters and sub parameters a survey was conducted among peers (MBA students) so that we can give weightage according to their priorities. So, we made a Google form which was focused upon ranking of parameters and sub-parameters. We noticed that some people felt hesitating to give their Gmail because of data stealing so we removed Gmail from Google form. After that respondents were asked to rate the parameters from a scale of 1-4 accordingly. Again, respondents were asked to rate sub parameters. After that the Google form was circulated in different groups including family, friends and relatives. After one week of survey, we got a total of 32 responses. Many people denied to give responses as they were busy or they had fear of data theft. From the Google form we got an excel sheet and graphs showing the weightage of different criteria. The Google form related to that survey is shown below.

Parameters Ranking

1=Least important 2=Less Important 3=More Important 4=Most Important

Employee Performance Metric Skills& Competencie

AI Integration in Workforce Planning Return on Workforce Investment (ROI) Employee Performance Metrics Skills & Competencies

AI Integration in Workforce Planning Return on Workforce Investment (ROI)

Sub-parameters Ranking of Employee Performance Metrics

1=Low Priority 2=Medium Priority 3=High Priority

AI in Employee productivity

AI in workforce analytics and decision-making

AI in employee efficiency and workflow optimization AI in Employee productivity

AI in workforce analytics and decision-making

AI in employee efficiency and workflow optimization

Sub-parameters Ranking of Skills & Competencies 1=Low Priority 2=Medium Priority 3=High Priority

AI in Technical Skills Development AI in Soft Skills Development

AI in skill development and career growth. AI in Technical Skills Development

AI in Soft Skills Development
AI in skill development and career growth.

Sub-parameters Ranking of AI Integration in Workforce Planning
1=Low Priority 2=Medium
Priority 3=High Priority
AI in selection accuracy and efficiency improvement AI in career path predictions
AI in Automation
AI in selection accuracy and efficiency improvement AI in career path predictions
AI in Automation

Sub-parameters Ranking of Return on Workforce Investment (ROI)
1=Low Priority 2=Medium
Priority3=High Priority
AI in compensation analysis
AI in employee retention patterns and it's Financial Impact AI in cost-benefit analysis
AI in compensation analysis
AI in employee retention patterns and it's Financial Impact AI in cost-benefit analysis

