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Determination of Activity Relationship Chart (ARC) Method in Office Layout Evaluation: A Case Study at XYZ Bandung Apartment

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ABSTRACT

XYZ Apartment Bandung has 12 departments located from the lobby floor to the fourth basement floor. The apartment has an office layout that is not yet optimally arranged, such as the placement of departments that are far apart, ineffective handling of goods, and the risk of work accidents. The purpose of this study is to improve the existing layout so that the comparison results can be seen between before and after the improvement. A survey of 56 employees and managers was conducted to gather data on department relationships. The ARC (Activity Relationship Chart) method was employed to analyze these relationships and inform layout optimization. Based on the results of the analysis, there was a change in department placement that resulted in an efficiency of travel distance of 64.3% and time efficiency of 64.4%. The findings emphasize the importance of optimizing workspace layout to enhance operational efficiency and employee satisfaction. Implementing the proposed layout changes can lead to cost savings, increased productivity, and improved employee well-being within XYZ Bandung Apartment.

Keywords: ARC Method; Facility Layout; Layout Efficiency; Layout Evaluation; Office Layout

JEL: L23

INTRODUCTION

One of the operational strategies that every company must have to increase competitiveness and achieve company goals is maintaining good facilities. A crucial factor to consider is the work environment, which is manifested in the office layout, as it affects the effectiveness of employee work. Layout refers to the arrangement of business processes and resources to optimize efficiency and effectiveness. An effective layout helps streamline workflows, saving time and enhancing the smoothness of production processes. By strategically positioning different parts of a business, a well-designed layout can contribute to long-term investments and operational efficiency. Additionally, the layout serves as a foundation for future business strategies, influencing how effectively an organization can adapt and grow over time.

XYZ Bandung Apartment, a service company in the hotel and apartment sector, faces issues with its office layout, which has not been arranged properly and optimally. Specifically, the placement of several departments with close relationships and the use of unused space need improvement. For instance, the Sales and Marketing department and the Accounting department are far apart, even though they frequently coordinate on tasks such as transaction reports, sales call activities, and invoices. An inefficient layout can also pose a risk of work accidents for workers. Currently, most offices are located on the basement floor, which is connected to the parking lot. This area is not only a parking lot but also a space where vehicles frequently enter and exit, causing disturbances and air pollution. Additionally, it serves as a logistics transportation hub for items like gas cylinders and food supplies for hotel kitchens. This condition highlights common problems in office layout planning, such as functional requirements or proximity between departments within the company (Dorrah & Marzouk, 2021).

Another study also shows that the dynamic behavior of occupants, which occurs due to the distance between departments, affects energy consumption and results in fatigue (Sonta et al., 2021). This was evident at XYZ Apartment in Bandung, where workers transported gas by hand via the emergency stairs from the warehouse on the first basement floor to the kitchen on the lobby floor. This inefficient process caused company activities to be ineffective due to the back-and-forth movement that occurred daily.

Many factors must be considered in the preparation of the layout, including travel distance, processing time, lighting, disturbances, and more. The office layout significantly impacts the comfort of people at work, affecting health, productivity, and psychology. Therefore, ergonomic considerations are very important (Eraslan et al., 2020). Initially, handling the layout focused more on minimizing material handling costs. This concept, developed in the traditional layout evaluation process, did not consider the time aspect (Azadivar & Wang, 2000).

A well-designed office layout not only influences the physical environment but also significantly affects organizational culture. Such a layout fosters a positive organizational culture by promoting effective communication and teamwork (Zerella et al., 2017). Arya and Clauhan (2013) demonstrated that analyzing and evaluating office layouts can increase productivity and work comfort.

A good layout arrangement impacts job satisfaction, productivity, and reduces work fatigue. The ARC method shows how a well-designed layout can increase productivity, reduce work accidents, boost work motivation, and improve company culture. Numerous studies indicate that work productivity is not solely influenced by screen arrangement but also by variables such as work motivation (Qing et al., 2020), organizational culture (Kaligis et al., 2023), and work motivation (Sulila, 2019).

This study aims to improve the existing office layout using the ARC tool, resulting in a layout that reduces travel distance and process flow time. The novelty of this study lies in its focus on office layout improvement, which has traditionally been more prevalent in manufacturing, where the emphasis is on the movement of raw materials. This research, however, focuses on the flow of people and information within an office setting.

LITERATURE REVIEW

Layout Concept

According to Wulansari and Yohanes (2010), the layout is the optimal arrangement of facilities, including the utilization of existing areas to facilitate the production process. A good layout supports the production process by saving time, reducing delays, minimizing the spread of goods, and improving efficiency between departments or sections. Additionally, a well-designed layout enhances job satisfaction, health, and safety. Kovács and Kot (2017) found that a good layout significantly impacts production cost efficiency, reduces waiting time, and increases productivity. Beyond these benefits, layout positively affects communication patterns and company culture (De Croon et al., 2005).

