A Ranking

by Iwan Iwan

Ranking of the Support Criteria Employees' Productivity Improvement When Working from Home

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Abstract

Covid-19 has affected the world, and its impact is not limited to medical and health aspects. It has also affected social, educational, business, economic, and work environments. The spread of the virus has forced most companies to implement work-from-home (WFH) policies to reduce the mobility of employees and curb the virus's spread, despite potential adverse effects on employees' productivity and performance. This research aims to rank the criteria for improving employees' productivity during WFH using the Fuzzy-Analytical Hierarchy Process (AHP) method. Four criteria and eight sub-criteria were identified to promote employees' productivity. The four main criteria are Income, Work Schedule, Work Environment, and Work Partner. Data processing results show that these criteria rank from top to bottom as follows: Work Schedule, Work Environment, Work Partner, and Income. We hope that the rankings observed in this research will help managers set policies to increase their employees' productivity when working from home.

Keywords: productivity, working from home, and fuzzy-AHP

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Ranking of the Support Criteria for Employees' Productivity Improvement When Working from Home

The Covid-19 virus originated in Wuhan, China, and has now spread to every corner of the globe. The pandemic primarily affects the world's health and medicinal systems, and consequently weakens other aspects such as business, economics, society, and the working environment. An observable and significant change in the working environment is the concept of working from home (WFH). A key aspect to maintain in this WFH system is productivity.

The productivity of an employee or worker has a broad range of definitions but includes the means of an individual's efficiency and is an essential factor in the systems of organizations or societies (Ma & Ye, 2019). Evaluating employee performance is expected to contribute to the improvement of a company's productivity and ultimately enhance its competitiveness against other companies that do not pay attention to their human resources.

During this pandemic situation, most employees are obligated to work remotely from their own homes. However, this policy may result in employees' underperformance due to various technical or behavioral factors. One factor that can represent employees' productivity is their attendance or absence, which is often used as a measure of productivity (Ma & Ye, 2019).

The purpose of this work is to rank various criteria that support the improvement of employees' WFH performance and productivity using the standalone Analytical Hierarchy Process (AHP) method, which tends to be subjective. The implementation of the Triangular Fuzzy Number (TFN) approach in AHP method complements the decision-making process mathematically, which is called Fuzzy-AHP.

Literature Review

During this pandemic, companies are striving to compete with each other to survive the situation and are taking any chance to maximize their profits. Their efforts aim to secure the health of their financial structures. Productivity is used to define the quantifiable utility of an activity in the context of maximizing a company's financial gain (Mittal et al., 2017).

An employee is a component of the company's human resources and is a primary input in the whole production system. Employees are the most essential determinant of the growth of a company or institution. Forming a decent group of human resources requires a proper selection process according to the desired characteristics in a particular department. Florez and Cortissoz (2017) mentioned that one strategy to improve the productivity of an institution is to group the workforce in a certain way.

Having a group of qualified members assures an increase in the company's profits. A proper selection and qualification process produces a group of employees with higher education levels who can provide suggestions or input to their superiors, despite there still being errors (Call et al., 2017). They can better identify and solve problems than a group of employees with minimal education (Call et al., 2017).

In this context, the employee is regarded as a productive human resource asset instead of a burden held by the company. Moussa and Arbi (2020) defined the values of qualified employees as: having adequate knowledge and skills, being creative, and maintaining good health. They added that in order to improve employees' productivity, the employees have to possess substantial working skills and a positive psychological mindset concerning their lifestyle, motivation, and cognitive skills. Thus, the employee is the main key to achieving a successful and productive company or institution. Every company strives to ensure that its employees hold

a purpose in their work-life balance and that its employees' performance reflects a sense of purpose, satisfaction, and happiness, for a contented employee is more likely to perform well and be more productive than the opposite (Adhikari et al., 2017).

