

## EFFICIENCY REDEFINED: AN ANP-OPTIMIZED WORK SCHEDULING ON EMPLOYEE PRODUCTIVITY IN THE MANUFACTURING INDUSTRY

**Ilham Muzakki, Rita Ambarwati\***  
Universitas Muhammadiyah Sidoarjo, Indonesia

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**ABSTRACT:** Scheduling is one of the important factors that affect employee productivity in a company. PT Maspion, as one of the large companies with a large number of employees, faces challenges in optimal work scheduling to meet varied production needs. This study aims to optimize work scheduling using the Analytic Network Process (ANP) method by considering several dimensions of criteria such as consistency, predictability, adequacy, and control. The research method used is a descriptive quantitative approach with primary data obtained through interviews and questionnaires to 30 experts in the field of work scheduling. The results show that consistent, predictable, adequate, and controlled work scheduling can increase employee productivity and employee well-being. In conclusion, the application of the ANP method in work scheduling can help companies in increasing employee productivity and welfare.

**Keywords:** Analytic Network Process; Efficiency; Productivity; Work Scheduling; Employee; Manufacture

\*Corresponding Author : [ritaambarwati@umsida.ac.id](mailto:ritaambarwati@umsida.ac.id)

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## INTRODUCTION

Human resources have a big role in companies to optimise the use of their potential to help support and meet the company's business and strategic goals. Human resource (HR) management helps organizations to assess organizational and environmental changes associated with their activities at a minimum cost. In addition, human resource management also ensures unity and coherence for personnel activities (Shahanipour et al., 2020). The current human resource management function makes the people involved in it, and the organization together increase productivity and creativity. Thus, HR must be proactive and practice is an inherent part of business strategy planning (Chakraborty & Biswas, 2019). Ultimately, a successful organization is one where managers, employees and all involved are always in a dynamic competition for innovation and creativity based on organizational strategy (Shahanipour et al., 2020).

The success factor of an organization/company is influenced by the productivity of its employees. There are many ways to increase productivity, one of which is through work scheduling. Scheduling in an organization/company is a complex and time-consuming problem to deal with (Guerriero & Guido, 2022). Employee scheduling is a major consideration in an industrial world where operations are not only labor-intensive but also have to deal with constant changes in staff demand caused by predictable phenomena, such as seasonal or unpredictable, as variability or unscheduled absences (Esteban Álvarez, Juan-Carlos Ferrer, Juan Carlos Muñoz, 2009). Employee scheduling involves a large investment for managers who are trying to optimize productivity while paying attention to employee capabilities and customer demands (Downes & Lee, 2023). Responsible scheduling that considers worker well-being can increase productivity by adhering to a scheduled work plan (Kesavan et al., 2022). Conversely, erratic scheduling can lead to negative impacts on the business, including increased employee turnover, absenteeism, and decreased morale (Loustanaou et al., 2020).

Maspion is one of the large-scale companies established in 1967 that employs 30,000 employees spread across 5 areas in East Java and Cibitung, Jakarta (Group, 2021). Productivity at PT Maspion is increasing every year, but there are problems related to work schedules. A large company with many employees often encounters problems regarding work scheduling. Employee scheduling issues vary from organization to organization because they are shaped by the characteristics and needs of the organization/company, such as operating hours, demand patterns, type of work and employee skills, shift start and end times, rest time considerations, and work agreements (Bürgy et al., 2019). The determination of work qualifications at Maspion is carried out based on the applicable labor law and adjusted to production needs. The working time in question is article 77 paragraph 1, which includes 7 hours of work a day and 40 hours of work a week for 6 working days a week or 8 hours of work a day and 40 hours a day for 5 working days a week (Law of the Republic of Indonesia No. 13 of 2003, 2003). Although some employees like overtime hours, the work demands of employees vary throughout the day and employees who work for many hours in one day will cause excess and lack of coverage at different times

of the day (Soriano et al., 2020). Therefore, work scheduling must be able to solve the problem of selecting a large pool of candidates, what shifts to work on, and the assignment of the number of employees for each shift to meet the demand (Ernst et al., 2004). Optimization of work scheduling determination to increase productivity can be done using the *analytic network process* (ANP) method. Analytic Network Process offers better flexibility in complex problems with interactions between elements, and overall, ANP is preferred in situations involving dynamic and interdependent relationships between criteria and alternatives, providing a more holistic and accurate model for decision making (Kheybari et al., 2020).