Furthermore, Ojaghi et al. (2015) emphasize that layout analysis needs to be conducted before establishing a factory to achieve company efficiency and reduce the risk of high production costs. They also note the importance of evaluating the layout while the factory is operational. Apple (2016) describes layout as a facility for analyzing and designing a system for producing goods and services, focusing on the arrangement of physical elements within an environment. Apple states that layout is a planning process that integrates all activities in industry, both services and manufacturing, including relationships between departments, material flow, placement of machines, and other facilities, to achieve cost efficiency and time effectiveness.

Kovács (2020) states that layout optimization can be achieved by minimizing the flow of work materials, reducing the distance between departments, and standardizing work ergonomics. Jacobs and Chase (2015) emphasize that layout involves the strategic placement of workstations or departments to facilitate the flow of people and materials. According to Haming (2022), the goal of layout planning is to produce the most optimal production facility layout, thereby facilitating employee performance and production processes. Layouts are prevalent in various activities, both business and non-business, including offices, factories, warehouses, retail sales, hospitals, schools, and more. This study focuses on office layouts, where the interactions analyzed are related to the tasks and functions of each section. Naqvi et al. (2016) found that good office layout planning significantly impacts employee productivity.

The COVID-19 pandemic has forced employees to work from home, leading to challenges in collaboration, communication, and work delegation. As the spread of the virus decreases, the office becomes a place where employees interact for an average of eight hours per day. This condition necessitates a system that allows employees to interact both formally and informally. Spaces that facilitate the transfer of knowledge, ideas, and creativity are essential. Several studies show that professional workers derive 80% of their ideas from informal interactions in the workplace (Allen & Henn, 2007). Office layout impacts productivity when there is an interaction between office occupant patterns and the main components of the layout, especially when there is a balance between private and shared spaces (Haynes, 2008).

There are many factors to consider when designing a layout. Firstly, the type of product being processed, whether it is a liquid or solid product, the quality level related to the product's resistance to weather, and the amount of inventory for raw materials and final products must be considered. Secondly, the type of production process is important, including production capacity, use of technology, interaction between departments, stages of the production process, and the material handling system used. Lastly, ergonomic considerations are crucial, taking into account human limitations in the production process, such as body resistance, movement space, fatigue, boredom, and protection from accidents and occupational health.

Pitchforth et al. (2020) produced a study dividing office layouts into four types: team-based layouts, open layouts, open-zoned layouts, and activity-based layouts. Their findings show that team-based and open-zoned layouts have a more positive impact on productivity compared to activity-based and open layouts. The open plan design often leads to noise, while the activity-based design provides limited space for employees. In general, the characteristics of a layout that will provide comfort and freedom in the process of interaction and collaboration include adequate space capacity, good air circulation, minimal turns that result in shorter interaction processes, and aesthetically pleasing storage of office equipment. Haynes (2008) stated that a good layout will contribute to employee happiness and welfare. However, an open work environment, where the layout is not limited by walls and several employees share the same area, can reduce concentration at work (Sander, 2018).

The company layout is intrinsically linked to its ability to build a positive image by providing a comfortable and secure environment, streamlining process flows, minimizing unnecessary movement, saving time, and boosting productivity. Conceptually, layout involves the strategic arrangement of equipment to optimize space utilization while considering process flow, departmental proximity, and land availability. A well-designed layout enhances security and efficiency and incorporates human ergonomic elements, as noted by Heizer and Render (2015). The primary goals of an effective layout include minimizing the time and cost associated with handling materials or moving personnel, and ensuring ample space for human movement around equipment like machines, work desks, filing cabinets, and stairs, thereby allowing for comfortable working conditions. Additionally, a good layout aims to improve employee safety and health, optimize the use of office equipment and facilities, and enhance cooperation between departments by maximizing space utilization.

Meanwhile, another study conducted by Javanroodi et al. (2019) and Muzaffar et al. (2020) showed that a lack of concentration at work impacts emotional behavior and drains cognitive power. However, closed layouts can negatively affect social interaction, leading to communication between departments being limited to email or chat. Good layout planning is proven to enhance collaboration and interaction between departments, reducing the travel distance within the office (Vaidya et al., 2013).