Adhikari et al. (2017) remarked that a work environment conducive to a comfortable atmosphere produces advantages for the company to grow its value, productivity, and profitability. Burdin and Perotin (2019) argued that from the employee's perspective, flexible work scheduling that allows the employee to vary their working time according to their personal needs may induce better work-life balance, comfort, and contentment. Collewet and Sauermann (2017) expressed that alternating work schedules or work shifts enables the company to assess variations to measure the influence of an employee's work schedule on their productivity.

AHP is a reliable method to analyze the options when making decisions with multi-criteria (Lin & Kou, 2020). The AHP method helps break down the decision problem into a hierarchy involving multiple criteria and sub-criteria, hence describing the priority and level of importance of the issue. The AHP is often used for its flexibility, systematic approach, and straightforward hierarchy presentation (Hu et al., 2021). Its advantage also lies in its fair analysis, flexibility in regard to integration with varying evaluation factors, and logical classification system. The method has been further advanced, and Lyu et al. (2020) declared fuzzy logic as one prevalent method to deal with unclear and uncertain issues in the AHP method, which incorporates fuzzy logic into its framework.

Fuzzy logic was first introduced by Professor Zadeh (Zadeh, 1965) to explain a vague real-life phenomenon mathematically (Li et al., 2019). Fuzzy logic describes a free-range structure and estimation model with an approach of a function modified by the association of linguistic input and/or output. The application of fuzzy logic facilitates the processing of a

system with difficulties in the modeling, vagueness in the information, or too much human control. Ly et al. (2018) are convinced that applying fuzzy logic in the analysis achieves better accuracy and accordance to the data and theory than conventional methods do.

Research method progress has brought about the integration of the AHP method and fuzzy logic to minimize the uncertainty in the employment of the AHP method alone. Bologa et al. (2018) exhibited a model to rank criteria by using the AHP method based on the scaling benchmark as the inferences from the fuzzy logic method, then this method was associatively performed great in a fuzzy system presented in it. The integration of the AHP method and fuzzy logic allows better efficiency in determining a priority. It is especially reliable in the case of multiple and varying information or inputs to consider in decision-making (Tyagi et al., 2017). Fuzzy logic completes the standalone AHP method, which tends to be subjective. The implementation of the TFN approach complements the decision-making process mathematically.

Methods

Based on the research objective, this is exploratory research aimed at extracting all the information necessary to define the problem's basis. In application, , that we using this method to achieve where the output will be implemented to solve the existing problem (Kuntjojo, 2009). This work follows a cross-sectional research design, collecting data at a single period and observing the variables in a particular time frame for a short duration. In terms of data collection techniques, we measured the research problem quantitatively and converted the data into mathematical and statistical measures for analysis.

Figure 1 displays the workflow of the entire process. Initially, we formulated the research topic, problem background, problem identification, and problem definition. Next, we studied human resource productivity through a literature review and journal reading. Then, we

determined the method to answer the research problem, and we proposed the Fuzzy-AHP

method. We collected data about the criteria affecting work productivity through interviews with

stakeholders and a questionnaire survey. The data was processed using MS Excel to rank the

criteria affecting work productivity, and it was then analyzed further. Finally, we provided

conclusions and recommendations based on the analysis.