Research on employee scheduling from various backgrounds has been carried out by previous researchers, including a study entitled Modeling a flexible staff scheduling problem in the Era of Covid-19 (Guerriero & Guido, 2022) stating that employee needs are met better when companies follow scheduled working days. Another study entitled A relational view of shiftwork: Co-scheduling with higher performers (Downes & Lee, 2023) proves that co-scheduling with higher-performing colleagues can improve employee performance because it encourages learning that can improve the performance of other employees in the long run. Another study entitled Integrated Employee Scheduling with Known Employee Demand, Including Breaks, Overtime, And Employee Preferences (Soriano et al., 2020) proves that the proposed model combination results in an optimal and feasible solution for employee scheduling. Another study entitled The Effect of Work Shifts on Performance Through Fatigue and Workload Variables as Intervening Variables at PT M.I (Arianto & Puspita, 2019) proves that ideal work shift times, reducing the number of night shift workers to reduce fatigue, adding labor for sustainable work, and implementing flexible working hours can increase employee efficiency and well-being without reducing the number of set working hours. Another study entitled The Effect of Communication, Scheduling, and Clarity of Job Description on Employee Work Efficiency at PT. Dianas Star (Patentius, 2022) proves that scheduling affects efficiency.

Previous studies have concluded that scheduling can increase productivity above average and meet employee needs, improving employee well-being by implementing ideal shift times and work flexibility. However, few of these studies still discuss the optimization of work scheduling using the work scheduling dimension (Kesavan et al., 2022) and using the analytic network process method. Based on this background, this study will discuss optimizing work scheduling to increase productivity with the analytic network process (ANP) method.

## **THEORETICAL REVIEW**

### *Work Scheduling*

Work scheduling is an important planning activity that companies must implement in determining where and when each operation as part of the overall work is carried out on limited resources so that employee work efficiency can be

achieved optimally (Patentius, 2022). Another definition describes scheduling as a number of activities, people, materials, or capital assigned for a predetermined period of time under certain constraints (Taghizadehalvandi & Ozturk, 2019). Scheduling is a vital activity in the industrial world because it significantly impacts costs, sales, and profitability (Bürgy et al., 2019). Employee scheduling is an important activity in the industrial world because it significantly impacts costs, sales, and profitability (Bürgy et al., 2019). Based on these definitions, it can be concluded that scheduling is a crucial planning activity in the industrial world, involving determining the time and location of operations on limited resources to achieve maximum efficiency, with a significant impact on costs, sales, and profitability. This study uses four dimensions of work scheduling criteria, as shown in Figure 1, namely consistency, predictability, adequacy, and control (Kesavan et al., 2022).

