

Macroergonomics-Based Approach in Job Design of Specialized Engineering Construction Company using the Hackman and Oldham's Model

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Abstract. Employees' interaction, communication, and motivation to work make an organization succeed. Within an organization, managers organize tasks into separate jobs among employees. The employees perform the tasks independently or collectively as a team. Many studies were conducted to understand the factors that motivate employees to work. The most cited theory is the Job Characteristics Model developed by Hackman and Oldham (1976), which listed the five job characteristics: skill variety, task identity, task significance, autonomy, and feedback. In this study, the job dimensions were scored by the employees of Specialized Engineering Construction Company. The researchers used Job Diagnostic Survey to evaluate employees' perceptions of their jobs. The results showed the top and low-motivating positions of the organization. The low-scoring jobs were attributed to a lack of autonomy (or freedom and independence in doing the work). The research study concluded with Job Design programs approach to enhance employee motivation and performance.

Keywords: organization, job motivation, job design, autonomy

1. Introduction

An organization exists everywhere and shapes our lives in various ways. When people interact together to do tasks that help achieve specific goals, that is an organization. Even our own family is an organization where members communicate with each other and contribute to household activities. Our community is an organization where neighborhoods cooperate to create a decent society. One could easily believe that an organization is present where there is people, work, and goal. Nonetheless, the people's interaction, communication of desired goals, and motivation to work make an organization succeed. In the book "Organization Theory & Design" by Richard L. Daft, he describes organizations as "entities that are goal-directed, are designed as deliberately structured, and coordinated activity systems and are linked to the external environment" [1].

In any industry, an organization comprises employees coordinating as a team and performing the same or different tasks to attain common business objectives. Within an organization, managers plan and organize the tasks into separate jobs among employees. Subsequently, employees perform the job assignment independently or collectively as a team. It is often assumed that "behavior and work performance within an organization are influenced and determined by motivational processes" [2]. As such, the motivation of people makes them work and perform. Moreover, motivation is driven by two factors: intrinsic and extrinsic. First, intrinsic motivation means an individual's motivation is from within. An employee's enthusiasm at the workplace is moved by personal beliefs and a desire to achieve success. Second, extrinsic motivation means an individual is motivated by outside influences. An employee's performance is stimulated by external factors such as the company's rewards and recognition. [3].

Many theories were initiated on describing the factors that motivate employees to work. One of them was developed by Hackman and Oldham (1976, 1980). The model theory listed five job characteristics that can enhance employee motivation and a higher degree of job performance. These job characteristics are skill variety, task identity, task significance, autonomy, and feedback [4]. The principles of Hackman and Oldham's model in the job design process were observed in various studies.

This study was aimed at Greenlex System Services, Inc, a firm specializing in building engineering projects through project management, sub-contracting, and outsourcing. It is an engineering company that designs, builds, operates, maintains, and provides consultancy services to different businesses [5]. The research was made to review prior studies conducted for construction companies using Hackman and Oldham's model. The researchers found some studies focused on engineering projects and construction companies. One study indicated that there is a positive side of the work-family interface in the construction industry. It explained that given the typical long work hours for construction industry workers, they have less time with family. However, when workers spend quality family activities and set priorities, overall efficiency and performance improvements [6]. Another study focused on understanding work motivation in temporary organizations. As an example, project-based construction job contracts are considered temporary work. The study explained that employees in temporary, project-based jobs use intrinsic motivation to keep them motivated at work [7]. Still, on construction firms, the additional study explained that the performance of construction professionals is related to task characteristics and training practices [8].

No formal job study or job design program was created for Greenlex System Services, Inc, a specialized engineering construction company. Hence, the objective of this study was to evaluate the job design of the company using Hackman and Oldham's model. Through the macroergonomics approach, the company can support a safe and healthy workplace, increase employee motivation, and improve performance. By applying the results of this study, this firm can adopt a culture of creativity, empowerment, and innovation.

