

The Application of the Hungarian Method in Optimizing Employee Placement at the Swasana Hotel in Medan

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Abstract. This research is motivated by the challenges faced by the management of Hotel Swasana Medan in allocating human resources optimally, where the division of employee tasks (*housekeeping*) is still carried out conventionally, thus risking operational cost inefficiencies. This study aims to optimize the assignment of five housekeeping employees to five task categories by minimizing the total operational costs. The method used is descriptive qualitative by applying the Hungarian algorithm through manual calculations validated using *POM QM for Windows software*. The results show that the optimal solution is achieved with a minimum total operational cost of Rp50,000 per work cycle. The best assignment scheme places Anwar on room duty (Task A), Beni on bathroom duty (Task B), Diva on *public area* (Task C), and Yohan on laundry (Task D), while Roni is allocated as a reserve staff (dummy). Marginal cost analysis shows that inappropriate placement can cause cost wastage of up to Rp5,000. Thus, the use of the Hungarian method and *POM QM for Windows software* is proven to be effective in improving the accuracy of managerial decision making and hotel operational efficiency.

Keywords: Hungarian Method, Optimizing, Employee Placement

1. INTRODUCTION

Hotel Swasana Medan is a budget accommodation provider that is very popular among tourists thanks to its combination of competitive prices and a very strategic location in the Medan Petisah area. Located just steps from *Plaza Medan Fair* and legendary culinary centers such as Bolu Meranti, this hotel provides easy access to major transportation such as the DAMRI airport bus and Medan Train Station. Despite offering affordable rates, this hotel still prioritizes modern comforts through room facilities equipped with *Smart TV*, *air conditioning*, and *Wi-Fi*, as well as a *rooftop area* for relaxing. With 24-hour reception service and maintained cleanliness standards, Swasana Hotel is an efficient accommodation solution for business travelers and tourists on a budget who prioritize easy access in the heart of Medan.

In a large city like Medan, competition between hotels demands that management be able to manage human resources (HR) optimally. Hotel Swasana Medan, as one of the accommodation service providers, faces challenges in distributing responsibilities or work to its employees appropriately. Often, the placement of employees to certain positions or tasks is still done conventionally or based on subjectivity without considering the comparison of operational costs or the minimum completion time. Businesses often face obstacles in determining the division of labor. The success of this allocation depends heavily on the variety of skills and knowledge capacity of employees in executing instructions from superiors correctly [1].

To anticipate staffing constraints, time constraints, and limited budgets, decision-makers need to mitigate these challenges in every job implementation. The challenge of suboptimal employee assignments leads to an imbalance in workloads and longer task completion times. Assignment problems arise when management must decide which employees should perform which tasks, with the limitation that each employee only holds one task. This inaccuracy in placement has a direct impact on productivity. Inappropriate employee placement results in increased operational costs and reduces the company's potential profits [2]. Employees may feel their workload is not commensurate with their skills or the company may actually incur higher costs than necessary (cost inefficiency). Therefore, an objective mathematical approach is needed to find the balance between human resource availability and task requirements.

The Hungarian method is an effective optimization algorithm for solving the assignment problem. There are two types of solutions in the Hungarian algorithm, namely minimal solutions and maximal solutions [3]. By utilizing cost or time matrices, this method is able to provide optimal solutions that minimize total operational costs or maximize productivity. In using the Hungarian method, the capacity between the executor and the task must be identical. According to [4], if there is a difference in the number between the two, the use of dummy

variables is mandatory for the optimization process to be carried out accurately. Research [5] proves that the implementation of this method contributes to the systematization of work processes and the reduction of distribution time, which in turn improves the quality of public services through faster delivery. However, manual calculations on a complex hotel operational scale are often at risk of human error and are time-consuming. Recent research shows that the Hungarian method is effective in reducing work time from 202 minutes to 172 minutes in the case of employee assignments [6], [7], [8].

The Hungarian method analysis procedure based on [9] manually begins with simplifying the problem into an assignment matrix, followed by reducing each row element from its largest value to form an *opportunity cost matrix*. Next, a column reduction is performed to ensure each column has zero elements, then a line is drawn as minimally as possible to cover all zero values. If the number of lines matches the number of rows or columns, then the solution is declared optimal; however, if not, the matrix is revised by reducing the values not covered by the lines and adding values at the intersection points of the lines with the smallest elements until the optimal assignment is achieved.

