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Optimization System of Non-Medical Warehouse at UOBK Regional Hospital (A Quantitative Validation using WinQSB Software)

Nurilia Fitri Prabawati [1], A. Anas Haikal [2]
Correspondence Email : nuriliafitri@uniska-kediri.ac.id
Universitas Islam Kadiri, East Java, Indonesia

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ABSTRACT

The previous study at UOBK Regional Hospital provided many informative suggestions, but still did not achieve the main objective and didn't show the quantitative validation. The previous study only showed the perspective by grouping the similar materials without any calculation for validation. However, this *study provided a quantitative validation using the CRAFT algorithm with winQSB software in the form of a functional layout. Data was obtained from the previous study then it was calculated to be the input data for this study. By considering the field study and made some adjustment, it was acceptable using the previous study information not only to calculate the cost but also to calculate the layout coordinate. So* this *study integrated two previous studies to analyze how the outcome of layout recommendation from the previous study compared with its initial layout (raw data). The total material handling cost using winQSB calculated that the initial layout value was 25360.50. The optimum value of this initial layout was 25070.38. The results supported the layout recommendation on the previous study by adding admin desk and grouping the similar materials. This was demonstrated by the optimum value of layout recommendation, which was 19195.23 using the two-way exchange option.* This *study implied that the layout recommendation reduced until 77% of total material handling cost and demonstrated better value than its initial layout.*

Keywords: *functional layout, quantitative, winQSB.*

Introduction

Based on the preliminary research (Zainida, et al., 2025), data was obtained from UOBK Regional General Hospital, that reasearch provided a proposed layout for non-medical Warehouse facilities using a class-based storage method. However, the research encountered obstacles due to the complexity of categorization, because at that time, the materials in the Warehouse were placed only by occupying the available empty space; not all materials were arranged on the shelves, there were no stock records on the available shelves, and there were no directions or symbols. Therefore, the research provided many informative suggestions, but did not achieve main objective and didn't show the quantitative validation. The previous study only showed the perspective by grouping the similar materials without any calculation for validation. In this study, we examined the categorization and integrated with another previous study (Anbiya and Haikal, 2025) by examining layout recommendation using quantitative method, so that preliminary research could be strengthened regarding the reason why warehouse rearrangement should be carried out in the non-medical Warehouse at UOBK Regional General Hospital. This study supported the previous research by reviewing several quantitative layout methods, such as class-based storage, that had been used in previous studies, as

well as other quantitative method. This research starts by reviewing previous categorizations and selecting an approach to represent the proposed improvements. Other algorithms considered in creating Systematic Layout Planning (SLP) such as blocplan or CORELAP. Taking into account data from previous studies, this study utilized winQSB (Quantitative System for Business) software with a functional layout. The results of this study were expected to serve as a reference for other Warehouse layouts, as shown in Table 1.

Figure 1. UOBK Regional Hospital
Source : Documentation

This non-medical warehouse represented the Minister Regulation that general hospital equipment was shown in Table-1. In point 12 stated that all types/classes of Hospitals have Equipment in the nutrition room, point 14 Equipment in the maintenance room of facilities and infrastructure, point 15 Equipment in the waste management room, point 17 Equipment in the laundry room, point 18 Equipment in the morgue, point 19 Equipment in the administration and management room, point 20 Equipment in the medical records room, point 21 Equipment for clean water, waste and sanitation management, and point 22 Fire fighting equipment.