2. Methodology

This study utilized one-on-one interviews with employees and surveys. The one-on-ones were casual and informal. During the interviews, the researchers briefly explained the purpose of the survey and its objective. Answers to surveys were kept confidential, and participation was voluntary. The survey was composed of fifteen statements that could be used to describe a job. Employees responded and marked their responses based on how much they agreed or disagreed with each statement. Each survey participant gave a score to each statement on a scale of 1 to 5, 1 is the lowest and 5 being the highest. The higher the score, the greater they agreed on the statements. On average, one interview and survey lasted for about 15 minutes per employee. The interviews and surveys were done individually; hence data gathering lasted for about a week. A total of 12 jobs were surveyed in this study. Each survey was scored manually and plotted into an excel chart for analysis. This study used Hackman & Oldham's theory about motivation through the design of work [9]. The theory proposes that individuals perform their work effectively when motivated under given conditions. It also explained the relationship of job dimensions and individual responses to the work through the Job Characteristics Model or JCM. The model is illustrated in Fig. 1.

2.1. The Job Characteristics Model (JCM)

Hackman & Oldham (1974) introduced the Job Characteristics Model [9] to propose that employees show positive personal and work outcomes when the three "critical psychological states" exist in their jobs. These states are: (1) experienced meaningfulness of the work, (2) experienced responsibility for work outcomes, and (3) knowledge of the work results. Furthermore, the theory described that these psychological states occur when the five "core" job dimensions exist. These job characteristics are (1) skill variety, (2) task identity, (3) task significance, (4) autonomy, and (5) feedback from the job.

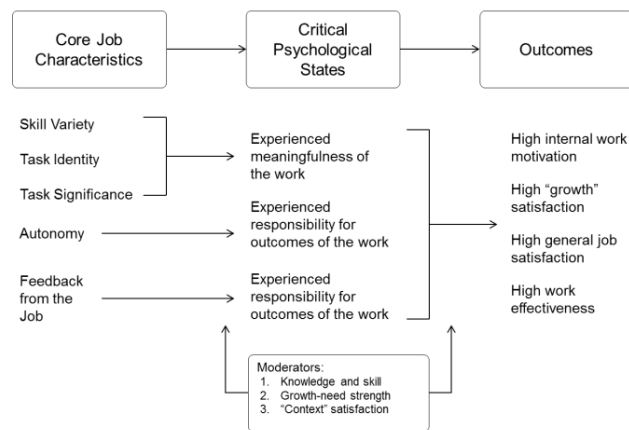


Fig. 1. The job characteristics model by Hackman & Oldham (1974).

2.2. The Job Core Dimensions

Hackman & Oldham's theory described these five core job dimensions as shown in Table I below:

Table 1: Job Core Definitions

Job Dimensions	Definition [9]
1. Skill variety	The job requires the use of variety of different activities and different skills and talent of employees.
2. Task Identity	The job requires a visible outcome of performing the from beginning to end.
3. Task Significance	The job has a substantial impact the work of other people.
4. Autonomy	The job provides substantial freedom and independence the employee in doing the work.
5. Feedback from the Job Itself.	The job provides direct and clear information about the effectiveness of employee's performance

2.3. The Job Diagnostic Survey (JDS)

The survey statements used in this study were adopted from The Job Diagnostic Survey by Hackman & Oldham (1974) and from The Performance Juxtaposition Site [10]. According to Hackman & Oldham, the Job Diagnostic Survey or JDS was intended to measure the job characteristics, the personal reactions of individuals to their jobs, and the readiness of individuals to respond to job redesign [9]. These five job characteristics were translated into survey statements to measure employees' perceptions on the job. The 15-statement survey was enumerated in Table II as follows:

Table 2: Job Core Definitions

Job Survey Statements
1. The job provides a lot of variety.
2. The job allows me to complete the work I started.
3. The job may affect other people by how well the work is done.
4. The job allows me to use my own initiatives and judgment in carrying out the task.
5. The job lets me work closely with other people.
6. The job allows me to use different skills and talents.
7. The job is arranged so that I have a chance to do the job from beginning to end.
8. The job is relatively significant in the organization.

9. The job provides me with opportunity for independent thought and action.
10. The job provides feedback on how well I am performing my work.
11. The job gives me the possibility to do several different things.
12. The job is organized so that I may see projects through final completion.
13. The job is very significant in achieving the company's ultimate goals and objectives.
14. The job gives me considerable opportunity for independence and freedom in how I do my work.
15. The job provides me with the feeling that I know whether I am performing well or poorly.