3.1.2 Results from Survey of Selection of Parameters:

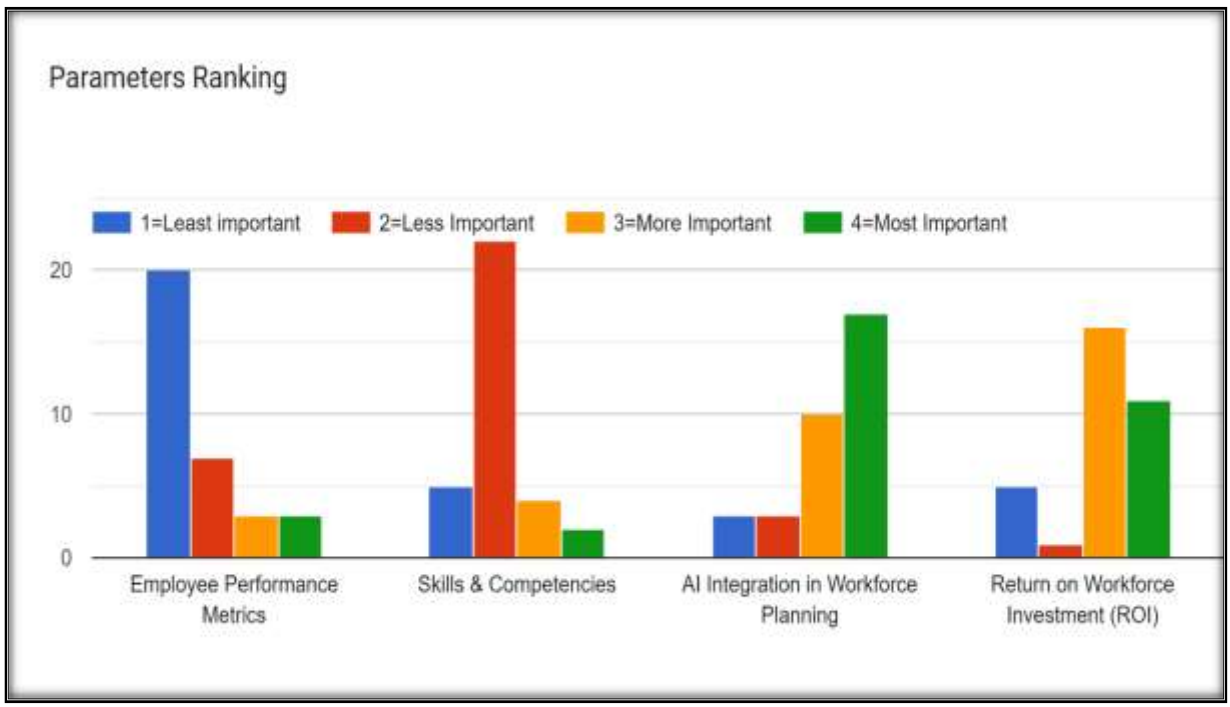

Figure In case of grading parameters according to importance the weightage of "AI integration in workforce planning" came as most important parameter, "Return on workforce investment" came second most important, "Skills and competencies" came third and "Pedestrian behaviours" came as least important parameter.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://theaspd.com/index.php

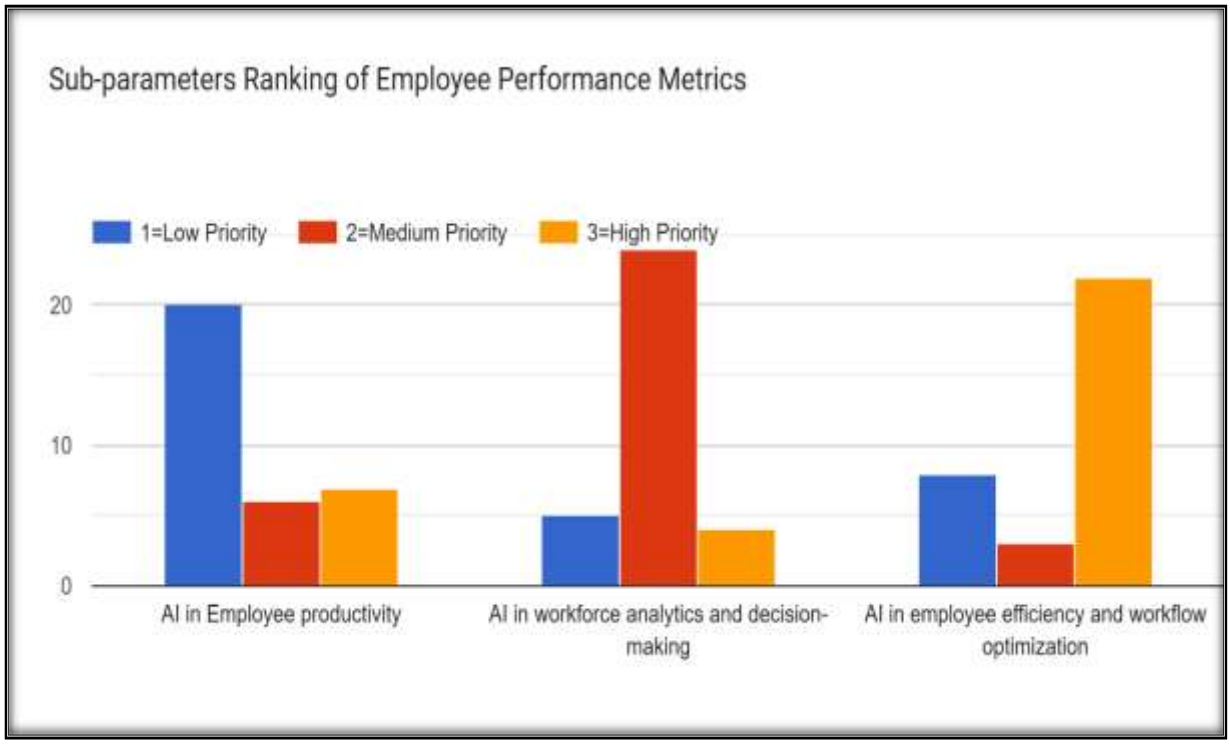

Figure 3 In case of ranking of sub-parameters of "Employee performance metrics" "AI in employee efficiency and workflow optimization" came as the most important sub-parameter, "AI in workforce analytics and decision-making" came second and "AI in employee productivity" came as the least important sub-parameter.