Table 1. Classification of General Hospitals (D. Equipment)

NO.	TYPE OF EQUIPMENT	CLASS A	CLASS B	CLASS C	CLASS D
1.	Equipment in the emergency room	+	+	+	+
2.	Equipment in the outpatient room	+	+	+	+
3.	Equipment in the hospital room	+	+	+	+
4.	Number of hospitalized beds	250	200	100	50
5.	Equipment in the operating room	+	+	+	+
6.	Equipment in the intensive room				
	a. HCU	+/-	+/-	+/-	+/-

	b. ICU	+	+	+	+
	c. ICCU/ ICVCU	+/-	+/-	+/-	+/-
	d. RICU	+/-	+/-	+/-	+/-
	e. NICU	+/-	+/-	+/-	+/-
	f. TRIGGER	+/-	+/-	+/-	+/-
7.	Equipment in the room obstetrics and disease content	+	+	+	+/-
8.	Equipment in the radiology room	+	+	+	+
9.	Equipment in the room laboratory	+	+	+	+
10.	Equipment in the blood bank room House Sick	+	+	+	+
11.	Equipment in the pharmacy room	+	+	+	+
12.	Equipment in the room nutrition	+/-	+/-	+/-	+/-
13.	Equipment in the medical rehabilitation room	+/-	+/-	+/-	+/-
14.	Equipment in the room maintenance facilities and infrastructure	+	+	+	+
15.	Equipment in the room waste management	+	+	+	+
16.	Equipment in the room sterilization	+	+	+	+
17.	Equipment in the laundry room	+/-	+/-	+/-	+/-
18.	Equipment in the room corpse	+/-	+/-	+/-	+/-
19.	Equipment in the room administration and management	+	+	+	+
20.	Equipment in the room medical records	+	+	+	+
21.	Equipment clean water, waste and sanitation management	+	+	+	+
22.	Fire countermeasures equipment	+	+	+	+
23.	Medical gas management equipment	+	+	+	+

Source : Regulation of the Minister of Health of the Republic of Indonesia Number 3 of 2020

To support the provision of professional and responsible hospital services within a comprehensive and integrated health development framework while supporting self-assessment, in this study, categorization based on Table 1 will serve

as a reference for the Minister Regulation. The approach used in this study was Warehouse Management using the class-based storage method for the categorization system, supported by layout planning using WinQSB software. The class-based storage method was also used in a journal entitled Perencanaan Tata Letak Gudang Menggunakan Metode *Class-Based Storage* CRAFT pada Distributor Computer dan Office Equipment (Nur and Maarif, 2018), with outputs in the form of procedures for product placement, resulting in more effective handpallet utilization. Other references were Relayout Fasilitas Menggunakan Metode Systematic Layout Planning dan Blocplan Guna Meminimasi Jarak Material Handling (Yulia & Cahyana, 2022) and Penerapan Metode *Systematic Layout Planning* untuk Meminimasi Jarak Perpindahan Material pada UKM X (Kholidasari et al., 2023). Meanwhile, the use of WINQSB software in facility layout studies was described in a journal entitled Strategi Penentuan Layout Gudang PT. Megah Bangunan Abadi guna Meminimalkan Jarak dalam Proses Bongkar Muat (Widayanto and Handayani, 2021). The research's output addressed the shortcomings of previous Warehouse layouts, which focused less on product layout based on product flow and distribution, but rather on brand type and available space, with insufficient attention to distance between facilities in the Warehouse layout. Distance was a crucial factor influencing the efficiency of product movement. The UOBK Regional General Hospital case required an approach by combining two methods from the two examples, in order to propose layout that took technical aspects into account.

Another reference considered outputs in the form of Standard Operating Procedures (SOP), regulations, and new material layouts (Rahardjo, 2017). Based on the existing SOP, stock cards and master material tables were created as Warehouse control tools. Other research that could be used as a comparison for this study (Yanti and Dahda, 2022) looking for solutions for specific material placement and the efficiency of the distance between shelves by considering materials requency and the exit point.

The limitation of this research was the design only focused on the Non-Medical Warehouse, which was expected to serve as a reference for further research and became a roadmap for reviewing the entire Warehouse System at UOBK Regional Hospital. Further research on other Warehouse Management at UOBK Regional Hospital could refer to Table-1 according to the Regulation of the Minister of Health of the Republic of Indonesia Number 3 of 2020.