2.4. The Scoring Process

After gathering the employee's responses to the 15-statement job survey above, the total score for core job dimensions statements were added altogether and recorded using the scoring guide shown in Table III below:

Table 3: Job Scoring Guide

Job Dimensions	Scoring
Skill variety	Total the scores for questions 1, 6, 11
Task Identity	Total the scores for questions 2, 7, 12
Task Significance	Total the scores for questions 3, 8, 13
Autonomy	Total the scores for questions 4, 9, 14
Feedback	Total the scores for questions 5, 10, 15

2.5. E.The Job Motivating Potential Score (MPS)

The survey scoring used in this study was the Motivating Potential Score or MPS proposed by Hackman and Oldham (1974). The MPS is a measure of the degree to the overall job motivation on the part of the employees [9]. MPS is computed by adding the total scores of job dimensions above (Table III) and using the MPS formula below:

$$MPS = \frac{\text{Skill Variety} + \text{Task Identity} + \text{Task significance} + \text{Autonomy} + \text{Feedback}}{3}$$

According to the Motivating Potential Score or MPS formula, jobs with low to near-zero scores on either autonomy and feedback can reduce the overall MPS, whereas low to near-zero scores on other job dimensions (skill variety, task identity, or task significance) cannot do so [9].

The scores of the 15-statement job surveys were plotted in the excel tables and charts. The job survey scores and MPS results of each job were described in the following sections.

3. Results

The overall aim of this section is to communicate the survey findings and results of jobs under study. This portion provides statistical information of job survey results using tabulation and graphical representation for direct interpretation and explanation.

3.1. Tabulated Scores

From the obtained survey scores, employees' jobs and corresponding job dimensions were tabulated below:

Table 4: Job Scoring Guide

	Skill Variety	Task Identity	Task Significance	Autonomy	Feed back	MPS
Job A	15	13	15	15	15	3225
Job B	15	15	15	15	15	3375
Job C	15	11	13	15	13	2535

Job D	11	11	11	15	11	1815
Job E	15	13	15	15	15	3225
Job F	15	11	13	15	15	2925
Job G	13	11	15	15	11	2145
Job H	15	11	13	13	15	2535
Job I	15	9	11	13	11	1668
Job J	7	15	15	7	15	1295
Job K	15	15	15	15	15	3375
Job L	13	13	15	7	10	957

Table IV shows the responses to the job survey. As names of employees were kept confidential, their jobs were classified as Job A through Job L. The following five columns are the five core characteristics' survey scores: Skill Variety, Task Identity, Task Significance, Autonomy, and Feedback. The last column reflects the total MPS for each job. One could easily assume that high scores for job characteristics correspond to a high MPS. However, that is not the case because, referring to the MPS formula, autonomy and feedback are given greater weight than skills and tasks. This scientific theory of MPS will be discussed consequently.

Using the scoring guide and MPS formula, 2 out of 12 jobs achieved high total scores with 75 points or 3,375 MPS. The top 2 jobs were Job B and Job K. In contrast, 4 out of 12 jobs scored low with 58-59 points. The low-scoring jobs were Job D, Job I, Job J, and Job L. Moreover, Job L scored the lowest motivation score of 957 MPS. The implication of varying scores among similar jobs or different job positions is explained in the next section.

3.2. Job Dimension Chart

Another technique to understand the company's job survey data is through a Job Dimension Chart. Fig. 2 below shows the jobs and corresponding job dimension scores or the five "core" job characteristics.

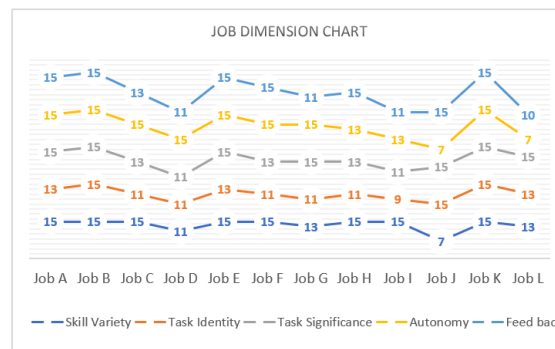


Fig. 2. Job Dimension chart

Most jobs scored high in Skill Variety except Job D with 11 points and Job J with 9 points. Similarly, all jobs scored high in Task Identity and Task Significance except Job I with 9 points. Looking at Autonomy (defined as substantial freedom and independence in doing the work), 2 out of 12 jobs scored low. These two jobs were Job L and Job J with 7 points each. Not only in Autonomy, but Job L scored low in Feedback with 10 points.