Figure 1

Research Flowchart
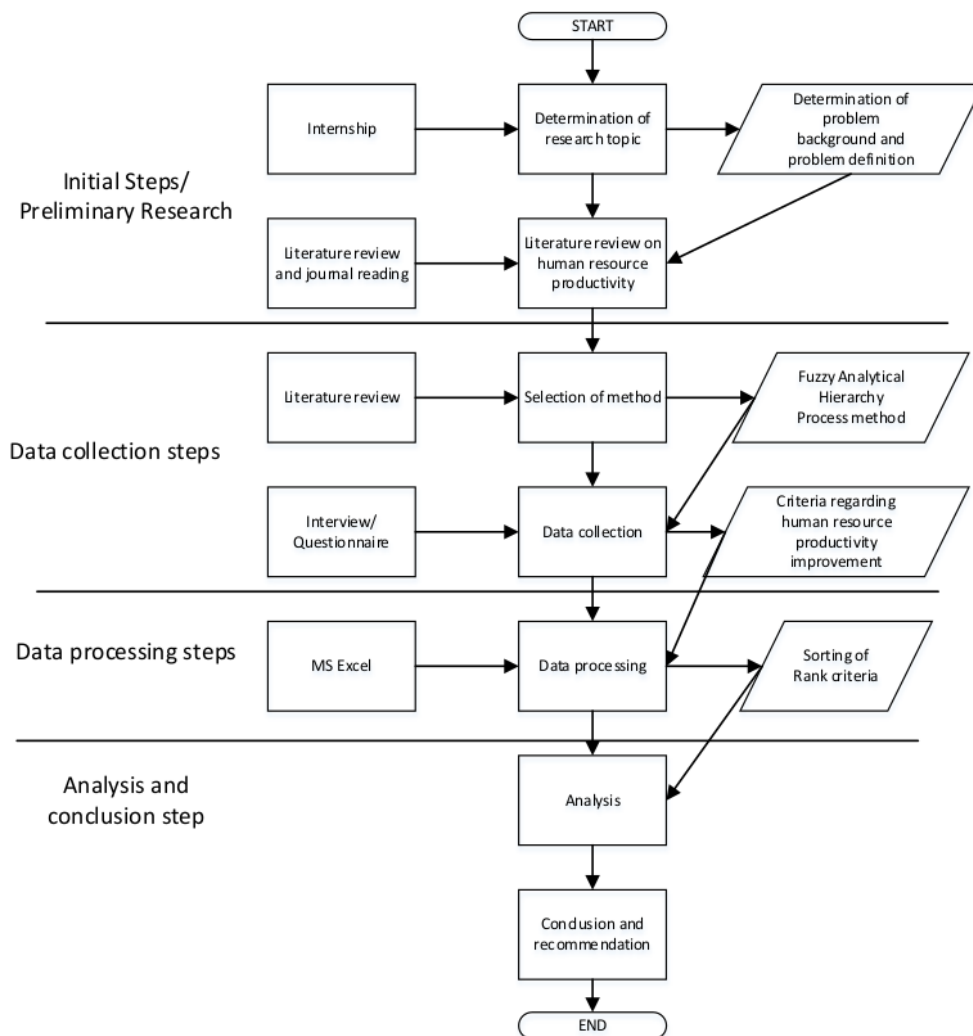
Participants/Sample

The data were obtained through interviews with participants at three levels of workers: top, middle, and low from Company X. The objective of this research is to contribute to the decision-making process of the company's management by considering the criteria affecting employee productivity and improving it.

Data Collection

Initially, we conducted interviews with the Human Resource Department (HRD) personnel of Company X to identify the key performance index (KPI) of the company. This revealed three values: (1) the KPI, which describes the relationship between each department and its subordinates; (2) competency, which describes the value of an employee's soft skills; and (3) the leadership value possessed by personnel. We collected data on the issues in each department by conducting literature reviews, interviews, and questionnaires, after extracting information on support criteria from experts. We designed the questionnaire based on the gathered information and spread it to the experts, or heads, of the respective departments. The details of the AHP questionnaire steps are as follows:

1. The questionnaire consisted of an evaluation of the criteria that can improve Company X employees' productivity, according to the results of interviews with experts in Company X.

2. The questionnaire was distributed to the three groups of participants in this study to obtain the best and most accurate results.

3. The leader or head of the department was instructed to answer the questionnaire regarding the criteria according to five priority scales such as : Extremely important, Very strongly important, Strongly important, Moderate important, Equally important)

using the Fuzzy-AHP method. Each answer would be marked to access the information later.

Data Analysis

Based on the questionnaire answers, we identified four criteria for this case such as: Income (I), Work Schedule (WS), Work Environment (WE), and Work Partner (WP). Eight sub-criteria were also identified, including Fund Support/Aid (FS), Compensation (C), Flexible (F), Variations (V), Work Facilities (WF), Comfort (Com), Mutual Supportive (MS), and Trustworthy (T), as shown in Figure 2.