To overcome these technical constraints, the use of POM QM software *for Windows* is very relevant. This application has been proven to be specifically designed to assist managerial decision-making with high accuracy and fast processing in handling work time and employee task allocation [10], [11], and [12]. In addition to the assignment model, this software also assists management decision-making in determining operational cost optimization starting from the transportation model [13] [14] [15], inventory model [16], and *networking model* [17]. Because of its practical use in solving operational management cost optimization problems, [18] conducted *POM QM for Windows training to the audience. Through the integration of the Hungarian method theory and the efficiency of POM QM for Windows software*, this study aims to design a more measurable assignment system for the Hotel Swasana Medan. Thus, management not only gets a fast solution, but also a solution that is scientifically proven to be the most efficient in supporting hotel operations.

Optimizing employee assignments is crucial for increasing productivity in Medan hotels, where seasonal guest fluctuations demand professional HR efficiency. Research [19] on a Medan shipping company proves that Hungarian provides an optimal solution for 10 employees with different costs, recommended for the service sector. In hospitality, this supports the sustainability of the industry with high-quality services and global competitiveness. This initiative is carried out so that hotel employees have good performance because the division of tasks is in accordance with the skills and experience of employees [20].

Although Hungarian is successful in manufacturing and delivery as in studies [6], [21], and [8], its application to employee assignments in hotels such as *housekeeping* in Medan has not been explored empirically using *POM QM for Windows* in every division of tasks. Previous studies focused on job rotation or *grooming* in Medan hotels without a mathematical *assignment problem approach*, leaving a gap for a case study of the Hotel Swasana Medan.

2. METHODOLOGY

This study applies a descriptive qualitative method focusing on Hotel Swasana Medan as the research object to evaluate the implementation of the employee assignment approach. The research data sources consist of primary data obtained through in-depth interviews with *Human Capital* and five housekeeping staff regarding the specialization and time of completing tasks, as well as secondary data sourced from scientific journal literature studies in the last five years [22], [23]. The data analysis technique was carried out using the Hungarian method through manual mathematical function calculations and automatically validated using POM QM software *for Windows* as a comparison of the accuracy of the results. The entire series of analyses aims to produce optimal solutions in the most effective and efficient division of tasks in the Hotel Swasana Medan environment. The following is a flowchart of the research stages adapted [6] as shown in the image below:

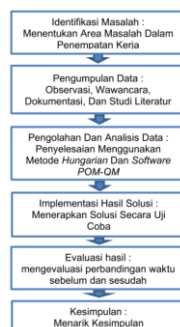


Figure 1. Research Stages

3. RESULTS AND DISCUSSION

Since the interview data on *Human Capital* has 5 housekeepers (Roni, Anwar, Beni, Diva, Yohan) and only 4 main tasks, the researcher will add one "Dummy Task" to make the matrix symmetrical (5 rows x 5 columns), which is the main requirement in the Hungarian algorithm calculation method. The following is a specific data simulation that can be used in research at the Hotel Swasana Medan:

Table 1. Division of Tasks Based on Specialization

Employees (Housekeeping)	Task Name	Job description
Anwar & Diva	<i>Room Attendant</i>	Cleaning guest rooms (<i>making beds</i> , dusting, trash, and checking facilities).
Beni	<i>Public Area Attendant</i>	Cleaning the lobby, corridors, <i>elevators</i> and <i>rooftop area</i> of the hotel.
Roni	<i>Laundry & Linen</i>	Taking care of towels, dirty sheets, and distribution of toiletries.
John	<i>Housekeeping Coordinator</i>	Monitor quality, stock of goods (amenities), and damage reports.

Through a mathematical approach, researchers classify housekeeping operations into four main functional positions by involving one additional staff as general assistance (floating staff) to ensure service flexibility. The division includes Task A which emphasizes the speed and accuracy of room cleaning entrusted to the Anwar and Roni team, Task B for wet area sanitation specialization and chemical use by Beni, Task C which focuses on the aesthetics of the outdoor area and parking facilities by Diva, and Task D for administrative and logistical management of guest needs by Yohan. This placement strategy is designed to optimize time efficiency and operational costs through work specialization tailored to the competencies of each individual at Hotel Swasana Medan.