To achieve efficiency and effectiveness in layout design, several principles outlined by Thomas et al. (2014) must be considered. The principle of overall integration emphasizes the need for the layout to integrate the workforce, job descriptions, material types, equipment, and information flow cohesively. The principle of minimum distance Movement focuses on reducing the distance people, raw materials, finished goods, and information must travel, thereby minimizing unnecessary movement and enhancing the use of office facilities. The principle of workflow prioritizes speed and smoothness, aiming to reduce turns and stops in the flow of work within both offices and factories. The principle of maximum space utilization insists on optimizing available space to ensure no area, whether vertical or horizontal, is left unused. The principle of satisfaction and safety

underscores the importance of designing layouts that consider human comfort and work safety, as offices and factories are environments where people work or process materials. Finally, the principle of flexibility highlights the need for the layout to be adaptable to changes, allowing for room expansions or reductions as necessary.

Heizer and Render (2015) discussed the concept of office layout, emphasizing how offices should be grouped based on tasks and arranged according to the flow of information to provide comfort and convenience in the collaborative process, thereby achieving organizational goals. Hadiatna (2018) highlighted the importance of art and comfort in office layout, while Mariam and Narasis (2014) pointed out that the purpose of structuring office layouts is not only to facilitate work but also to create a sense of comfort and security for employees, make a positive impression on guests, and prevent inefficiency in personnel and employee working time. The objectives of office layout, according to Hadiatna (2018), include minimizing mileage in carrying out work activities, ensuring smooth administrative activities, achieving worker satisfaction and health, maximizing employee supervision, making optimal use of space, giving the company a good reputation, providing flexible office space, facilitating the flow of information at various levels of the company's hierarchy, avoiding distractions for workers such as noise, creating a comfortable environment and increasing worker satisfaction, managing the use of equipment and machines effectively and efficiently, and creating a spacious work area for future needs.

According to Heizer and Render (2015), there are several types of layouts designed to optimize different work environments. An office layout is arranged to facilitate the efficient flow of information, considering job descriptions, work facilities, and available space. A retail layout is designed to organize store displays so that consumers can easily view the entire selection, enhancing comfort and encouraging more shopping. A warehouse layout focuses on organizing goods to ensure the "First in, First out" concept is easily implemented and maintains work safety. A fixed position layout is used in project activities like constructing bridges, buildings, and roads, where the product remains stationary, and workers and equipment move around it. A process layout arranges factory equipment or machines based on similar functions, ideal for factories with high product variance but low production quantities. Lastly, a product layout arranges machines according to the production process flow, suited for factories with high production capacity and low product variance.

The role of office space arrangement must be made effective because a proper arrangement can facilitate a quick and precise workflow, resulting in smoother communication channels. Additionally, it makes supervision and coordination easier. All of this leads to increased work productivity due to the comfort experienced by office employees (Hapsari et al., 2017). Furthermore, Haynes (2008) states that a good office layout supports the pattern of relationships between employees, thereby increasing productivity. For offices requiring high work concentration and tranquility, a closed office layout is preferable (Reddy, 2013). A closed layout, where employees work in areas with wall partitions, positively affects productivity and concentration but may also cause boredom and a lack of human interaction (Naqvi et al., 2016). Good layout planning has been proven to reduce mileage and inventory (Shah & Joshi, 2013).

Activity Relationship Chart (ARC)

The concept of the Activity Relationship Chart (ARC) focuses on the closeness of relationships between departments by considering both the frequency of interactions and their level of importance (Durmusoglu, 2018; Dweiri, 1999). ARC is a powerful tool for analyzing departmental closeness by exploring preferences within business processes (Gölcük et al., 2022).

The ARC is used to analyze the proximity between departments by evaluating how often relationships occur and how crucial these relationships are. These relationships can involve material transfers, information flows, or human interactions. In ARC, these relationships must be adjusted—either brought closer together or moved farther apart—during the layout planning process to ensure the smooth operation of the organization (Jamalludin & Ramadhan, 2020).

In this study, to assess the level of importance of inter-departmental relationships, field analysis is conducted through observations and interviews. Muther in Apple (2016) and Prayogo & Zusi (2020) provide a code to evaluate the degree of closeness between departments, which helps determine which activities should be located together. The code for the activity is as follows: (A) Absolute Necessary, (E) Especially Important, (I) Important, (O) Ordinary, (U) Unimportant, and (X) Undesirable.

Table 1. Proximity Color Symbol in ARC

Color Symbol	Meaning	Code
	Absolute necessary	A
	Especially important	E
	Important	I
	Ordinary	O
	Unimportant	U
	Undesirable	X

Source: Apple (2016)

In general, Table 1 can be explained as follows. If a relationship is absolute or must be close, it is marked with a red symbol. For example, the secretary of the board of directors has a very high frequency of activity with the board of directors, so it is given a red color code. Another example is the machine maintenance section's relationship with the operations section in industrial manufacturing.