Also, the above chart could quickly identify jobs that scored high on any of the five job dimensions. However, translating these job scores into Motivation Potential Score or MPS could give a clearer understanding of the job motivation factors.

3.3. The MPS Index

The tabulated Motivation Potential Score or MPS survey results of jobs under study (refer to Table IV) could be better exemplified using a graphical representation as shown in Figure 3 below:

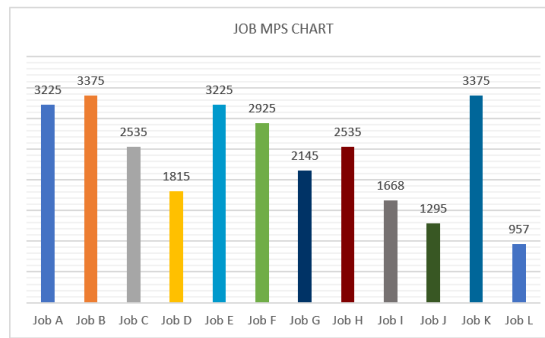


Fig. 3. Job MPS chart of the 12 jobs.

As discussed earlier, MPS is a measure of the overall job motivation on the part of the employee. Figure 3 reflects the MPS results of all the 12 jobs under study. It can be noted that 2 out of 12 jobs got the highest score of 3,375 MPS: Job B and Job K. Mid-high MPS jobs were Job A and Job E with 3,225 MPS each, Job F with 2,925 MPS, Job C and Job H with 2,325 MPS each. Job G then followed them with 2,145 MPS. In contrast, Job D, Job I, Job J, and Job L scored the lowest MPS. Analyzing jobs that scored the highest and the lowest MPS could further help understand an organization's job motivating factors. Evaluation and analysis of these jobs are discussed subsequently.

4. Discussion

The names of employees remain confidential. However, to better comprehend the job survey results and evaluate the company's job design using Hackman and Oldham's model, some specific job titles under study could be disclosed. According to the MPS formula, the autonomy (or job that provides freedom and independence at work) and feedback (or job that provides information about employee's performance) could significantly influence the job motivating factors. The following illustration explained this theory:

4.1. High-Motivating Jobs

Interestingly, the top two jobs with perfect job scores and highest MPS were the Company's top positions, the President of the Company and the Financial Analyst. A previous study of Greg R. Oldham, J. Richard Hackman, and Leo P. Stepina (1979), entitled "Norms of the Job Diagnostic Survey," observed the same result. The researchers obtained data from various job positions in the organizational hierarchy or job categories: (a) upper-level management; (b) middle-level management; (c) first-line management; (d) staff; or (e) non-management. The results suggested that the higher the job's level, the higher the core dimensions. Thus, the highest scores were in the top levels of management and the lowest in the non-management areas [11].

4.2. Low-Motivating Jobs

Fig. 4 below represents the lowest job survey scores in the organization. The study proved that jobs with low scores in either Autonomy and Feedback reduced the overall MPS despite high scores in other job dimensions: Skills Variety, Task Identity, or Task Significance. These low-scoring jobs were Job D, Job I, Job J, and Job L. In other words, the motivating potential score would be very low if a job completely lacks autonomy or feedback, regardless of levels of variety, task identity, and significance [13]. It is often thought that these jobs are similar because of similar scores. However, similar jobs could have different scores, as explained subsequently.