Research methods

Preliminary research (Zainida, et al., 2025) provided information on the categorization and quantity of incoming and outgoing materials at the time of the

study, as shown in Table 2. Class-based storage was a method based on the Pareto diagram. Class-based storage was a storage method by grouping items based on their characteristics and frequency of retrieval. In previous research, Table 2 showed the number of incoming and outgoing materials. This study conducted further research to collect frequency data over the observation period. The expected output of this research was optimization based on the blocplan algorithm, which would arrange items based on activity flow while grouping specific items in a separate location for items with the highest frequency using a Pareto diagram (class-based storage method).

Blocplan was a hybrid facility layout design algorithm system (constructing new or renovating facilities). Blocplan was developed by Donaghaye and Pire. The Blocplan algorithm was similar to the CRAFT (Computerized Relative Allocation of Facilities Techniques) algorithm. The difference was the Blocplan algorithm used an activity relationship chart (ARC), while the CRAFT algorithm still used a from-to chart. CORELAP (Computerized Relationship Layout Planning) could be used as a comparison algorithm for the future research.

Figure 2. Proposed Layout with the Highest Frequency and based on Categorization

In this study, materials did not move like items that went through several processes and thus passed through several workstations. Therefore, the research method that initially aimed to analyze quantitative approach by considering the relationship between items with ARC or ARD. Therefore, in this study, previous research was used (Anbiya and Haikal, 2025) as a reference layout to obtain coordinates so that quantitative analysis could still be carried out using a from-to chart with data supported by previous studies (Zainida, et al., 2025).

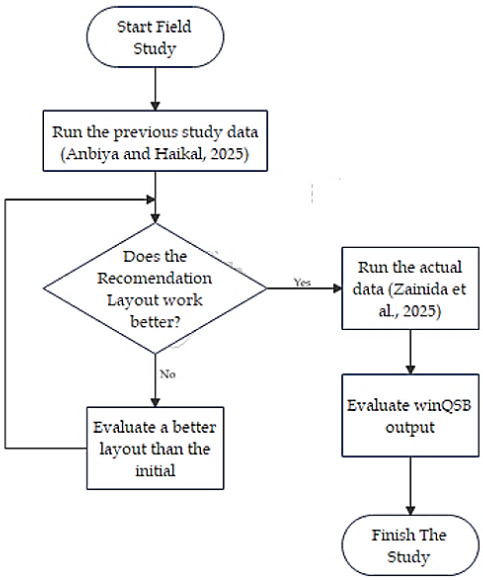

Figure 3. Research Flowchart

This study implemented WinQSB software to apply the from-to chart approach and the CRAFT method. The data used in the CRAFT method include the size of each area, the material flow matrix between areas, and the distance between area centers to calculate the total transfer cost. In the calculation, an iteration would swap positions until the minimum cost was reached and stop when there was no significant improvement (Wahyuni and Safitri, 2014). The layout was displayed in discrete form. Therefore, the department exchange must be adjacent or have the same area. The options used include two-way, three-way, two-way then three-way, and three-way then two-way (Tompkins et al., 2010).

References about facility study were The Facility Layout Design Practicum Module which discusses the arrangement of the production floor layout (Parahyangan University, 2017), Design and improvement of the layout of a production floor using the Automated Layout Design Program (ALDEP) and CRAFT algorithm at CV. Aji Jaya Mandiri (Suhardini and Rahmawati, 2019), and Perancangan Tata Letak Lantai Produksi Menggunakan Metode *Systematic Layout Planning* pada Departemen Produksi CV. CALTICS Yogyakarta (Pradana, 2025). Meanwhile, references about winQSB for example at CV TMI (Pranata and Setyorini, 2020), Redesign layout of production floor facilities using the CRAFT Algorithm (Sembiring et al., 2019). Research with the CRAFT method was also used in the medical field in a study entitled Integrating computer vision and non-linear optimization for automated deformable registration of 3D medical images (Huang, 2019).