Figure 2

Goal, Criteria, and Sub-Criteria
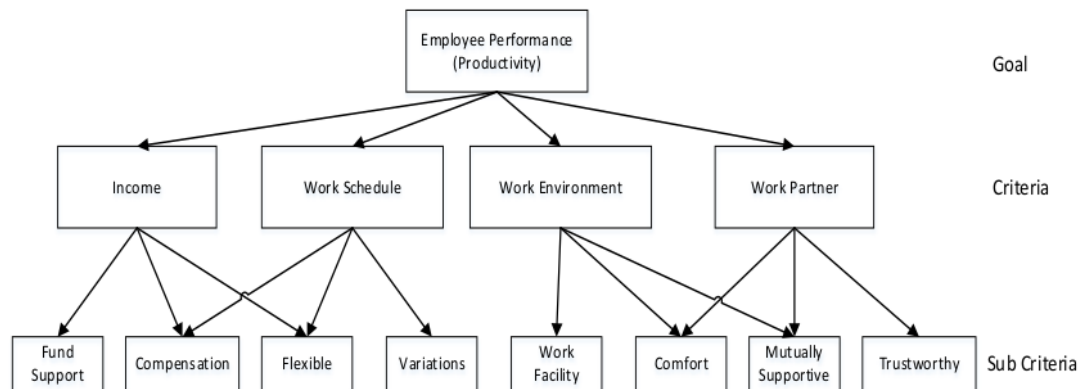
The results obtained from the questionnaire were compared with each other and arranged into a pairwise comparison matrix based on TFN for scaling. The TFN settings are shown in Table 1.

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Table 1

Triangular Fuzzy Number

Scale of Interest	Fuzzy Number	Linguistic Variable	Membership Function
1	1	Equally important	(1,1,1)
3	3	Moderate important	(2,3,4)
5	5	Strongly important	(4,5,6)
7	7	Very strongly important	(6,7,8)
9	9	Extremely important	(9,9,9)

Note. Source: Buckley (1985)

After obtaining the fuzzy numbers, the defuzzification process was initiated to generate quantifiable results from the fuzzy numbers and obtain crisp output values. This research followed the centroid method to convert fuzzy numbers. We calculated the eigenvalues of the crisp values to determine the weight/scale of the criteria. Additionally, the values were tested for consistency to examine the reliability of the obtained data. Inconsistency would indicate the need to collect data again to achieve consistent results.

Results and Discussion

The information obtained from the proper respondents was presented as a pairwise comparison matrix. The results are displayed in Tables 2, 3, and 4.

Table 2

Criteria Assessment of Respondent 1

Respondent 1	Income			Work Schedule			Work Environment			Work Partner		
I	1	1	1	1/6	1/5	1/4	1/4	1/3	1/2	1/6	1/5	1/4
WS	4	5	6	1	1	1	2	3	4	1	1	1
WE	2	3	4	1/4	1/3	1/2	1	1	1	1	1	1
WP	4	5	6	1	1	1	1	1	1	1	1	1

Table 3

Criteria Assessment of Respondent 2

Respondent 2	Income			Work Schedule			Work Environment			Work Partner		
I	1	1	1	1/4	1/3	1/2	1/8	1/7	1/6	1/6	1/5	1/4
WS	2	3	4	1	1	1	1	1	1	1/4	1/3	1/2
WE	6	7	8	1	1	1	1	1	1	1	1	1
WP	4	5	6	2	3	4	1	1	1	1	1	1

Table 4

Criteria Assessment of Respondent 3

Respondent 3	Income			Work Schedule			Work Environtment			Work Partner		
I	1	1	1	1/6	1/5	1/4	1/4	1/3	1/2	1/6	1/5	1/4
WS	2	3	4	1	1	1	2	3	4	1	1	1
WE	1	1	1	1/4	1/3	1/2	1	1	1	1	1	1
WP	1/6	1/5	1/4	1/8	1/7	1/6	1/4	1/3	1/2	1	1	1

After obtaining the fuzzy values for the three respondents, then we proceeded with the calculation of defuzzification, or of changing the fuzzy value to a crisp value. In the defuzzification step we used the centroid method, using this formula:

$$\frac{1+4*1+1}{6}$$

An example of a defuzzification table from respondent 1 sub-criterion P is shown in Table 5.