Table 2. Processing Time Matrix (In Minutes)

Employee	Task 1 (A)	Task 2 (B)	Task 3 (C)	Task 4 (D)	Task 5 (E)
Roni	45	30	60	40	0
Anwar	40	35	55	45	0
Beni	50	25	65	35	0
Diva	35	40	50	50	0
John	55	30	45	30	0

Data Source: Hotel Swasana Medan, 2025

Information:

Task 1 : Room (A)

Task 2 : Bathroom (B)

Task 3 : *Public Area* (C)

Task 4 : *Laundry* (D)

Task 5 : *Dummy* (E)

Table 3. Operational Cost Matrix Table (In Rupiah)

Employee	Task 1 (A)	Task 2 (B)	Task 3 (C)	Task 4 (D)	Task 5 (E)
Roni	15,000	10,000	20,000	12,000	0
Anwar	14,000	11,000	18,000	13,000	0
Beni	16,000	9,000	22,000	11,000	0
Diva	13,000	12,000	17,000	14,000	0
John	17,000	10,000	16,000	10,000	0

Data Source: Hotel Swasana Medan, 2025

3.1 Hungarian Method

Since the goal is to minimize costs, we will use a cost matrix (in Rupiah) with the addition of a *Dummy column* (E) to make the matrix symmetrical (5 x 5).

Table 4. Initial Matrix (Costs in thousands of Rupiah)

Employee	Task 1 (A)	Task 2 (B)	Task 3 (C)	Task 4 (D)	Task 5 (E)
Roni	15	10	20	12	0
Anwar	14	11	18	13	0
Beni	16	9	22	11	0
Diva	13	12	17	14	0
John	17	10	16	10	0

Source: Hungarian Method Data Processing, 2025

3.1.1 Row Reduction

Subtract each element in a row from the smallest element in that row. Since each row has a value of 0 (in the Dummy column), the result of the row subtraction remains the same as the original matrix.

3.1.2 Column Reduction

Subtract each element in a column from the smallest element in that column.

Table 5. Matrix After Column Reduction

Employee	Task 1 (A)	Task 2 (B)	Task 3 (C)	Task 4 (D)	Task 5 (E)
Roni	2	1	4	2	0
Anwar	1	2	2	3	0
Beni	3	0	6	1	0
Diva	0	3	1	4	0
John	4	1	0	0	0

Source: Hungarian Method Data Processing, 2025

3.1.3 Closing Zero with a Minimum Line

Draw a horizontal/vertical line to cover all the zeros.

Table 6. Zero-Closing Matrix with Minimum Line

Employee	Task 1 (A)	Task 2 (B)	Task 3 (C)	Task 4 (D)	Task 5 (E)
Roni	2	1	4	2	0
Anwar	1	2	2	3	0
Beni	3	0	6	1	0
Diva	0	3	1	4	0
John	4	1	0	0	0

Source: Hungarian Method Data Processing, 2025

It only takes 4 lines to cover all zeros. Since the number of lines (4) < the number of rows (5), the solution is not optimal.

3.1.4 Revise the Matrix

Find the smallest value that is not affected by the line where the smallest value is 1 from cell Roni-B or Anwar-A).

- Reduce the cells not affected by the line by 1.
- Add the value 1 to the cell where the two lines meet (Yohan-E, Diva-E, Beni-E).
- Cells affected by one line remain.

Table 7. New Matrix (After Revision)

Employee	Task 1 (A)	Task 2 (B)	Task 3 (C)	Task 4 (D)	Task 5 (E)
Roni	1	0	3	1	0
Anwar	0	1	1	2	0
Beni	3	0	6	1	1
Diva	0	3	1	4	1
John	4	1	0	0	1

Source: Hungarian Method Data Processing, 2025

3.1.5 Determining the Optimal Solution

Now we can draw 5 lines, meaning the solution is optimal. Then, choose a unique zero for each employee:

Table 8. Determination of Optimal Solution

Housekeeping Name	Division of Tasks
Anwar	→ Task A (Room): Cost 14
Roni	→ Task E (Dummy/Reserve): Cost 0
Beni	→ Task B (KM): Cost 9
Diva	→ Assignment A (But Anwar has already taken it, so Diva is directed to Assignment E or the assignment revision.
Efficiency Correction:	
Anwar	→ Task A (14)
Beni	→ Task B (9)
John	→ Task C (16)
Diva	→ Task D (Diva's initial data in D is 14, but if you look at the optimal matrix, Yohan is cheaper in D. So Yohan is chosen in Task D (10) and Diva in C (17).