The blue color symbolizes a close relationship that is very important. For example, this includes the relationship between the president director, finance director, human resources director, and marketing director. Another example is the relationship between the restaurant section and the kitchen.

The green color code represents an important relationship in activities that are not too frequent but are not classified as rare. For instance, this includes the relationship between the sales section and the tax section, or the Human Resource (HR) section and the finance section.

The yellow color signifies a normal relationship or one that is not too frequent. For example, this includes the relationship between the warehouse section and the accounting section, which may not occur often but is necessary for managing inventory for financial reports.

The white color symbolizes an unimportant relationship. For example, this includes the relationship between the kitchen section and sales, or between the form office section and engineering.

Finally, the brown color signifies an undesirable relationship, indicating that there is no direct working relationship. For instance, this includes the relationship between the engineering section and the sales and marketing section.

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Activity Relationship Diagram (ARD)

ARC is used to analyze the level of relationship between departments, while ARD (Activity Relationship Diagram) is a technique to see the use of space between one department and another. ARD is performed after ARC is completed (Tompkins et al., 2016).

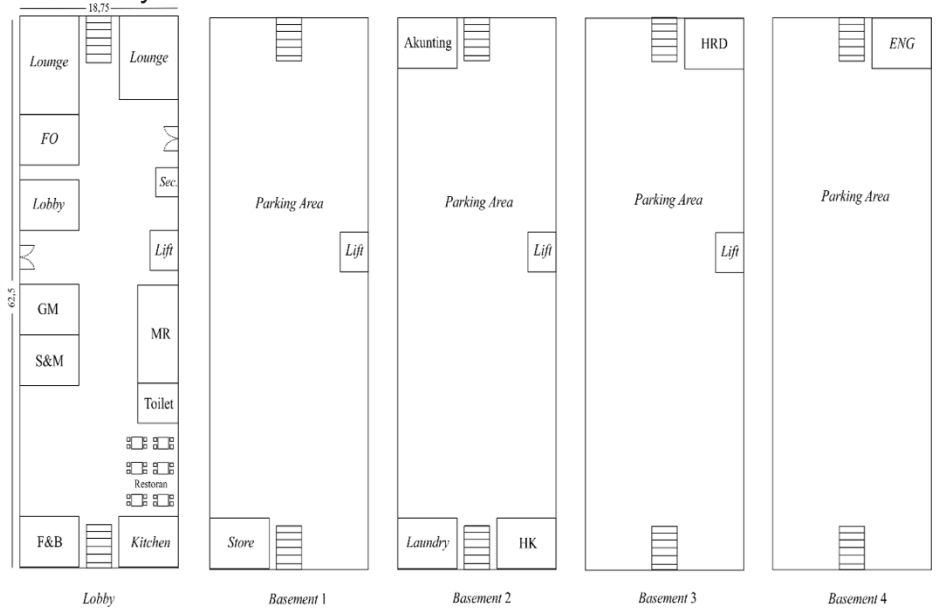
RESEARCH METHOD

This study employs a survey research method with a case study approach, using the ARC as the tool to address the problem. The study began by collecting field data related to layout issues, analyzing the frequency of interactions, distance traveled, and proximity between departments. Based on this data, an analysis was conducted through a literature review, followed by discussions with management to identify layout problems and several interviews with employees.

To assess departmental proximity and the frequency of interactions, data from employees and management directly related to department activities and relationships were used, involving 56 samples. The final analysis of this study compares conditions before and after the implementation of the ARC. The results will demonstrate the efficiency and effectiveness of the updated layout compared to the previous layout.

RESULTS

Figure 1. Initial Layout



Source: Field observation

Figure 1 above shows the initial layout for the XYZ Bandung Apartment office, illustrating the placement of all departmental offices across four different floors, from the lobby floor to the basement floor four. The offices in this layout include the Front Office, General Manager, Sales & Marketing department, Food & Beverages (F&B) department, Kitchen, Store, Accounting department, Laundry, Housekeeping department, Human Resource Development (HRD), and Engineering department.

Visually, the layout demonstrates how close the departments are to one another. In the basement, a shop is positioned directly adjacent to the parking area. This arrangement is concerning from a safety and health perspective, as the parking area is linked to significant air pollution, dust, and a high likelihood of workplace accidents. Although

placing the shop near the parking area may facilitate shopping for consumers who arrive or leave by vehicle, it overlooks those who prefer to make purchases directly without using a vehicle. This oversight can lead to decreased interest in shopping and a negative impact on consumer behavior.