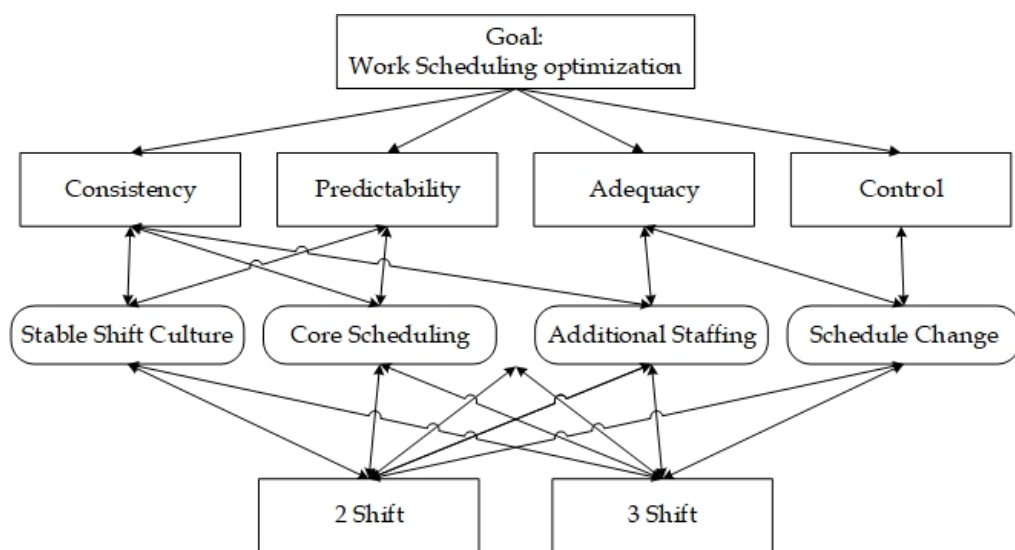


Figure 1. Analytic Network Process Model

Work schedules in the industrial sector are routinely unstable and unpredictable, and this unpredictability may have harmful effects on health and economic insecurity (Harknett et al., 2021). Therefore, consistency in scheduling is needed so that employees and business actors can minimize the impact caused by uncertainty. Just-in-time work schedules afford employers a great deal of flexibility (Schneider & Harknett, 2021). Previous researchers have found positive impacts on the consistency of workers' schedules which led to increases in workers' subjective well-being, sleep quality, and economic security (Harknett et al., 2021). Consistency is a fixed and stable scheduling from time to time. Consistent scheduling helps employees to have clear expectations about their working hours. By maintaining a consistent schedule, employees can reduce confusion and increase efficiency.

Predictability means that it is volatile and can be taken into account. Predictability is scheduling that can be predicted and reliable. For employees, predictability is not only about the work schedule that will be carried out, but also the wages that will be received in the future (Schneider & Harknett, 2021). Workers with the most unpredictable and unstable work schedules were twice as likely to

report material hardship compared with their counterparts with the most predictable and stable schedules (Schneider & Harknett, 2021). Unpredictable work schedule changes were associated with worse outcomes that day for workers, including increased negative mood and decreased perceived sleep quality (Ananat & Gassman-Pines, 2021). Good predictability can help employees better plan their activities outside of work. Workers can avoid uncertainty and improve the balance between work and personal life with a predictable schedule.

Adequacy refers to the adequacy of time and resources allocated to complete assigned tasks. Not only that, adequacy in work scheduling also considers the balance between workload and employee work capacity to prevent fatigue and decreased productivity. Previous research shows that a higher workload will lead to low work productivity (Chandrayuni et al., 2023). Workers deserve their rights as employees for what they do and the lack of salary will certainly affect productivity (Mahaputra, 2022). Low wages and unstable work schedules can cause psychological distress, unhappiness and generally affect workers' well-being (Schneider & Harknett, 2019). By ensuring this adequacy, organizations can avoid overwork and ensure that each task can be completed properly within the set deadlines and employees receive wages according to their entitlements.

Control is the regular monitoring of employee work schedules, including ensuring that employee work schedules are in accordance with the needs of the company and the needs of employees as individuals. Improving schedule control can be one way to help reduce experience low job satisfaction, high turnover, and susceptibility to poor sleep (Brossoit et al., 2020). From an employee's point of view, control means they have the right to strike a balance between work and the individual so that they do not feel stressed at work. Previous research has found that occupational stress and alertness resulting from being burdened with higher working hours seem to have many harmful ramifications for work-life well-being, such as work-life imbalance and job dissatisfaction (Hsu et al., 2019). By controlling schedules, employees can ensure that they can better balance their work and personal lives.

### *Multi Criteria Decision Making*

Multi-Criteria Decision Making (MCDM) is a decision-making approach used to identify the optimal choice from several alternatives based on specific criteria. These criteria typically consist of measurements, rules, or standards applied to support decision-making processes. There is no decision that can be addressed without referring to the decision-making process. This process can be rational or irrational, and on the other hand, it can use implicit or explicit assumptions that are influenced by several factors such as physiological, biological, cultural, social, etc. All these aspects, together with authority and risk levels, can affect the complexity level of a decision-making process (Taherdoost & Madanchian, 2023). MCDM methods have been developed to assist in a key managerial activity, decision-making, which according to the contingency approach must take into account situational factors that may affect the decision-

making process outcomes (Gonzalez-Urango et al., 2024). ANP is a multicriteria decision-making (MCDM) developed by Saaty, and it is an extension of a previous method developed also by Saaty, which models a decision problem as a hierarchy (Quezada et al., 2022).