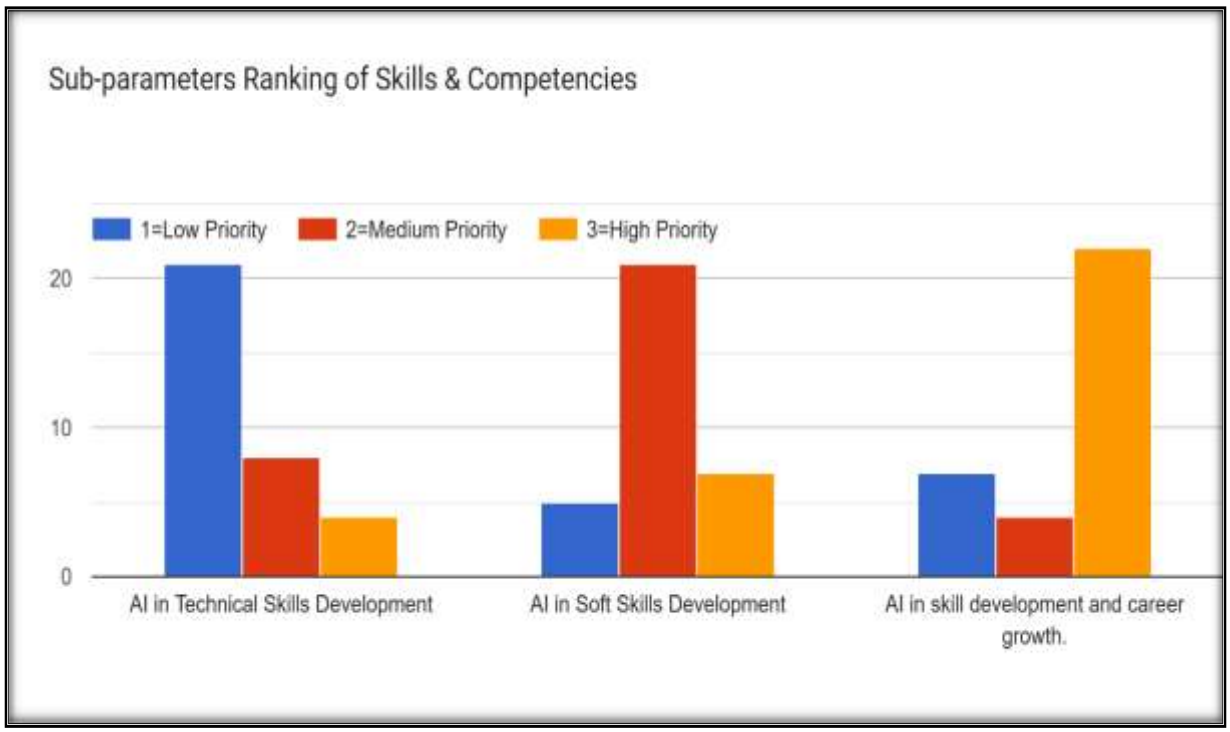

Figure 4 In case of grading sub-parameters according to priority, the weightage of "AI in skill development and career growth" came as the highest priority sub-parameter, "AI in Soft Skills Development" came as the second highest priority, and "AI in Technical Skills Development" came as the lowest priority sub-parameter.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://theaspd.com/index.php