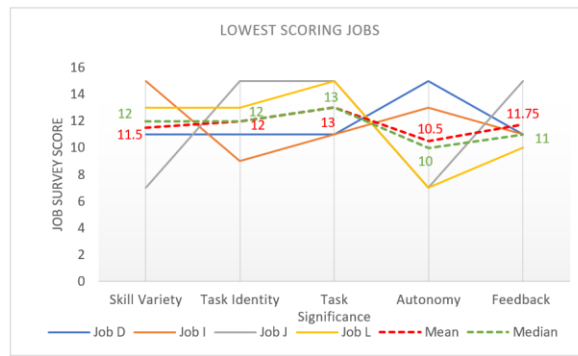


Fig. 4. The mean and median of the lowest scoring jobs.

The application of statistical analysis using the mean and median is shown in Fig. 4. The red and green dotted lines are the average scores of the four (4) lowest jobs. These jobs scored high in skills and task dimensions (11-13 points) but scored significantly low in autonomy and feedback (10-11 points). Thus, job MPS scores were also low.

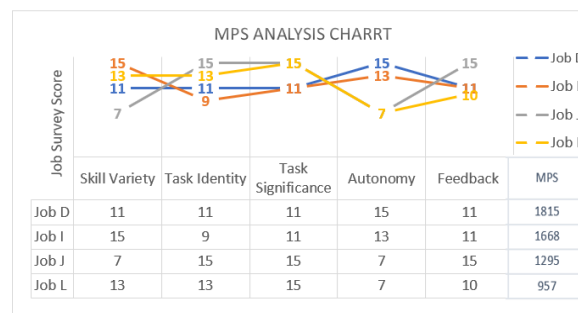


Fig. 5. The mean and median of the lowest scoring jobs.

A closer examination of Fig. 5 above reveals that Job J and Job L scored the lowest in Autonomy (7 points each). Hence, they got the lowest job scores with 1,295 and 957 MPS, respectively. For further investigation, the job titles of Job J and Job L will be disclosed in the subsequent discussion.

4.3. Similar Jobs, Different Scores

Being a specialized engineering construction company, this organization was composed of managers: Business Development Manager, Technical Manager, Operations Manager, Technical Support Manager, General Manager, and Project Manager. These six jobs belong to employees with similar functions but working on different specializations or projects.

The job scores and MPS of these six managerial jobs were tabulated in Fig. 6 below. MPS and survey scores were relatively high in all the job dimensions, namely: Skills Variety, Task Identity, Task Significance, Autonomy, and Feedback – except for one Manager, Job L, which scored very low in Autonomy thus, resulted in the lowest MPS.

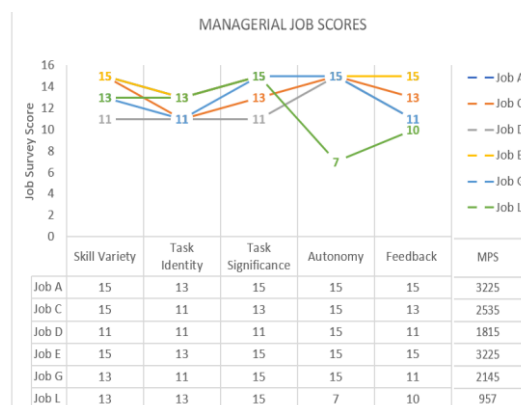


Fig. 6. Survey scores of managerial jobs.

The Company under study showed that five out of six managers scored perfectly high in Autonomy (15 points). The results of this study were similar to the study conducted by Fuller & Unwin (2010). Their research proved that employees in a small-sized privately-owned company are “in a position to act autonomously, make its own decisions about priorities and goals.” This relative freedom is certainly not shared by firms with several thousand employees [14].

In contrast, Job L, a Managerial position, scored very low in Autonomy (7 points), resulting in low MPS. No further investigation or interview was conducted to understand factors of low Autonomy score of Job L despite its similar job responsibilities with the rest of the managers.

4.4. Rank and File’s Perceptions

Nevertheless, rank and files also had different job perceptions. Fig. 7 above reveals that Job J scored significantly low in Skills and Autonomy. Job J, a Clerical or Secretarial position, scored the lowest among the rank and file or non-management positions. Compared to Oldham, Hackman, and Stepina's (1979) study, the same result was observed. The employees in clerical, structural, and processing jobs scored the lowest MPS [11].