## METHODOLOGY

This study uses a descriptive quantitative approach. Quantitative data analysis is a process carried out after the required data is collected, either through questionnaires from respondents or other data sources, to answer the research questions that have been described. The goal is to perform calculations on the data. (Sugiyono, 2019). This method is used to build an appropriate analysis for determining work scheduling. The types of data used in this study are primary and secondary. Primary data was obtained directly through interviews and questionnaires. Meanwhile, the secondary data in this study was obtained from previous research journal articles and other supporting data related to the company obtained through the internet. In this study, sampling was carried out using the purposive sampling method. This technique was chosen when the researcher wanted to direct the selection of individuals who had characteristics relevant to the study. The sample selected in this study is expected to provide significant information related to the specific topic of the research question. (Turner, 2020). This study conducted interviews and questionnaires with 30 experts in charge of work scheduling: personnel and heads of company parts of PT Maspion. The stages of the research are shown in Figure 2.

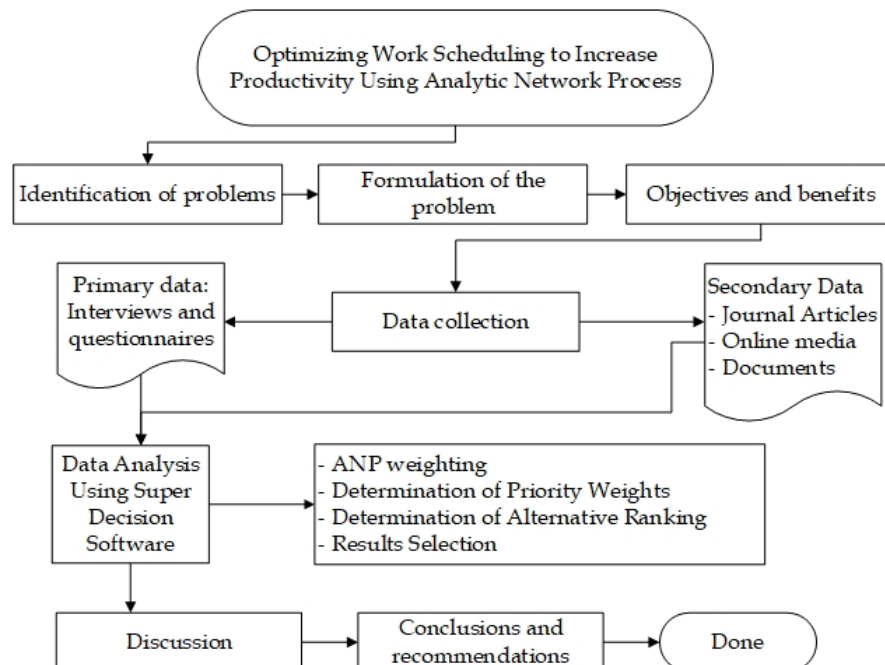


Figure 2. Research Methodology Work Flow

Data analysis in this study uses the Analytic Network Process (ANP). The ANP has been used to assist decision-makers and is identified as a valuable and powerful tool for management because it uses decision-maker input to prioritize logically and consistently (Carlucci, 2010). Many decision dilemmas cannot be

organized hierarchically because they involve the interaction and dependence between elements at different levels. In addition to the importance of criteria for assessing alternatives in the hierarchy, the importance of the alternatives themselves in determining the criteria is also a significant factor (Niemira & Saaty, 2006). Therefore, many professionals rely on decision-making methodologies, such as the ANP, to review which aspects or criteria should be considered in management in order to obtain greater benefits for the company (Rodrigues et al., 2021).

Clear steps and methodologies are needed to optimize work schedules. The first step is to identify decision-makers in the field of work scheduling, namely the head of the section and company personnel. Furthermore, it is to identify the criteria and sub criteria that are taken into consideration in determining work scheduling. The identification process is carried out through the study of previous research literature.

The steps in developing an ANP questionnaire as in Table 1 are 1) To identify relevant elements, such as criteria, sub-criteria, and alternatives in the decision-making process. 2) These elements are then put into a network model, where the relationship between elements can be interdependent or feedback. 3) The ANP questionnaire uses a pairwise comparison method where respondents are asked to compare two elements at a time based on how much influence one element has on the other. 4) Respondents are asked to provide ratings using a numerical scale, usually based on the Saaty scale (1 to 9 scale) (table 1), which represents degrees of preference or influence. 5) The results of the questionnaire are organized in the form of a pairwise comparison matrix. This matrix reflects the respondents' assessment of the elements being compared. Each pairwise comparison assessment is tested using the consistency ratio (CR) calculated from the pairwise comparison matrix. The data processing of the weighting results uses software that can accommodate decision-making models, namely super decisions.