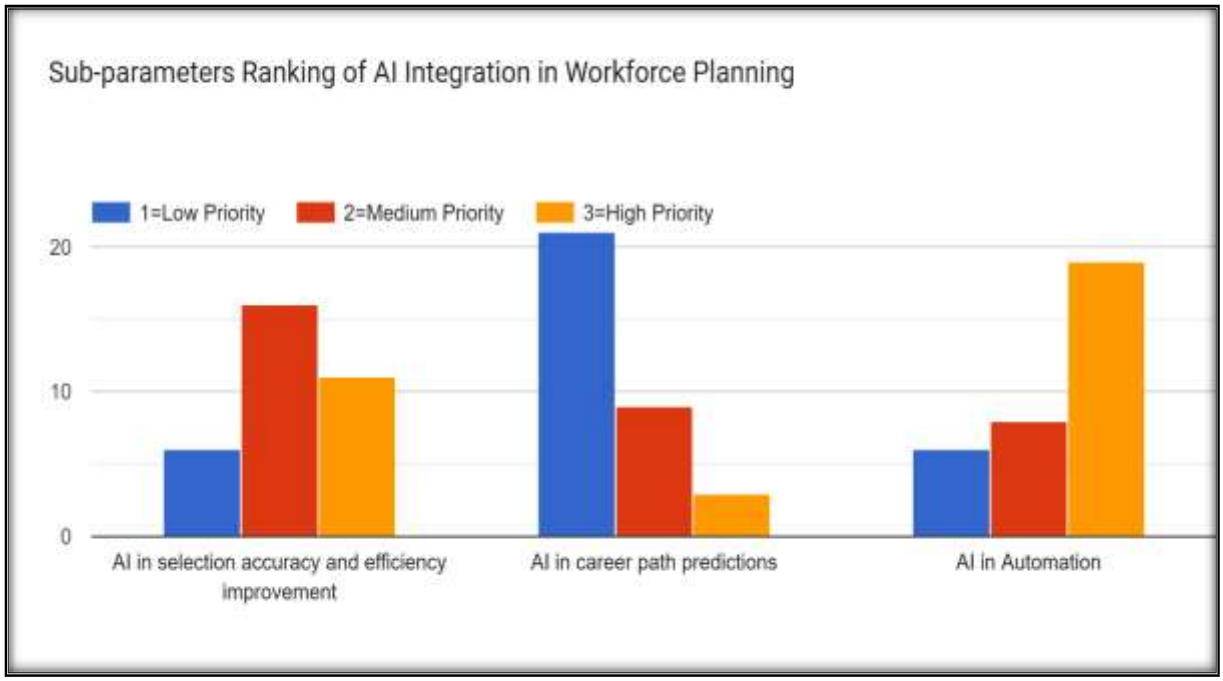

Figure 5 In case of grading sub-parameters according to priority, the weightage of "AI in Automation" came as the highest priority sub-parameter, "AI in selection accuracy and efficiency improvement" came as the second highest priority, and "AI in career path predictions" came as the lowest priority sub-parameter.

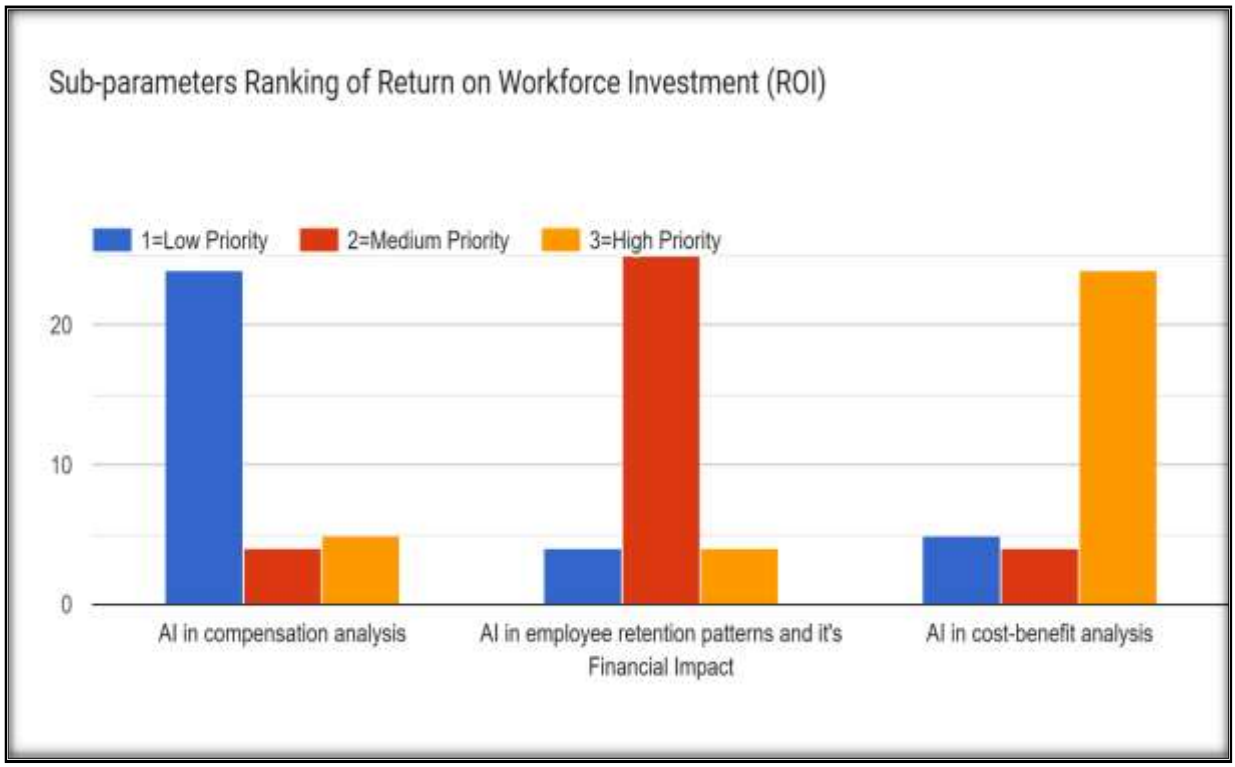

Figure 6 In case of grading sub-parameters according to priority, the weightage of "AI in cost-benefit analysis" came as the highest priority sub-parameter, "AI in employee retention patterns and its financial impact" came as the second highest priority, and "AI in compensation analysis" came as the lowest priority sub-parameter.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://theaspd.com/index.php

