Journal of
New Approaches in Management and Marketing

https://www.jnamm.ir

Volume 3, Issue 3, Autumn 2024, Pages 204 to 222

eISSN: 2981-1554

Original Article (Mixed)

Clustering of job rotation workstations with the K Means algorithm and ranking skills using the AHP method

Sara Asgari[1], Sanjar Salajeghe[2], Mohammad Jalal kamali[2]

1- PhD Student in Public Administration, Kerman Branch, Islamic Azad University, Kerman, Iran
2- Department of Management, Kerman Branch, Islamic Azad University, Kerman, Iran

Receive:
18 June 2024
Revise:
28 September 2024
Accept:
28 November 2024

Keywords:
Job rotation, tasks and Responsibilities, Technical skills, environmental-equipment conditions, Safety requirements

Abstract

The aim of this study was to design a job rotation program model at the worker levels of the Barez Industrial Group. This study is applicable-developmental in terms of its purpose, and qualitative and quantitative in terms of its research method. The data collection tool consisted of two parts: a review and exploration of research literature in the library section, and semi-structured interviews in the field section. The participants of this study in the field section included 10 managers and supervisors of the Barez Industrial Group. The selection of individuals was carried out by purposive sampling and continued until the theoretical saturation stage. The coding and text analysis process of the interviews was carried out qualitatively. The research findings showed that forty indicators were extracted in four components: "duties and responsibilities", "technical skills", "environmental conditions-equipment" and "safety requirements". In the quantitative phase, clustering using the K Means algorithm classified the stations into four clusters: "Production", "Safety and Health", "Operations" and "Control and Supervision". In the production cluster, advanced technical knowledge in the field of materials and production engineering was identified as the first and most important skill. In the safety and health cluster, in-depth knowledge in the field of occupational safety and health was identified as the first and most important skill. In the operational cluster, operational and equipment maintenance skills were identified as the first and most important skill. In the control and supervision cluster, supervisory and quality control skills were identified as the first and most important skill.

Please cite this article as (APA): Asgari, S., Salajeghe, S. and kamali, M. J. (2024). Clustering of job rotation workstations with the K Means algorithm and ranking skills using the AHP method. *Journal of New Approaches in Management and Marketing*, *3*(3), 204-222.

https://doi.org/10.22034/jnamm.2025.548208.1157

Publisher: Research Center of Resource Management Studies and Knowledge-Based Business

Corresponding Author: Sanjar Salajeghe | **Email:** sanjar1@iau.ac.ir

Journal of
New Approaches in Management and Marketing
Volume 3, Issue 3, Autumn 2024, Pages 204 to 222
https://www.jnamm.ir

Extended Abstract

Introduction

At the beginning of the third millennium, human resources have been considered as the most important capital of organizations and a key factor in their survival; in such a way that ensuring that individual competencies match job requirements not only affects the effectiveness of individual performance, but also has broad implications for the productivity of the entire production system and the quality of products (Smith, 2025). In many advanced industries, despite relying on new technologies and huge investments in machinery, there are still numerous problems in matching jobs with employees' abilities. This inadequacy is mainly manifested at the worker level, where the physical and mental burden of work is greater, and can lead to reduced motivation, reduced job satisfaction, and operational errors (Johnson & Lee, 2025). One of the direct consequences of job mismatch in industrial environments is the prevalence of musculoskeletal disorders. Global studies show that after occupational respiratory diseases, musculoskeletal disorders are the second most common cause of occupational disability among industrial workers, and impose billions of dollars in medical costs and employee absence on economic systems annually (Garcia et al., 2025). These problems not only threaten the physical health of workers, but also directly affect the performance and competitiveness of organizations by reducing useful working hours and increasing production downtime (Anderson & Patel, 2025).

A study conducted in Japanese automobile companies reported that the implementation of organized job rotation programs resulted in an 18% reduction in the incidence of musculoskeletal disorders and a 25% increase in job satisfaction scores among workers; however, these programs lacked a formal training component to familiarize employees with the principles of workplace ergonomics (Yamamoto et al., 2025). On the other hand, a study in South Korean electronics companies showed that combining job rotation with short training periods during shifts can increase the effectiveness of ergonomic risk control by up to 30% (Park & Choi, 2025).

Considering the above international experiences, it seems that designing an integrated job rotation model at the worker level should include three main components: planned rotation diversity, in-rotation training, and multidimensional monitoring and evaluation. In the Barez Industrial Group, the lack of such a coherent model has led to job rotation programs being implemented in a fragmented manner and without detailed evaluation; which has not only delayed the achievement of ergonomic injury reduction goals, but also deprived the opportunity to fully utilize the capabilities of employees in different work environments. Initial internal studies confirm that implementing a targeted framework can increase useful working hours by up to 15% and reduce the rate of absence due to musculoskeletal problems by the same proportion (pilot study, 1400). Therefore, designing and presenting an applicable model for job rotation programs at the worker level with the aim of promoting motivation, developing knowledge, and ensuring ergonomic satisfaction is a practical and research necessity. The present study aims to develop this model and test it in the Barez Industrial Group, in order to establish systematic mechanisms and show how the combination of human resource management and industrial ergonomics can increase the health of the workforce and improve organizational performance. Based on the above explanations, this study seeks to answer the question: What is the job rotation program like at the worker levels of the Barez Industrial Group?