Table 5

Example of the Results of Defuzzification of Respondent 1 Sub-Criterion P

I	FS	C	F
FS	1	5	3
C	0.20	1	1
F	0.35	1	1
Total	1.55	7	5

Next, the final calculation using the Fuzzy-AHP method concluded the rank of the support criteria affecting productivity from the largest weight to the smallesty weight: Work Schedule (0.39), Work Environment (0.28), Work Partner (0.22), and Income (0.11).

According to the results, Work Schedule was the most important factor that should be followed by every employee. The work schedule is established by the company according to its capability with the purpose of achieving the expected output. In this work, we compiled three sub-criteria to augment the Work Schedule criteria. Our analysis concludes that the weight of the three sub-criteria from highest to lowest was as follows: Flexibility (0.44), Compensation (0.39), and Variations (0.19). Flexibility ranks highest considering WFH policies and the prevalence of technology (internet connection, Wi-Fi, video conference) allows remote group work. Flexibility in the work schedule reduces some work stress and pressure for the employees and grants them more comfort to finish their work according to their work target. Compensation can serve as an incentive for employees to increase their productivity, such as through financial rewards for overtime work.

The second-ranked criterion was Work Environment, which considers the situation and facilities in the workplace that can improve the mood and comfort of an employee. A good setting is expected to promote the employee's productivity in positive ways. Three sub-criteria supporting the Work Environment are Work Facility (0.37), Mutually Supportive (0.35), and Comfort (0.28). Remote work requires proper technological accomodations, such as Wi-Fi, modems, routers, laptops, PCs, related software, and licenses.

Work Partner was ranked third in productivity improvement criteria, considering the ease of establishing connections with desired coworkers during isolated work conditions, compared to the normal situation where employees may be separated by work department, workplace, or

simply by time or attendance. The sub-criteria in this element are Comfort (0.61), Mutually Supportive (0.20), and Trustworthy (0.19). Establishing a comfortable connection with a work partner enables cooperation and improves the contributions of both employees in their work; thus, it helps to promote better total productivity despite employees working in separate places.

Income was the least important factor regarding productivity improvement. This may be used as another option when employees achieve their target and perform well. It can be evaluated by assessing the Work Schedule and Work Partner factors. The rank of Income sub-criteria was Fund Support/Aid (0.66), Compensation (0.18), and Flexibility (0.17). The following is the scaling of criteria and sub-criteria according to the Fuzzy-AHP method, as shown in Table 6.

Table 6

Results of Fuzzy-AHP Method

Rank	Criteria	Sub-Criteria	Weight	Rank
1	Work schedule (0.4)	Flexibility	0.44	1
		Compensation	0.39	2
		Variations	0.19	3
2	Work environment (0.27)	Work Facility	0.37	1
		Mutually Supportive	0.35	2
		Comfort	0.28	3
3	Work partner (0.22)	Comfort	0.61	1
		Mutually Supportive	0.2	2
		Trustworthy	0.19	3
4	Income (0.11)	Fund support	0.66	1
		Compensation	0.18	2
		Flexibility	0.17	3

Conclusion

Our study utilized the Fuzzy-AHP method to analyze multiple factors affecting employees' productivity improvement in Company X. Our findings suggest that the Work Schedule criterion holds the most significant weight (0.39) in improving employee productivity

during the WFH situation, followed by the Work Environment (0.28), Work Partner (0.22), and Income (0.11) criteria.

A flexible work schedule allows for appropriate work hours during WFH, while providing amenities such as laptops and internet connection contributes to a better work environment and employee comfort. Establishing a positive connection with the right work partner also promotes better comfort for employees. As for the Income factor, allocating fund support/aid can encourage employees to perform better and be more productive. In summary, our research indicates that improving the Work Schedule, Work Environment, and Work Partner criteria can effectively enhance employee productivity in Company X during the WFH situation.

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