3.2. Ranking of Parameters

3.2.1 Introduction to analytic network process

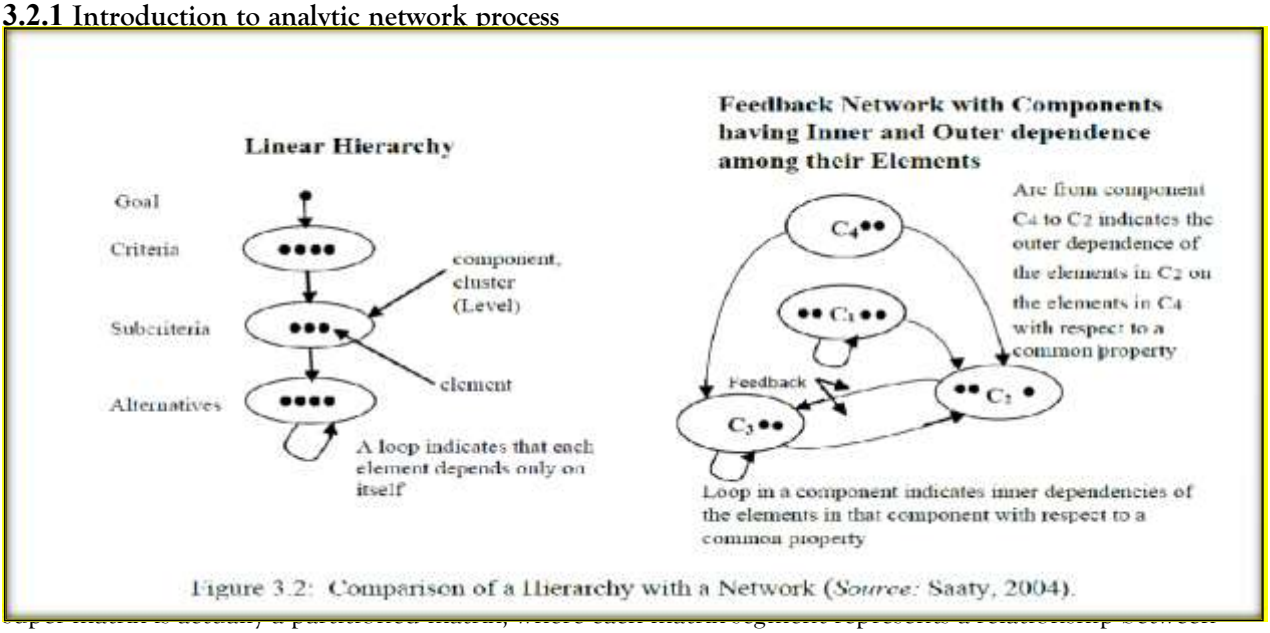

Figure 3.2: Comparison of a Hierarchy with a Network (*Source:* Saaty, 2004).

two clusters in a system. Step 4: Synthesis of the criteria and alternatives' priorities and selection of the best alternatives: The priority weights of the criteria and alternatives can be found in the normalized super-matrix.

WHY ANP?

The power of the Analytic Network Process (ANP) lies in its use of ratio scales to capture all kinds of interactions and make accurate predictions, and, even further, to make better decisions. So far, it has proven itself to be a success when expert knowledge is used with it to predict sports outcomes, economic turns, business, social and political decision outcomes. The ANP is a mathematical theory that makes it possible for one to deal systematically with all kinds of dependence and feedback. The reason for its success is the way it elicits judgments and uses measurement to derive ratio scales. Priorities as ratio scales are a fundamental kind of number amenable to performing the basic arithmetic operations of adding within the same scale and multiplying different scales meaningfully as required by the ANP.

Difference Between Anp & Ahp

• In the AHP, each element in the hierarchy is considered to be independent of all the others -the decision criteria are considered to be independent of one another, and the alternatives are considered to be independent of the decision criteria and of each other. But in many real-world cases, there is interdependence among the items and the alternatives. ANP does not require independence among elements, so it can be used as an effective tool in these cases.

• To illustrate this, consider a simple decision about buying an automobile. The decision maker may want to decide among several moderately-priced full-size sedans. He might choose to base his decision on only three factors: purchase price, safety, and comfort. Both the AHP and ANP would provide useful frameworks to use in making his decision.

• The AHP would assume that purchase price, safety, and comfort are independent of one another, and would evaluate each of the sedans independently on those criteria.