Results and Discussion

(Anbiya and Haikal, 2025) In a similar study entitled Analysis of the Implementation of 5S Principles in Non-Medical Warehouses at UOBK Regional Hospital, represented a better warehouse layout reccomendation based on categorization and could be a reference to calculate the coordinates between shelves. Those information could be transformed as input for this study. In the previous research could be represented that the area had a length of 33 meters and a width of 15 meters. Figure 4 and Table-3 showed the conditions before the improvements and Figure 5 and Table-4 showed the conditions after the proposed improvements and layout recommendation applied.

However, this study did not involve a blocplan but still used the CRAFT method using winQSB software to calculate the effectiveness and efficiency of movement and to represent it in quantitative form. Table 3, which refered to Figure 4, showed that the initial layout coordinates could describe 25 item categories. Meanwhile, Table 4, which refered to Figure 5, showed that the initial layout coordinates could describe 21 item categories.

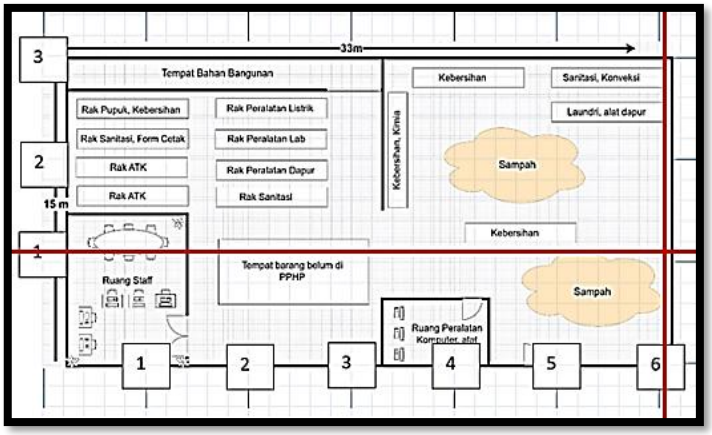

Figure 4. *Initial Layout*
Source : (Anbiya and Haikal, 2025), Data processed

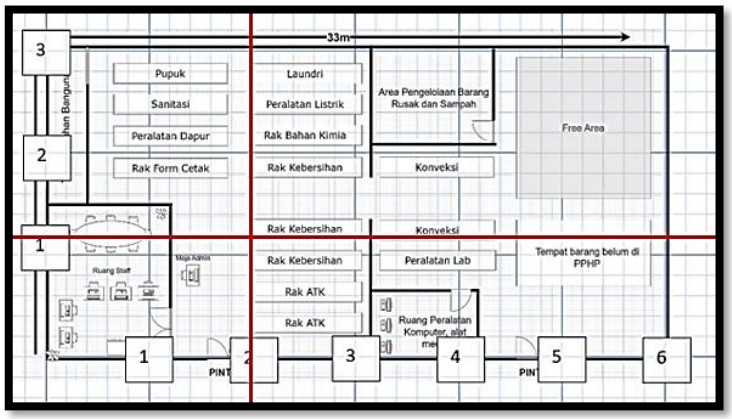

Figure 5. Recommendation Layout
Source : (Anbiya and Haikal, 2025), Data processed

1.1 Pareto Diagram

Figure 6 showed consistency with data from previous research (Anbiya and Haikal, 2025). The results of the study explained that the items which had the most frequent transfers in sequence were stationery, cleaning supplies, printed forms, chemicals, kitchen utensils, electrical equipment, sanitation, laundry, fertilizer, convection, laboratory equipment, and computer equipment.