Table 1. Pairwise Comparisons Element priority

Level of Importance	Description
1	Both elements are equally important
3	One element is a little more important than the other
5	One element is more important than the other
7	One element is clearly more important than the other
9	One element is much more important than the other
2,4,6,8	The value between the two closest consideration values

## RESULTS

### *Analytic Network Process Model*

The data processing in this study uses super decisions software. Weighting with the ANP method begins by building a model of the relationship between *clusters* and their elements. The relationship model can be seen in Figure 3.

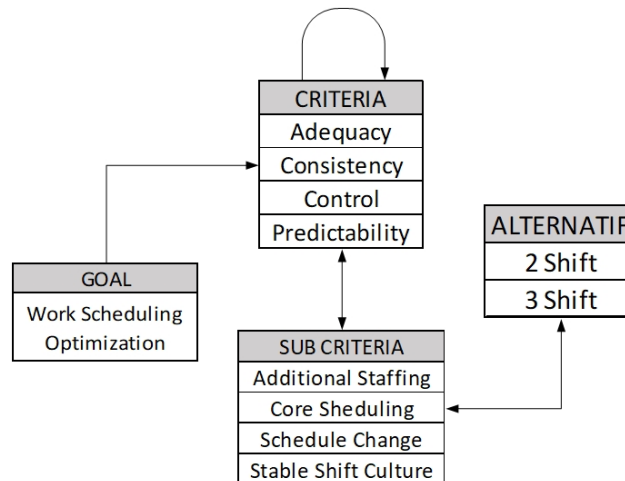


Figure 3. ANP model using Super Decisions software

### Pairwise Comparison

Furthermore, the ANP method is implemented by applying pairwise comparison. The calculation scale used follows the priority scale determined by Saaty, which is 1 – 9 (Niemira & Saaty, 2006). The values entered into the paired comparison were obtained from the results of the geometric mean (geomean) questionnaire of respondents processed using Microsoft Excel software. Geomean calculations need to be done to combine the assessments of each expert (Kurniawan et al., 2021). The inconsistency ratio in this study was 0.0578 or 5.7%. The research data can be considered valid and consistent if it has an inconsistency ratio of less than 0.1 or 10% (Trenngonowati & Kulsum, 2021) (Kurniawan et al., 2021).

### Unweight Supermatrix

In the preparation stage of the unweighted supermatrix, the calculation results show weights that indicate the relationship between the objectives, criteria, and sub-criteria. In general, this stage shows how much the relationship between clusters is affected in the network model. The results can be interpreted that the relationship or interaction between the elements in the destination cluster, criteria, and sub-criteria will result in a maximum weight of 1. However, if there is no linkage between clusters, the weight will be 0. The weight of the weightless supermatrix can be seen in the Table 2.

### Weighted Supermatrix

At the stage of compiling the weighted supermatrix, the calculation results will show the result of the weight obtained by multiplying the result between the unweighted supermatrix value and the weight value of the influence on each cluster. Thus, the comparison of the resulting weight values between the weights of the unweighted supermatrix and the weighted supermatrix values in each cluster did not show a significant difference. The weight value of the preparation of the weighted supermatrix can be seen in Table 3.



Table 2. Unweight Supermatrix

Clusters	Nodes	2 Shift	3 Shift	Work Scheduling Optimization	Adequacy	Consistency	Control	Predictability	Additional Staffing	Core Scheduling	Schedule Change	Stable Shift Culture
ALTER NATIVE	2 Shift	0.00	0.000	0.0000	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50
	3 Shift	0.00	0.000	0.0000	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50
GOAL CRITERIA	Work Scheduling Optimization	0.00	0.000	0.0000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Adequacy	0.00	0.000	0.3333	0.00	0.00	0.00	0.00	0.50	0.00	0.66	0.00
SUBCRITERIA	Consistency	0.00	0.000	0.3333	0.00	1.00	0.00	0.00	0.50	0.66	0.00	0.66
	Control	0.00	0.000	0.1666	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00
	Predictability	0.00	0.000	0.1666	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.33
	Additional Staffing	0.24	0.240	0.0000	0.50	0.33	0.00	0.00	0.00	0.00	0.00	0.00
SUBCRITERIA	Core Scheduling	0.33	0.331	0.0000	0.00	0.33	0.00	0.50	0.00	0.00	0.00	0.00
	Schedule Change	0.18	0.187	0.0000	0.50	0.00	1.00	0.00	0.00	0.00	0.00	0.00
	Stable Shift Culture	0.24	0.240	0.0000	0.00	0.33	0.00	0.50	0.00	0.00	0.00	0.00
	Culture	0.703	0.703	0.00	0.000	0.333	0.000	0.000	0.000	0.000	0.000	0.000