The situation is similar for basements two, three, and four, which also adjoin parking areas. The Accounting department is located in basement two, HRD in basement three, and Engineering in basement four. The parking areas contribute to poor air quality, dust, and noise, which are not conducive to continuous human interaction. Such a placement layout increases the risk of health and safety issues for workers and can also lead to psychological effects such as fatigue, stress, and illness.

Table 2. Floor Area Based on the Initial Condition Layout

No.	Department	Floor Size (meters)		
		Length	Width	Large
1.	Front Office (FO)	6	6	36
2.	General Manager (GM)	6	6	36
3.	Sales & Marketing (S&M)	6	6	36
4.	Food & Beverages (F&B)	6	6	36
5.	Kitchen (KTC)	6	6	36
6.	Store (STO)	6	6	36
7.	Accounting (ACC)	6	6	36
8.	Laundry	6	6	36
9.	Housekeeping (HK)	6	6	36
10.	Human Resources Development (HRD)	6	6	36
11.	Engineering (EN)	6	6	36
12.	Security	3	3	9
Total				405

Source: Field Observation

The current office space allocation for each department is detailed in Table 2. As previously mentioned, the facility houses 12 departments. The Front Office department has a space with a length of 6 meters and a width of 6 meters. The General Manager's office is similarly sized, with a length of 6 meters and a width of 6 meters. The Sales & Marketing department also occupies an area of 6 meters by 6 meters. The F&B department has a room with an area of 36 square meters, where both the length and width are six meters. The Kitchen room also measures 6 meters by 6 meters. The remaining departments include the Shop, Accounting, Laundry, Housekeeping, HRD, Engineering, and Security, with the latter being notably smaller at 3 meters by 3 meters.

The total floor area is 405 square meters, with each department's area being 36 square meters, except for the Security section, which is only 9 square meters. All rooms measure 6 meters by 6 meters. The uniform size of the rooms does not account for differences in workload, number of employees, or the equipment used. This lack of differentiation also affects the corridors where employees interact. The identical room sizes imply that all departments have the same equipment, workforce, and workload, which is not the case. This uniformity represents a significant weakness in the current layout system, as it fails to accommodate the varying needs of different departments.

The distance traveled between one department to another is shown in Table 3 below.

Table 3. Distance Between Departments (meters)

	FO	GM	S&M	F&B	KTC	STO	ACC	HK	HRD	EN
FO	0	19.5	25.7	41.5	41.5	57.5	31.7	65.5	39.7	47.7
GM	19.5	0	12.5	22.7	22.7	30.7	51	38.7	59	69
S&M			0	18	18	26	55.2	34	63.2	71.2
F&B				0	6.75	16	74	24	82	90
KTC					0	16	74	24	82	90
STO						0	66	16	74	82
ACC							0	50	16	24
HK								0	66	74
HRD									0	16
EN										0

Source: Field Data Measurement and Processing

Based on Table 3, the greatest distance between departments is 90 meters, observed between the F&B and Engineering departments, as well as between the Kitchen and Engineering departments. The shortest distance is 16 meters, which occurs between the HRD and Engineering departments, the Accounting and HRD departments, and between Food & Beverage and the Stores.

From Table 3, it can be analyzed that the Front Office has the shortest distance to the General Manager, at 19.5 meters. Conversely, the Front Office has the longest distance to the Housekeeping department. The Front Office's proximity to the General Manager is crucial, as their activities are closely linked compared to other functions. The General Manager, despite having a distant relationship with the Accounting department, relies heavily on financial information decision-making. This distance is notable despite the functional and operational dependence between the General Manager and Accounting. Additionally, the significant distance between F&B and Engineering reflects the minimal interaction and low dependency between these departments in terms of technical activities.

Activity Relationship Chart (ARC)

Based on the data in Tables 2 and 3, the researchers can create an ARC map. ARC is obtained from the identification of information derived from interviews and observations. The ARC map images are as follows.