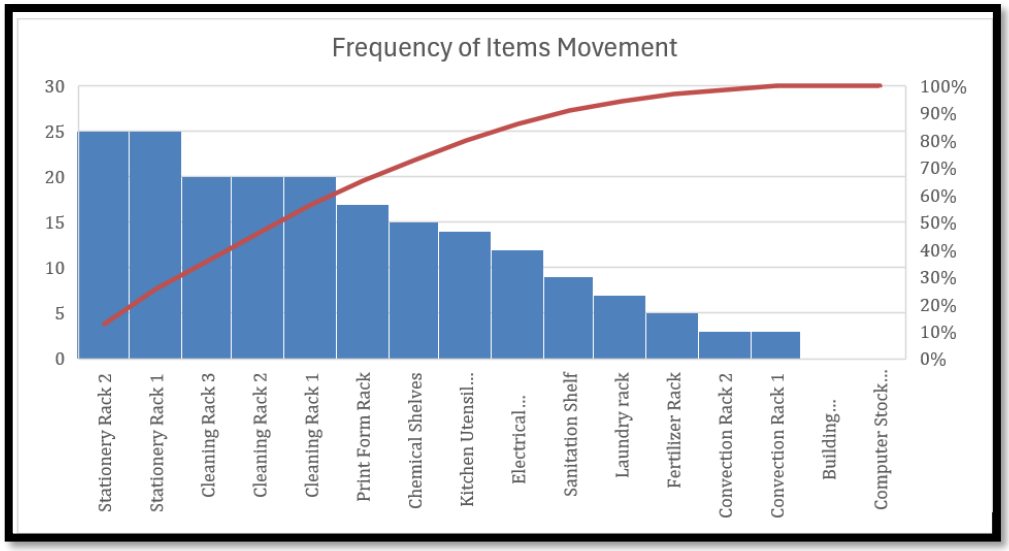

Figure 6. Item Frequency

The item movement frequency shown in Figure 6 was a representation of Table 3. This movement frequency served as a reference for the movement frequency in Table 4.

Table 3. Initial Layout

Initial Layout				
Department Cod	Department Name	Fixed Locatior	Coordinate	Frequency of Movements
A	Staff Room	Yes	(0,0)-(7,7)	
B	Sanitation Shelf 1	No	(9,8)-(14,9)	9
C	Kitchen Utensil Rack 1	No	(9,9)-(14,10)	14
D	Stationery Rack 1	No	(2,8)-(7,9)	25
E	Stationery Rack 2	No	(2,9)-(7,10)	25
F	Lab Equipment Rack	No	(9,11)-(14,12)	2
G	Sanitation Shelf 2	No	(2,11)-(7,12)	9
H	Print Form Rack	No	(2,11)-(7,12)	17
I	Electrical Equipment Rac	No	(9,12)-(14,13)	12
J	Fertilizer Rack	No	(2,12)-(7,13)	5
K	Cleaning Rack 1	No	(2,12)-(7,13)	20
L	Cleaning Rack 2	No	(17,8)-(18,13)	20
M	Chemical Shelves	No	(17,8)-(18,13)	15
N	Cleaning Rack 3	No	(18,14)-(24,15)	20
O	Cleaning Rack 4	No	(21,6)-(26,7)	20
P	Laundry rack	No	(25,12)-(30,13)	7
Q	Kitchen Utensil Rack 2	No	(25,12)-(30,13)	14
R	Sanitation Shelf	No	(25,14)-(30,14)	9
S	Convection Rack	No	(25,14)-(30,14)	3
T	Building Materials Rack	No	(0,15)-(17,15)	0
U	Computer Stock Room	Yes	(16,0)-(22,4)	0
V	PPHP not set	No	(9,3)-(16,6)	0
W	Defect and waste Area 1	No	(20,8)-(27,12)	0
X	Defect and waste Area 2	No	(23,2)-(30,6)	0