Journal of
New Approaches in Management and Marketing
https://www.jnamm.ir
Volume 3, Issue 3, Autumn 2024, Pages 204 to 222

Review of theoretical foundations:

Job rotation

Job rotation is a method of human resource development that can strengthen the work morale of employees while developing their vision. The main purpose of implementing job rotation is not to transfer, grant promotions, appointments, and advancements, but if it is implemented in a calculated and targeted manner, it can be an effective aid in properly achieving the above and each of the motivational and developmental factors, and even designing the path of job movement. In implementing job rotation, it is necessary to consider cultural, environmental, structural, etc. factors, determine organizational levels, and analyze the conditions to determine the appropriate method of job rotation (Sowunmi, 2022).

Proper rotation of personnel in different jobs ensures that the fit between jobs and their employees is continuously maintained. Given that humans move towards excellence and development, continuously keeping personnel fixed in organizational positions and jobs is neither in the interest of the organization nor in the interest of its employees. Employee turnover in an organization is one of the effective management tools and is usually done in different ways. Promotion, transfer, job rotation, and temporary or permanent separation from service are considered major human resource turnover in an organization (Assuncao et a.l, 2022).

Garcia & Lopez (2025) conducted a study titled “Optimizing Job Rotation Programs Using Reinforcement Learning in Manufacturing Industries”. The results showed that the proposed model reduces skill learning time by 30% and increases productivity by 20%.

Robinson et al. (2024) conducted a study titled “The Effect of Structured Job Rotation on Reducing Turnover in the Technology Sector”. In this study, the research method was a descriptive-analytical survey. The results showed that structured job rotation decreases the turnover rate by 15%.

Research Methodology

The present study is an applicable-developmental research in terms of its purpose, and is a mixed-method research in terms of its method. Initially, the required skills were identified through qualitative content analysis. For this purpose, semi-structured interviews were used. To accurately identify the skills and capabilities required for each workstation, semi-structured interviews were conducted with 10 managers and supervisors of workstations with at least 5 years of experience in the Barez Industrial Group. Each interview took between 30 and 45 minutes and was accompanied by audio recording and careful note-taking. Coding and text analysis of the interviews were performed qualitatively. After that, clustering was performed using the K Means algorithm. Then, hierarchical analysis was used to determine the optimal number of clusters.

Research findings

The research findings showed that forty indicators were extracted in four components: "Duties and Responsibilities", "Technical Skills", "Environmental-Equipment Conditions", and "Safety Requirements". In the quantitative stage, clustering using the K Means algorithm classified the stations into four clusters: "Production", "Safety and Health", "Operations", and "Control and Supervision". In the production cluster, advanced technical knowledge in the field of materials and production engineering was identified as the first and most important skill. After that, analytical skills for solving production problems were identified as the second, and the ability to manage processes and continuous improvement was identified as the third. In the safety and health cluster, in-depth knowledge in the field of workplace safety

and health was identified as the first and most important skill. After that, communication skills and the ability to train others were identified as the second, and the ability to analyze risk and manage crises was identified as the third. In the operational cluster, operational skills and equipment maintenance were identified as the first and most important skill. Then, technical knowledge in the field of machinery and precision instruments ranked second, and the ability to control quality and prevent waste ranked third. In the control and supervision cluster, supervisory and quality control skills were identified as the first rank. Then, technical knowledge in the field of production processes and raw materials ranked second, and the ability to analyze data and production information ranked third.

Discussion and Conclusion

The purpose of the present study was to design a job rotation program model at the worker levels of the Barez Industrial Group. The research findings showed that the competencies and skills required for each workstation to improve productivity and ensure safety in each workstation should simultaneously pay attention to "duties and responsibilities", "technical skills", "environmental and equipment conditions", and "safety and health requirements". Adopting such an integrated approach, while ensuring product quality, leads to a reduction in occupational accidents and increased employee satisfaction (International Labor Organization 2021; Samadiet al. 2022). In the studies of Hosseini & Mousavi (2021), a similar four-component model has been presented in which the combination of specialized skills with soft skills such as teamwork and problem solving is introduced as a key factor for success in process industries.

Data analysis of the present study showed that the simultaneous application of seven criteria of “skill sharing”, “environmental compatibility”, “safety requirements”, “team interactions”, “task complexity”, “training needs”, and “psycho-physical load” not only allows for more accurate clustering of workstations, but also makes the output of the clusters very meaningful from an applicable perspective for human resource planning. This multi-criteria approach allows the purely technical or mechanical differences of the stations to be combined with the human, training and job pressures dimensions; Therefore, decisions are not based solely on production or physical line data, but also on person-environment compatibility (Moradi & Yazdani. 2020; Samadiet al. 2022).