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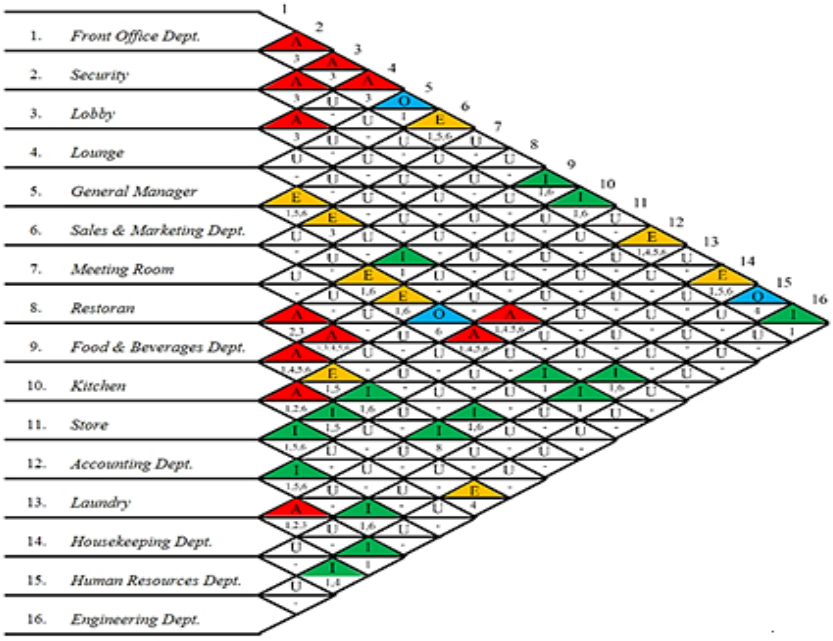
Figure 2. Activity Relation Chart (ARC)



Source: Field Data Measurement and Processing

The ARC image illustrates the sections or departments that require close proximity based on a questionnaire completed by employees and leaders interested in the company's activities. The red 'A' symbol indicates departments that must be brought closer due to frequent and important collaboration, cooperation, and information exchange. The orange 'E' symbol signifies a very important relationship, while the green 'I' symbol represents importance. Further descriptions can be seen in Figure 2.

To interpret the image, consider the Front Office as the first department. The red marks show its necessary proximity to Security, the Lobby, the Restaurant, and F&B, indicating crucial business process connections. The green marks indicate an important relationship with the Store and Accounting, while the yellow mark signifies a normal relationship with the General Manager. The white marks show no significant relationship with the Meeting Room, House, Engineering, and HRD.

In the second column, the Security department has a red relationship with the Front Office and F&B, a yellow relationship with Sales & Marketing and the Kitchen, and a green relationship with the Store and HR. Relationships with other departments are marked in white. This pattern can be followed for other departments as explained above.

Activity Relationship Diagram (ARD)
The next step is to analyze the degree of proximity by creating a worksheet from ARC, as shown in Figure 3 below.