Source : (Anbiya and Haikal, 2025), Data processed

Table 4. After Relocation

After Relocation				
Department Cod	Department Name	Fixed Locatior	Coordinate	Frequency of Movements
Z	Admin Desk	Yes	(7,4)-(8,5)	
A	Staff Room	Yes	(0,0)-(7,7)	197
B	Sanitation Shelf 1	No	(4,12)-(9,13)	9
C	Kitchen Utensil Rack 1	No	(4,11)-(9,12)	14
D	Stationery Rack 1	No	(10,1)-(16,2)	25
E	Stationery Rack 2	No	(10,3)-(16,4)	25
F	Lab Equipment Rack	No	(16,5)-(22,6)	2
H	Print Form Rack	No	(4,9)-(9,10)	17
I	Electrical Equipment Rac	No	(10,12)-(16,13)	12
J	Fertilizer Rack	No	(4,14)-(9,15)	5
K	Cleaning Rack 1	No	(10,5)-(16,6)	20
L	Cleaning Rack 2	No	(10,6)-(16,7)	20
M	Chemical Shelves	No	(10,11)-(16,12)	15
N	Cleaning Rack 3	No	(10,9)-(16,10)	20
P	Laundry rack	No	(10,14)-(16,15)	7
S	Convection Rack	No	(16,6)-(22,7)	3
T	Building Materials Rack	No	(0,7)-(2,15)	0
U	Computer Stock Room	Yes	(16,0)-(22,4)	0
Y	Convection Rack 2	No	(16,9)-(22,10)	3
V	PPHP not set	No	(23,4)-(30,12)	0
W	Defect and waste Area 1	No	(16,11)-(22,15)	0

Source : (Anbiya and Haikal, 2025), Data processed

1.2 Quantitative Analysis

Because the existing data was not yet capable of describing the ARD (Activity Relationship Diagram), this study only used a from-to-chart considering item frequency. Categorization by calculating workflow such as items flow on several workstation couldn't be done. Therefore, item classification would be directly placed on one shelf and shelves with similar types of items placed close together. ARC and ARD could not be done because there were no items that move as in the

concept of items processing at several workstations (Lubis, et al., 2022), (Yulistio, et al., 2022), (Shiddiqi, et. al, 2025). In Figure 7, the lowest total cost was 6148.32, this calculation still considered the initial layout form before improvement (Anbiya and Haikal, 2025). The results of data processing on the initial layout were obtained from 10 iterations with 2-way-exchange. The distance calculation used by calculating the perpendicular distance called the Rectilinear (Manhattan) distance, because the distance between shelf points could not be reached using the Euclidean distance which was the shortest distance, such as measuring the distance between departments without considering the aisle specifically. In Figure 7, iteration 1 swaped shelf Q with W, iteration 2 swaped S with W, which was resulting a lower total cost with increasing iterations, until reaching the 10th iteration which swaped F with W and produced an optimal value compared to other options. Figure 7 represented the layout calculation using winQSB where the initial layout refered to Figure 4.