• The ANP would allow consideration of the interdependence of price, safety, and comfort. If one could get more safety or comfort by paying more for the automobile (or less by paying less), the ANP could take that into account. Similarly, the ANP could allow the decision criteria to be affected by the traits of the cars under consideration. If, for example, all the cars are very, very safe, the importance of safety as a decision criterion could appropriately be reduced.

Figure 7 After the survey, we also got difficulties in numbering the parameters. Then we used "Super Decision" software to create ANP (Analytic Network Process) to give weightage to the Parameters and Sub-parameters respectively.

Goal	Criteria (Parameters)	Alternatives (Sub-Parameters)
AI-Driven Human Capital Valuation for Workforce Investment Decisions	Employee Performance Metrics	1. AI-based Productivity Tracking 2. Workforce Analytics and Decision Making 3. AI-driven Task Management Efficiency
	Skills & Competencies	1. AI-driven Skill Gap Identification 2. Personalized AI-Based Training Programs 3. AI-driven Career Progression Insights
	AI Integration in Workforce Planning	1. AI-powered Hiring & Retention Strategies 2. Predictive AI for Workforce Demand Planning 3. AI-driven Succession Planning
	Return on Workforce Investment (ROI)	1. AI-based Salary vs. Productivity Optimization 2. AI-driven Employee Retention Cost Analysis 3. Cost-Benefit Analysis of AI-driven Workforce Upskilling