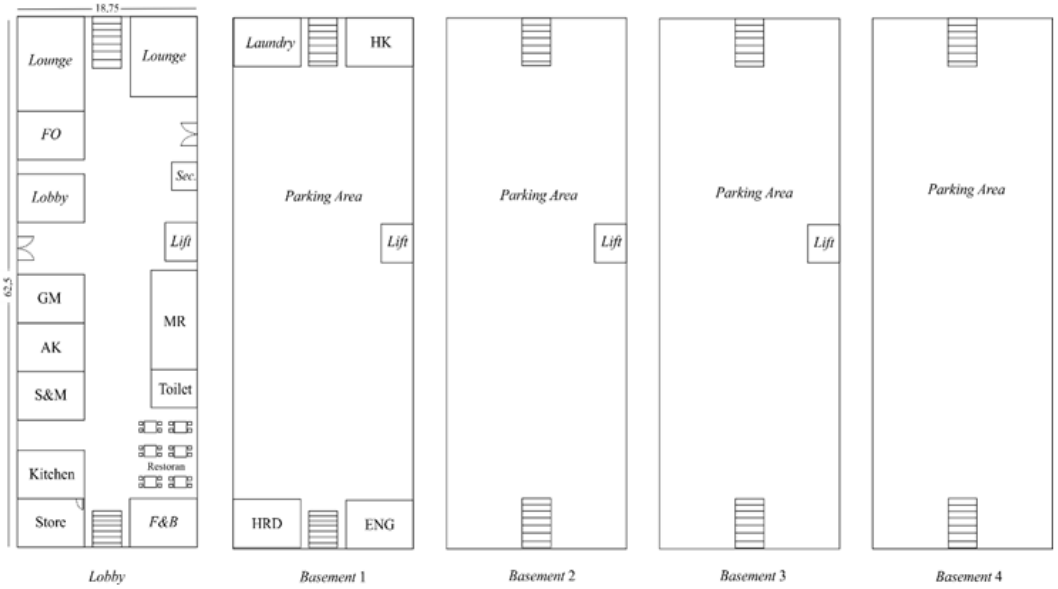
Figure 3. ARC Worksheet

A-2,3,4	E-6,12,14	A-1,3	E-	A-6,5	E-1	A-	E-5
1. *Front Office*		**2. *Security***		**12. *Accounting***		**7. *Meeting Room***	
I-10,16	O-5,15	I-	O-	I-9,10,11,13,15	O-	I-	O-
A-1,2,4	E-	A-1,3	E-	A-12	E-6,7	A-12	E-1,5,9,10
3. *Lobby*		**4. *Lounge***		**5. *General Manager***		**6. *Sales&Marketing***	
I-	O-	I-	O-	I-9,15	O-1	I-14,15	O-11
A-13	E-1	A-8,10	E-6,11	A-9,8,11	E-6,16	A-10	E-9
14. *Housekeeping*		**9. F&B**		**10. *Kitchen***		**11. *Store***	
I-6,8,9,16	O-	I-1,5,12,14	O-	I-1,12	O-	I-12	O-6
A-14	E-	A-9,10	E-	A-	E-10	A-	E-
13. *Laundry*		**8. Restoran**		**9. *Engineering***		**15. HRD**	
I-12,16	O-	I-14	O-	I-1,13,14	O-	I-5,6,12	O-1

Sources: Field Data Measurement and Processing

Based on Figure 3, in the upper left corner, A-2-3-4 is visible. Here, 'A' represents an absolute relationship as defined in Table 1, while the numbers 2, 3, and 4 correspond to the descriptions of ARC in Figure 2. Therefore, A-2-3-4 indicates an absolute relationship needed between the front office, security, and the lobby. In the next column, the symbols E-6, 12, and 14 denote a relationship of significant interest between the sales and marketing department, the store, and the laundry. This pattern can be similarly explained for other symbols and numbers in the figure.

Figure 4. Area Allocation Diagram (AAD)



Source: Field Data Measurement and Processing

From Figure 4, there is a difference between the layout before the analysis with the ARC method, shown in Figure 1, and the improved layout. On the second, third, and fourth basement floors, all areas are used for parking spaces. The Engineering, HRD, and Accounting departments are relocated. Accounting is moved to the lobby area, adjacent to the General Manager and Sales & Marketing. Engineering and HRD are moved to the first basement; although still connected to the parking area, they are not far from other functions such as the Kitchen, Shop, Accounting, Sales & Marketing, General Manager, Meeting Room, and Front Office. Housekeeping remains close to the Laundry, but it was moved to the first basement from its original location in the second basement.

Comparison between Initial Office Layout and Proposed Office Layout

After the improvements have been made to the layout, the effectiveness of the distance and the efficiency of the delivery time between departments will be analyzed and compared. The mileage and travel time between departments before the changes are shown in Table 4.

Table 4. Distance and Travel Time in the Initial Layout

No.	From	To	Distance (meters)	Travel Time (seconds)
1.	Accounting	General Manager	51	76.5
2.	Sales & Marketing	Accounting	55.25	82.9
3.	Store	Kitchen	16	24
4.	Accounting	Front Office	31.75	47.6
5.	Food & Beverage	Accounting	74	111
			228	342

From Table 4, the total travel time is 342 minutes, with a total distance of 228 meters. By evaluating with the ARC method, improvements in distance and travel time are shown in Table 5 below. In the current condition, the distance between the Accounting department and the General Manager is 51 meters, with a travel time of 76.5 seconds. The distance from the Sales & Marketing department to the Accounting department is 55.25 meters, with a travel time of 82.9 seconds. The distance from the Store to the Kitchen is 16 meters, with a travel time of 24 seconds. The distance from the Accounting department to the Front Office is 31.75 meters, with a travel time of 47.6 seconds. The distance from Food & Beverage to Accounting is 74 meters, with a travel time of 111 seconds.

Table 5. Distance and Travel Time in the Proposed Layout

No.	From	To	Distance (meters)	Travel Time (seconds)
1.	Accounting	General Manager	12.5	18.75
2.	Sales & Marketing	Accounting	12.5	18.75
3.	Store	Kitchen	12	18
4.	Accounting	Front Office	26.5	39.75
5.	Food & Beverage	Accounting	17.75	26.62
			228	121.9

After analyzing the suggested layout, it is evident that there are significant improvements in distance and travel time. The improved layout results, shown in Table 5, indicate the following changes: the distance from the Accounting department to the General Manager is reduced to 12.5 meters, with a travel time of 18.75 seconds; the distance from the Sales & Marketing department to the Accounting department is also 12.5 meters, with a travel time of 18.75 seconds; the distance from the Store to the Kitchen is 12 meters, with a travel time of 18 seconds; the distance from the Accounting department to the

Front Office is 26.5 meters, with a travel time of 39.75 seconds; and the distance from Food & Beverage to Accounting is 17.75 meters, with a travel time of 26.65 seconds.