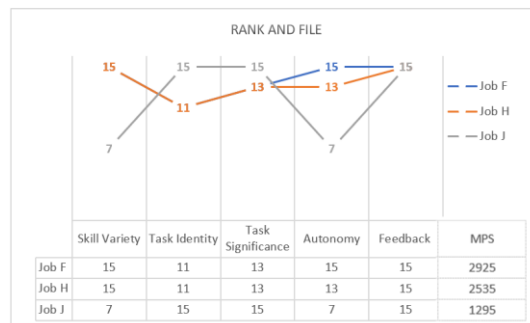


Fig. 7. Rank and file job scores.

4.5. Autonomy and Motivation

Since this study focused on analyzing Job Diagnostic Survey results, the researchers further analyzed scores of each statement to understand which job statements were rated the lowest. Understanding employees' perceptions about their job could help in the job design. These lowest-scoring job statements are shown in Table V below:

Table 5: Job Survey Statements with Lowest Scores

Autonomy
9 - The job provides me with opportunity for independent thought and action.
14- The job gives me considerable opportunity for independence and freedom in how I do my work

Job survey statements No. 9 and No. 14 were related to Autonomy or opportunity for independence and freedom at work. Both Job L (managerial role) and Job I (clerical job) gave the lowest score to both statements. These data implied that employees in any position (managers or ranks) could perceive a low (or high) job Autonomy. On the other hand, some might have taken the stance that employees who scored low in Autonomy were not motivated at work.

Even so, the research conducted by Sisodia and Das (2013) concluded that employees who were given more job autonomy, job commitment, or motivation would also be high [12].

5. Conclusion

This study was the first job survey conducted for Greenlex System Services, Inc., a specialized engineering construction company. The researchers achieved the purpose of the study by evaluating the company's job design using Hackman and Oldham's model. The employees scored the job based on the Job Characteristics Model, Job Diagnostics Survey, and Motivational Potential Score. The macro-ergonomics approach and job survey questions were designed to obtain employees' perceptions of their jobs and reactions. Hence, similar job titles performed by employees within the same organization gained different scores in the

five job core dimensions. The statistical analysis, data tabulation, and graphical techniques identified the high and low motivating jobs. The results showed the top position jobs of the company scored the highest. Most jobs typically scored high-- except for one rank and file role and one managerial position that scored the lowest MPS. The low-scoring jobs were evaluated for Job Design strategies to improve motivation

The study justifies a Job Design program for the Company. The Job Characteristics Model or JCM by Hackman and Oldham's Model (1974) explained that when an employee is provided with autonomy in doing the job, the individual experience or sense of responsibility for work-related outcomes is enriched. In other words, autonomy at work increases job motivation, thus improving performance [13]. To enhance employee job motivation, the following job approaches can be considered. The four common job design strategies are namely, Job Rotation, Job Simplification, Job Enlargement and Job Enrichment.

Each Job Design technique has specific objectives. Firstly, Job Rotation is a strategy to move the employees from one job to another to learn new skills, thus increasing skills variety. On the other hand, Job Simplification refers to removing tasks existing roles to focus on few tasks. In contrast to simplification, Job Enlargement involves adding more tasks or roles. [15]. Job Enlargement aims to add tasks across the same level in the organization, whereas Job Enrichment focuses on adding autonomy and responsibility with hierarchical levels [16]. Moreover, Job Enlargement is a horizontal expansion of tasks, whereas Job Enrichment is the vertical expansion of the role. Researchers recommend careful planning and balance when approaching job designs for a particular job role.

This research is limited and applicable specifically only to Greenlex System Services, Inc. Only 12 jobs were surveyed and evaluated; hence results cannot be generalized to other companies. The implementation of the proposed job design/redesign is beyond the scope of this paper. However, by applying the results and recommendations of this study, the company can achieve a safe and healthy work environment, increase job motivation, and improve overall employee performance and creativity. Despite its limitations, this study provided a foundation for future research efforts. To improve this study, future researchers can apply advanced statistical tools and use a variety of job-related questions of the Job Diagnostic Survey by Hackman and Oldham (1974). Researchers can gather more respondents from similar and different job titles, management and supervisory levels, individual contributors, and various organizations' rank and files positions. Also, pre-and post-surveys can be initiated to assess employees' motivational scores before and after implementation of job design programs [17], [18].

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