Table 3. Weighted Supermatrix

Clusters	Nodes	2 Shift	3 Shift	Work Scheduling Optimization	Adequacy	Consistency	Control	Predictability	Additional Staffing	Core Scheduling	Schedule Change	Stable Shift Culture
ALTER NATIVE	2 Shift	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.25
	3 Shift	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.25
GOAL CRITERIA	Work Scheduling Optimization	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Adequacy	0.00	0.00	0.333	0.00	0.00	0.00	0.00	0.25	0.00	0.33	0.00
SUBCRITERIA	Consistency	0.00	0.00	0.333	0.00	0.50	0.00	0.00	0.25	0.33	0.00	0.33
	Control	0.00	0.00	0.166	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00
	Predictability	0.00	0.00	0.166	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.16
	Additional Staffing	0.24	0.24	0.000	0.50	0.16	0.00	0.00	0.00	0.00	0.00	0.00
SUBCRITERIA	Core Scheduling	0.33	0.33	0.000	0.00	0.16	0.00	0.50	0.00	0.00	0.00	0.00
	Schedule Change	0.18	0.18	0.000	0.50	0.00	1.00	0.00	0.00	0.00	0.00	0.00
	Stable Shift Culture	0.24	0.24	0.000	0.00	0.16	0.00	0.50	0.00	0.00	0.00	0.00
	Culture	0.703	0.703	0.00	0.000	0.166	0.000	0.000	0.000	0.000	0.000	0.000

*Limit Supermatrix*

Then, at the stage of compiling the supermatrix limit, it is intended to increase the weight of the weighted supermatrix matrix, which in increasing the weight is done by multiplying the result of the supermatrix weight with the result

itself, until the same value is achieved for each column. So, it can be concluded that from these results, the supermatrix limit has been declared stable, and matrix multiplication can be stopped. Furthermore, the weight value of the supermatrix limit can be seen in Table 4.

Table 4. Limit Supermatrix

Clusters	Nodes	2 Shift	3 Shift	Work Sch Optimization	Adequacy	Consistency	Control	Predictability	Additional Staffing	Core Scheduling	Schedule Change	Stable Shift Culture
ALTER	2 Shift	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
NATIVE		1243	1243	1243	1243	1243	1243	1243	1243	1243	1243	1243
	3 Shift	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
		1243	1243	1243	1243	1243	1243	1243	1243	1243	1243	1243
GOAL	Work Scheduling Optimization	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
CRITERIA	Adequacy	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
		8154	8154	8154	8154	8154	8154	8154	8154	8154	8154	8154
	Consistency	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
		0112	0112	0112	0112	0112	0112	0112	0112	0112	0112	0112
	Control	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
		4162	4162	4162	4162	4162	4162	4162	4162	4162	4162	4162
	Predictability	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
		0114	0114	0114	0114	0114	0114	0114	0114	0114	0114	0114
SUBCRITERIA	Additional Staffing	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
		9315	9315	9315	9315	9315	9315	9315	9315	9315	9315	9315
	Core Scheduling	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
		0387	0387	0387	0387	0387	0387	0387	0387	0387	0387	0387
	Schedule Change	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
		4975	4975	4975	4975	4975	4975	4975	4975	4975	4975	4975
	Stable Shift Culture	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
		0295	0295	0295	0295	0295	0295	0295	0295	0295	0295	0295

*Work Schedule Priorities*

This is the last stage of the calculation process, which optimizes work scheduling to increase productivity using the Analytic Network Process. The following are the calculation results of the Unweight supermatrix, Weighted supermatrix, and Limit Supermatrix so that they produce priority in determining work schedules. The priority results can be seen in Table 5.