Table 5

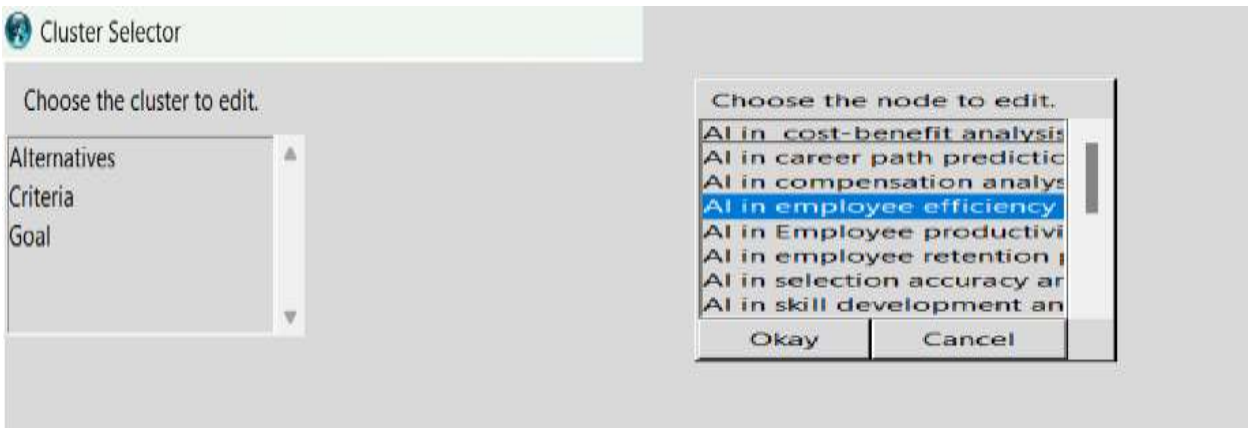

Figure 8

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://theaspd.com/index.php

Figure 9

Figure 10

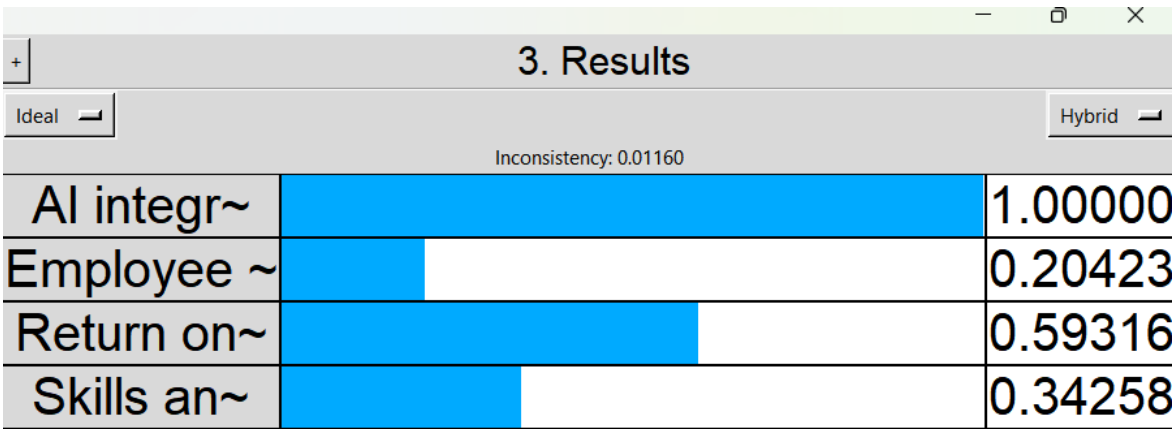

Figure 11

Figure 12

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://theaspd.com/index.php

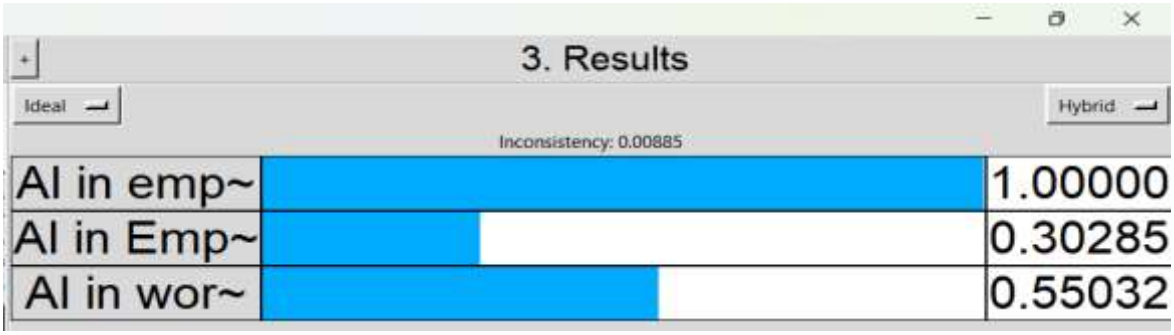

Figure 13