Comparing Tables 4 and 5, it is clear that the travel distances between departments have decreased significantly. For example, the travel distance between the Accounting department and the General Manager was originally 51 meters, which has been reduced to 12.5 meters, achieving a 75% reduction and saving 64.15 minutes in travel time. Similarly, the travel distance between the Sales & Marketing department and the Accounting department decreased from 55.25 meters to 12.5 meters, resulting in a 77% reduction and a time saving of 77 minutes.

By comparing the initial layout with the proposed layout, it can be calculated the efficiency gained from the layout improvements. According to Safitri et al. (2017), the efficiency calculation formula can be applied to determine the exact gains in efficiency.

$$Efficiency = \frac{starting\ path - final\ path}{starting\ path}\ x\ 100\%$$

By entering the data, it can be calculated as follows:

$$Efficiency = \frac{228 - 81.3}{228}\ x\ 100\% = 64.3\%$$

Based on the efficiency calculation with the above formula, the next step is to compare the efficiency of distance and travel time from the initial layout and the proposed layout in Table 6 below.

Table 6. Comparison of Initial Layout and Proposed Layout

No.	Indicators	Initial Layout	Proposed Layout	Efficiency
1.	Distance	228 meters	81.25 meters	64.3%
2.	Time	342 seconds	121.9 seconds	64.4%

The comparative analysis of the proposed layout against the existing layout in Table 6 reveals a significant improvement in efficiency. The new layout reduces travel distance by 64.3% and travel time by 64.4%. These findings underscore the positive impact of layout optimization on overall operational performance.

DISCUSSION

XYZ Bandung Apartment spans a land area of 20,000 square meters, with a building area of 1,172 square meters. The property features 22 floors, with all departments located from the lobby floor to basement 4. There are 12 departments: General Manager, Front Office, Sales & Marketing, Food & Beverages, Kitchen, Store (General & Daily), Accounting, HRD, Housekeeping, and Engineering.

In the proposed layout, nine departments have moved or exchanged locations based on the degree of proximity. The Accounting department has moved from the 2nd basement floor to the lobby floor, while the Daily Store has moved from the 1st basement floor to the lobby floor. The Housekeeping and Laundry departments have relocated from the 2nd basement floor to the 1st basement floor. The HRD department has shifted from the 3rd basement floor to the 1st basement floor, and the Engineering department has moved from the 4th basement floor to the 1st basement floor. Additionally, the Sales and Marketing department has been repositioned due to the Accounting department's move, now situated between the Sales and Marketing department and the General Manager's office.

In the calculation of layout analysis using the ARC method, six degrees of importance are considered: Absolutely Necessary, Especially Important, Important, Ordinary, Not Important, and Underrated. The classification of the relationships between departments is determined by the frequency and significance of the activities that connect them.

In the initial layout, the total distance traveled is 228 meters, with a total travel time of 342 seconds. In the proposed layout, the total distance traveled is reduced to 81.25 meters, with a travel time of 121.9 seconds. This results in a decrease in total travel distance of 146.75 meters and a reduction in travel time of 220.1 seconds. Thus, the mileage efficiency is calculated to be 64.3% and the time efficiency is 64.4%.

The research results demonstrate that the ARC method can enhance layout efficiency by analyzing the level of relationships between departments. This method enables significant savings by reducing time and shortening distances (Tompkins et al., 2016). Shortening the distance traveled facilitates smoother communication processes, thereby enhancing work productivity (Hapsari et al., 2017; Haynes, 2008; Naqvi et al., 2016). Effective layout planning has been shown to reduce both the distance traveled and inventory levels (Shah & Joshi, 2013).

CONCLUSION

The ARC method is highly effective for analyzing layout improvements in both offices and industries. Field analysis shows that ARC can significantly shorten travel distances by evaluating the importance of proximity between departments. The relationship between departments is determined by the number of activities that connect to the business process, ultimately aiming to provide consumer satisfaction. As previously explained, office layout is closely related to productivity, and both physical and mental work fatigue are influenced by the harmony among employees.

The ARC method helps analyze the relationships between departments by conducting structured interviews with leaders and employees, assessing the importance of interconnected activities. This analysis forms the basis for department placement. The results of the ARC analysis demonstrate significant distance savings, leading to reduced travel time and minimizing unproductive time waste. However, some factors not yet analyzed in the ARC method include noise, dust pollution, and air circulation, which could also impact the effectiveness of the layout.

LIMITATION

This research was based on a case study conducted at the XYZ Bandung Apartment office. The study focused solely on the relationship between departments in terms of time and distance efficiency, without examining the relationship between layout and employee efficiency and productivity. Future research will explore this aspect in greater depth.

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DECLARATION OF CONFLICTING INTERESTS

This research was compiled for the benefit of developing the scientific knowledge of the author and researcher, there is no conflict of interest whatsoever in writing this paper.

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