Table 5. Work scheduling priorities

Name	Normalized By Cluster	Limiting
Optimise work scheduling	0	0
2 Shift	0.5	0.111243
3 Shift	0.5	0.111243
Adequacy	0.17488	0.058154
Consistency	0.66191	0.220112
Control	0.04259	0.014162
Predictability	0.12063	0.040114
Additional staffing	0.26814	0.119315
Core scheduling	0.29302	0.130387
Schedule change	0.19097	0.084975
Stable shift culture	0.24787	0.110295

Based on Table 5 above, it can be seen that of the two alternative options available, both have the same value, 0.5 and 0.25. This shows that 2 and 3-shift

alternatives can increase productivity through optimal work scheduling. This is also applied at Maspion the determination of work shifts is adjusted to the production needs of each division (Dian, 2024). Companies schedule 3 shifts instead of 2 when production demand increases, requiring increased working hours and labour. Meanwhile, 3 shifts are scheduled when production operations are running normally.

### *Consistency*

The results of the final priority value for determining work scheduling to increase productivity can be obtained through the criteria and sub-criteria with the greatest value. From Table 5 above, it can be seen that the greatest value is owned by consistency and followed by core scheduling. This means that work productivity can be achieved through consistent work scheduling and having core employees on each shift. Core employees, in practice, must always be placed in vital parts of production, as they have deeper knowledge and experience of operational tasks and processes so that their presence can ensure increased productivity (Han, 2024). In addition to taking on great responsibility in production operations, psychologically core employees can also motivate other employees to work more productively (Wang et al., 2024). For other employees, Core employees can act as leaders or mentors for new or inexperienced employees, helping them to adapt faster and improve their skills. Proper scheduling of core employees on an ongoing basis can optimize the resources available while minimizing production costs (Dong & Ibrahim, 2020). Another positive impact for the company is the maintenance of work quality, which also impacts product quality.

The next priority that can be achieved through consistent work leadership is additional employees. In this context, additional employees do not mean that the company has to recruit new employees, but are workers who are seconded between divisions (Serov, 2023). From the human resource management perspective, this is a natural thing and is done by many companies. As production demand increases, rather than having to recruit new ones, flexibility in allocating human resources to meet temporary needs is urgently needed to help increase production (Serov, 2023) (Pfeifer & Mohrenweiser, 2023). Through this strategy, companies can save on recruitment and training costs while still being able to increase productivity (Gong et al., 2020). From the employee's point of view, allocating human resources to other divisions can also facilitate workers for the transfer of individual knowledge and skills and in general help the sustainable development of human resources (Matherly & Nahyan, 2015). In addition, employees can experience a new work environment and can reduce boredom in one work environment.

The next priority that can be achieved through consistent work planning is through a stable shift structure. Stable shifts ensure that employees work in a predictable pattern, allowing them to become more proficient and productive at their jobs (Kale, 2024). Then a stable shift helps reduce turnover because employees feel more comfortable and less burdened with unexpected shift changes. A comfortable organisational atmosphere can make employees feel

more at home at work and they tend to be more involved in the organisation's vision and mission, which ultimately increases productivity and performance (Rasool et al., 2021) (Rachman, 2021). The advantage for the company is that for employees who work in the same team consistently, collaboration and communication will be more effective, and it can contribute to higher productivity (Joshua et al., 2020).

### *Adequacy*

The result of the next priority value after consistency is adequacy. Adequacy in the context of work scheduling can be seen from various perspectives. From the company's point of view, adequacy can be interpreted as the adequacy of time and resources allocated to complete the assigned tasks. By ensuring this adequacy, companies can avoid excessive work accumulation through more efficient operational management and avoid delays or non-optimal production (Joshua et al., 2020). When production demand increases, a company often experiences a shortage of employees. This sufficiency of labour can be obtained by proposing additional employees borrowed from other divisions to increase production.

In addition to being viewed from the company's point of view, the adequacy of the workforce can also be seen from the employees' perspective. Assistance to other divisions means the employee will gain additional experience and add value to each individual. A comfortable and healthy new work environment can also make employees work more effectively (Rachman, 2021). Assistance to divisions with high production also means increasing overtime hours which has an impact on increasing employee income drastically. An employee who works expects a high income to meet his and his family's needs. Obtaining sufficient income in terms of income indirectly makes these employees more active in working and increasing productivity (Mahaputra, 2022).