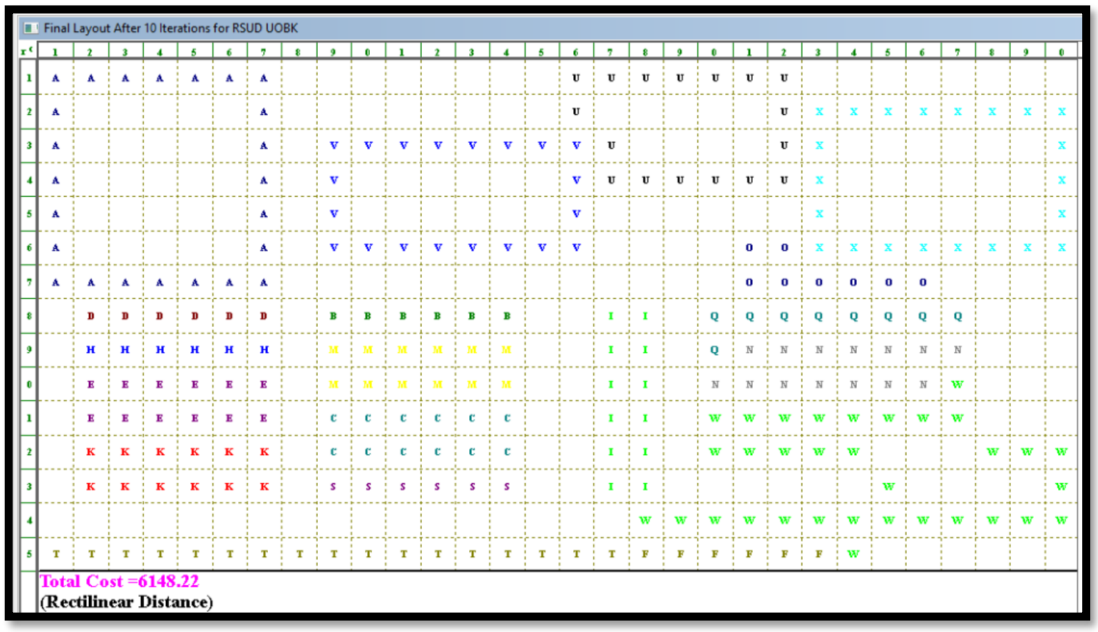

Figure 7. Initial Layout 10 Iterations

Similarly, Figure 8 obtained the lowest total cost of 4816.55 with 11 iterations and with the option after 3 – then 2 way exchange through the exchange option provided by the software. The first iteration was by exchanging shelves B-C-I, followed by further iterations until the 10th iteration exchanging shelf J with P and when reaching the optimal iteration exchanging shelves C (Kitchen Utensils) and M (Chemical Shelves). Figure 8 was based on the improved layout model of previous research (Anbiya and Haikal, 2025), namely the recommended layout shown in Figure 5.

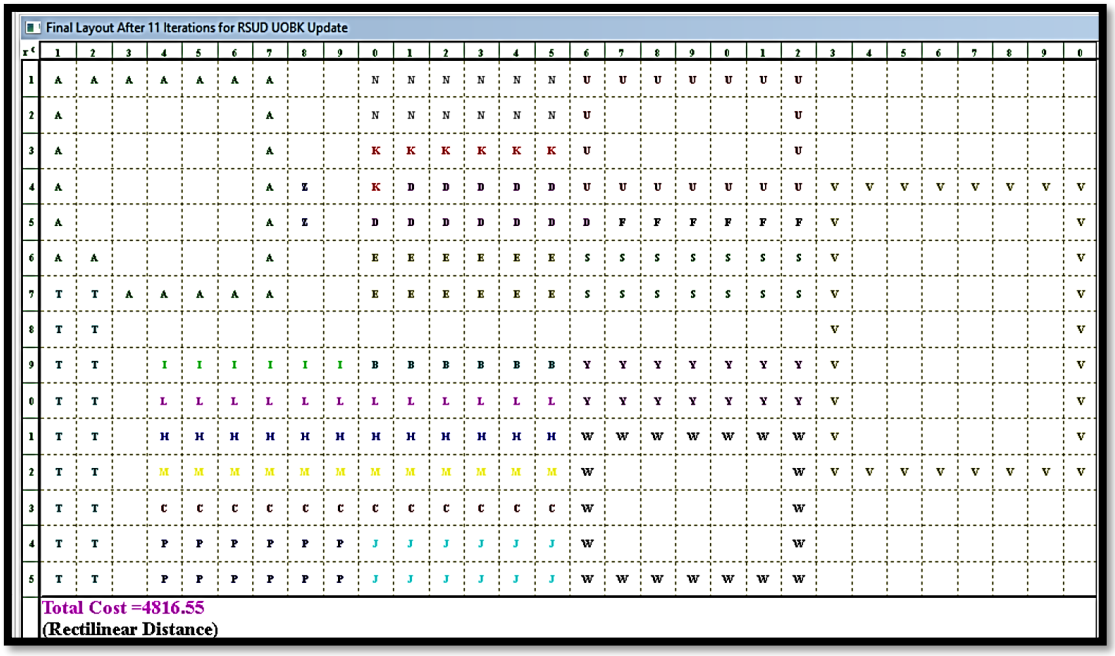

Figure 8. After Relocation

Because the value of the layout recommendation from previous research had a lower value than the initial layout, this research confirmed that the layout recommendation model could be applied (Anbiya and Haikal, 2025).