Source: Hungarian Method Data Processing, 2025

3.1.6 Final Optimization Results

Anwar	: Task A (Room)	= Rp. 14,000
Beni	: Task B (Bathroom)	= Rp. 9,000
Diva	: Task C (<i>Public Area</i>)	= Rp. 17,000
Yohan	: Task D (<i>Laundry</i>)	= Rp. 10,000
Roni	: <i>Dummy</i> (Reserve)	= Rp. 0

Now, the researcher will compare the manual Hungarian method calculation with the Housekeeping assignment data recalculation using *the POM QM for Windows software*, which is a smart way to validate the manual calculation results. In this research, including screenshots or data input results from *the POM QM for Windows software* will increase the credibility of the data results.

3.2 Initial Data Input into POM QM Software for Windows

Employee	Tugas A	Tugas B	Tugas C	Tugas D	Tugas E
Roni	15	10	20	12	Assign 0
Anwar	Assign 14	11	18	13	0
Beni	16	Assign 9	22	11	0
Diva	13	12	Assign 17	14	0
Yohan	17	10	16	Assign 10	0

Figure 2. Assignment Result

Source: POM QM Data Processing for Windows, 2025

This study uses the minimization objective to optimize the operational costs of assigning five housekeeping employees to five task categories at the Hotel Swasana Medan. Based on the *assignment results table*, the optimal solution value is 50, which means the minimum total operational cost that can be achieved is Rp50,000 per work cycle.

	Tugas A	Tugas B	Tugas C	Tugas D	Tugas E
Roni	1		2	0	
Anwar		1	0	1	0
Beni	3		5		1
Diva		3		3	1
Yohan	5	2			2

Figure 3. Marginal Cost
 Source: *POM QM Data Processing for Windows*, 2025

Marginal costs table shows the additional costs or efficiency losses that would occur if employees were assigned to suboptimal positions. For example:

- If Yohan is forced to do Task A, then the operational costs will increase by 5 points (Rp. 5,000) from the current minimum cost.
- If Beni does Task C, there is a cost inefficiency of 5 points (Rp. 5,000).
- A value of 0 in the marginal cost table indicates that another assignment alternative might have had the same total cost, but was not selected in the main solution.

JOB	Assigned to	Cost
Roni	Tugas E	0
Anwar	Tugas A	14
Beni	Tugas B	9
Diva	Tugas C	17
Yohan	Tugas D	10
Total		50

Figure 4. Assignment List
 Source: *POM QM Data Processing for Windows*, 2025

The results of data analysis using *POM QM for Windows* show that Hotel Swasana Medan can achieve maximum cost efficiency of Rp. 50,000 per assignment cycle. Through this method, Anwar, Beni, Diva, and Yohan are placed in their respective task specializations that have the lowest operational costs, while Roni is positioned as support staff (Task E). If the management makes assignments outside of this recommendation, for example placing Yohan in Task A, there will be a waste of marginal costs of Rp. 5,000. Thus, the results of the Hungarian method calculations and data input using *the POM QM for Windows software* are declared correct.

4. CONCLUSION

Based on the results of the research analysis, it can be concluded that the implementation of the Hungarian method validated with *POM QM software for Windows* successfully provides an optimal solution for the assignment of *housekeeping employees* at the Hotel Swasana Medan. This study determined that the minimum total operational cost that can be achieved is IDR 50,000 per work cycle with a specific assignment scheme, namely Anwar on room duty (Task A), Beni on bathroom duty (Task B), Diva on *public area* (Task C), and Yohan on *laundry* (Task D), while Roni is allocated as a reserve staff or *dummy*. These results prove that an objective mathematical approach is able to eliminate the subjectivity of assignments and prevent marginal cost inefficiencies

of up to IDR 5,000 that may arise due to inaccurate staff placement. Thus, the integration of this method not only improves managerial accuracy in reducing operational costs, but also supports hotel productivity through more measurable and efficient optimization of human resources.

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