Another perspective of this adequacy can be seen from employees' perspective as human beings. Ideal work scheduling should also consider the balance between the workload and the employee's work capacity to prevent burnout and decreased productivity. Employees, as human beings, must also balance work and personal life. Excessive fatigue due to too hard work can make employees decrease their productivity (Chandrayuni et al., 2023). Therefore, employees also need to obtain their right to take vacation leave and change their work schedule temporarily. The company, as a place where employees work, should also be able to understand the individual needs of employees by not making it difficult for employees to apply for permits or leave. Employees will feel valued and more productive by creating a positive work environment (Han, 2024).

### *Predictability*

Predictability in work scheduling can be interpreted as the company's ability to observe the trend of production demand spikes at a certain time. Predictable work planning results in certainty regarding work shifts, working hours, and other resource planning (Chandrayuni et al., 2023). Suppose a surge

in production demand is predictable and core employees are perceived to be insufficient to meet production capacity. In that case, the company can plan to apply for additional employee loans to other divisions. Additionally, additional employees can serve as backups to replace core employees who may be absent due to illness, leave, or other reasons, ensuring that operations continue to run smoothly (Omar et al., 2022). With predictable scheduling and additional employees, production workloads can be distributed more evenly to increase efficiency and productivity.

Predictability in work scheduling also has a positive effect, namely creating stable shifts. If there is a surge in production demand, but the company has predicted it, then planning for scheduling shifts and working hours is no longer a problem. Stable shifts can allow employees to develop their skills consistently and become more competent at work (Kale, 2024).

### *Control*

Control in work scheduling means regular monitoring of employee work schedules, including ensuring that employee work schedules are following the needs of the company and the needs of employees as individuals. As an employer, the company has the full right to regulate employee working hours and conduct periodic evaluations. The goal is for employees to be disciplined and respect the working hours given to them. From an employee's point of view, control means they have the right to strike a balance between work and the individual. The dimension of employee productivity can be obtained from the work-life balance (Bhende et al., 2020) (Alikor & Anele, 2022). For example, when production demand increases and employees have fulfilled their obligations to the company, they are allowed to take permits or leave if they wish. This can reduce excessive work stress and make employees feel more appreciated.

Work scheduling is indeed suitable for use in the manufacturing industry because the industry uses a lot of labor. However, it is possible that work scheduling can also be applied to other fields such as services industry. In the field of services, for example, the service industry also experiences non-stationary demand, which necessitates adjustments in staffing as demand changes. Efficient workforce scheduling is critical for meeting fluctuating customer demand, maximizing profitability, and adhering to legal and organizational constraints. The combination of long-term scheduling and real-time scheduling models ensures better alignment between staff availability and actual customer demand, leading to greater efficiency and profitability (Amirthalingam & Høstmælingen, 2024). Another sector that implements work scheduling is the aviation sector. Effective employee scheduling is key in managing the workforce in the aviation sector, especially in ensuring operational efficiency, employee satisfaction, and passenger experience. Airport operators often face challenges in balancing the operational needs of airports 24/7 with employee well-being and satisfaction. The aviation sector can adopt a more flexible and employee-centric scheduling system, which not only takes into account operational needs but also employee well-being. These adjustments can

help improve job satisfaction and productivity, as well as improve the passenger experience at the airport (Heimo, 2024).

## FURTHER STUDY

Based on the research process that has been carried out, there are limitations experienced and can be a concern for further research. The limitation of this study is that the location of the research is only carried out on companies engaged in the manufacturing industry, so the results of this study do not generalise the results of the research in general. Then the next limitation is the use of work scheduling dimensions that are limited to those offered by this study, while there are still many work scheduling dimensions/variables that can be used. The discussion in this study only looks at employee welfare from the financial side but ignores the other side of employees who have to work to achieve the productivity that the company wants.

The results show that producibility can be achieved by consistent, predictable work scheduling, adequacy between the company and employees, and control over scheduling. The suggestions put forward in this study are that although production demand often occurs unstable, through consistent and predictable work scheduling, companies can still produce high productivity. The suggestion for the next research is that it is necessary to look at other variables that can be used to increase productivity through work scheduling in addition to the variables used in this study. In addition, research that discusses work scheduling to increase productivity needs to be carried out on companies engaged in the service sector to be compared in this study. Future research can also use similar methods to be used in human resource systems, namely employee recruitment, training, and development decisions by considering skills, performance, and future company needs. Further research also needs to look at employee welfare from other sides, such as worker health, work mentality, workers as a family, and so on.

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