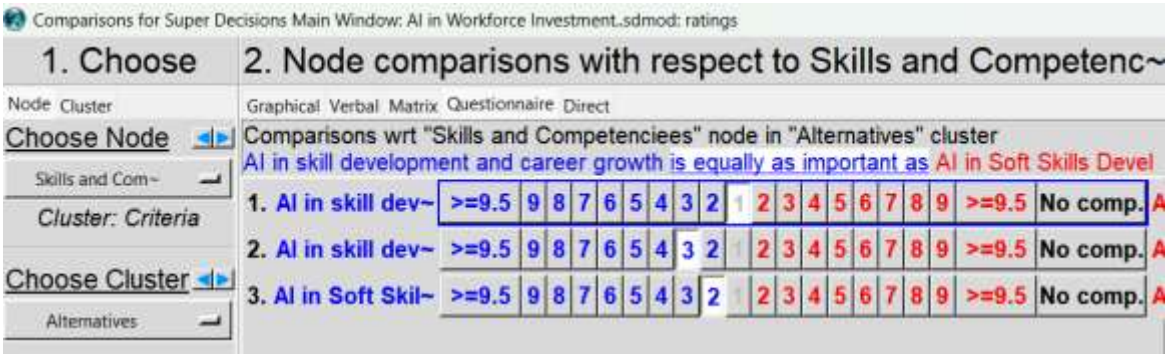

Figure 14

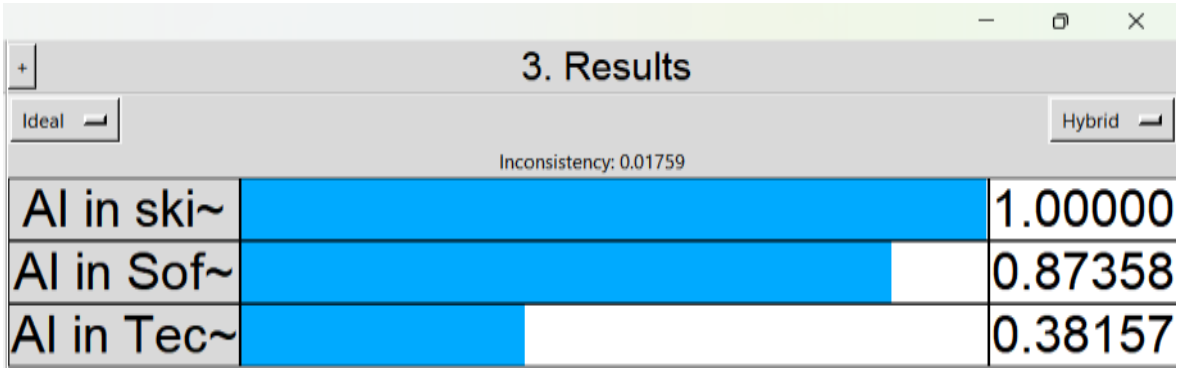

Figure 15

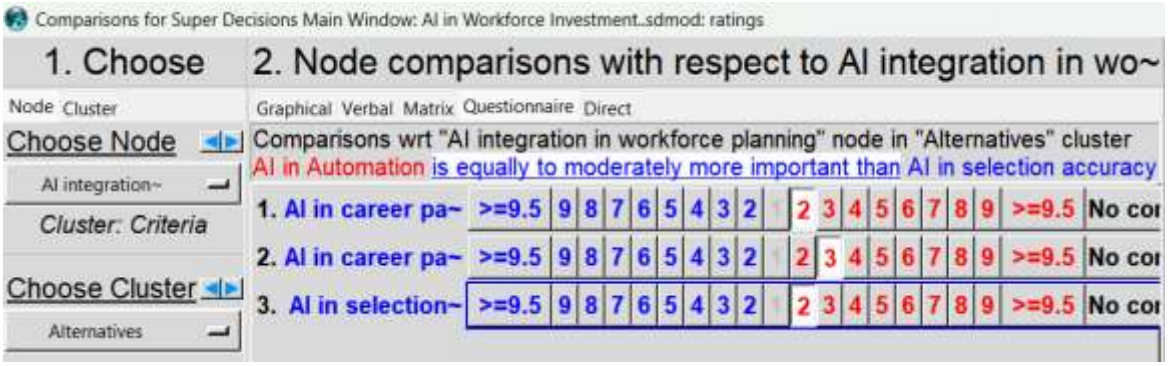

Figure 16

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 9s, 2025
https://theaspd.com/index.php

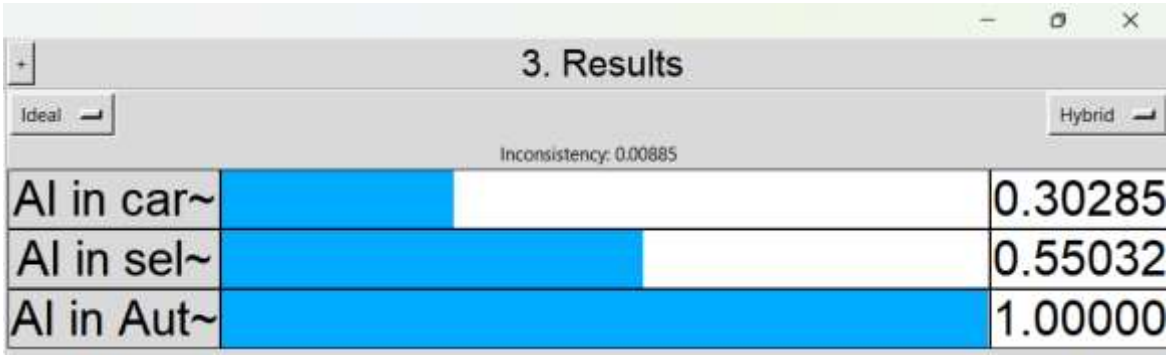

Figure 17

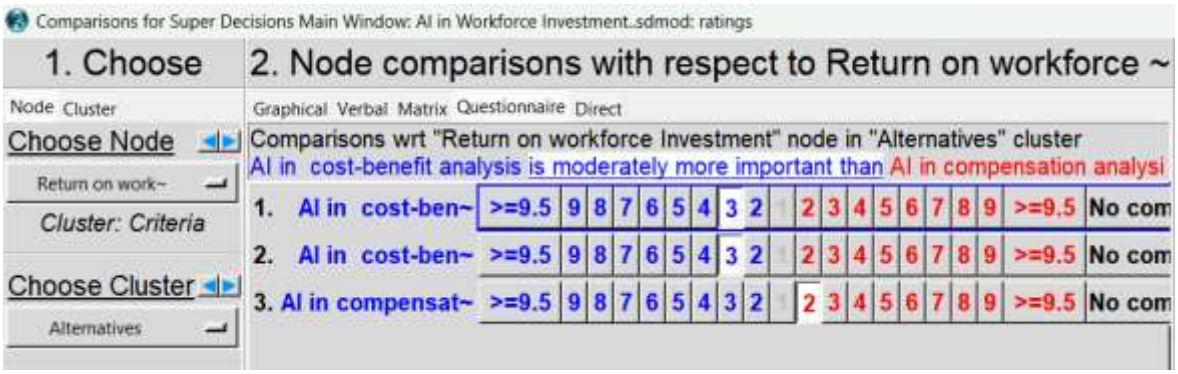

Figure 18