1.3 Actual Data Analysis

This section would discuss how the initial layout and the layout recommendation were applied as an input which had been obtained from the actual data from previous research (Zainida et al., 2025). Table 5 showed how the data from the previous research was processed and categorized according to the shelf classification for similar items, as represented in Figures 4 and 5.

Table 5. In-Out Items Data

List of Items	Enter	Go out	Code	Facility Name
Stationery: Cupboard, Table		15	5 D	Stationery Rack 1
Stationery: Ink, Paper shredder		15	5 E	Stationery Rack 2
Stationery: Ballpoint pens, markers		200	100 E	Stationery Rack 2
ATK: Clip, Plung		250	50 H	Print Form Rack
ATK: Print Form		250	50 H	Print Form Rack
Stationery: Paper		30	10 E	Stationery Rack 2
Hygiene Tools: Wipes, Gloves		200	100 F	Lab Equipment Rack
Stationery: Paper folders, plastic folders		200	50 D	Stationery Rack 1
Unused items		20	0 W	Defect and waste Area 1
Palette		10	4 V	PPHP not set
Electrical Equipment: Cables and Electricity		75	25 I	Electrical Equipment Rack
Building Supplies: Paint, Glue, Cement		150	50 T	Building Materials Rack
Medical Equipment: Pipettes, tubes, etc.		150	30 F	Lab Equipment Rack
Sanitation: Mop soap, glass cleaner, etc.		200	150 B	Sanitation Shelf 1
Nutritional consumables: Plastic bags, cups, oil paper		200	150 C	Kitchen Utensil Rack 1
Plastic Trash Can		10	4 B	Sanitation Shelf 1
Stationery: HVS paper, Buffalo		50	20 E	Stationery Rack 2
Table and Chair Stock		10	3 D	Stationery Rack 1

Source : Zainida , et al., 2025 Data processed

From Table 5, the total frequency was obtained based on the categorization shown in Table 6. The actual data obtained over a specific period of timeand represented the frequency of item transactions in the Non-Medical Warehouse. Table 6 was used as a new input in the layout model as shown in Figures 4 and 5.

Table 6. Frequency of Items based on research data previously

Row Labels	Sum of Enter	Sum of Go out
Building Materials Rack		
Building Supplies: Paint, Glue, Cement	150	50
Defect and waste Area 1		
Unused items	20	0
Electrical Equipment Rack		
Electrical Equipment: Cables and Electricity	75	25
Kitchen Utensil Rack 1		
Nutritional consumables: Plastic bags, cups, oil pape	200	150
Lab Equipment Rack		
Hygiene Tools: Wipes, Gloves	200	100
Medical Equipment: Pipettes, tubes, etc.	150	30
PPHP not set		
Palette	10	4
Print Form Rack		
ATK: Clip, Plung	250	50
ATK: Print Form	250	50
Sanitation Shelf 1		
Plastic Trash Can	10	4
Sanitation: Mop soap, glass cleaner, etc.	200	150
Stationery Rack 1		
Stationery: Cupboard, Table	15	5
Stationery: Paper folders, plastic folders	200	50
Table and Chair Stock	10	3
Stationery Rack 2		
Stationery: Ballpoint pens, markers	200	100
Stationery: HVS paper, Buffalo	50	20
Stationery: Ink, Paper shredder	15	5
Stationery: Paper	30	10
Grand Total	**2035**	**806**

Source : Zainida , et al., 2025 Data processed

Using the data in Table 6 as input, the calculation for initial layout referring to Figure 4 was obtained with the lowest total cost, 25070.38, which was shown in Figure 9.

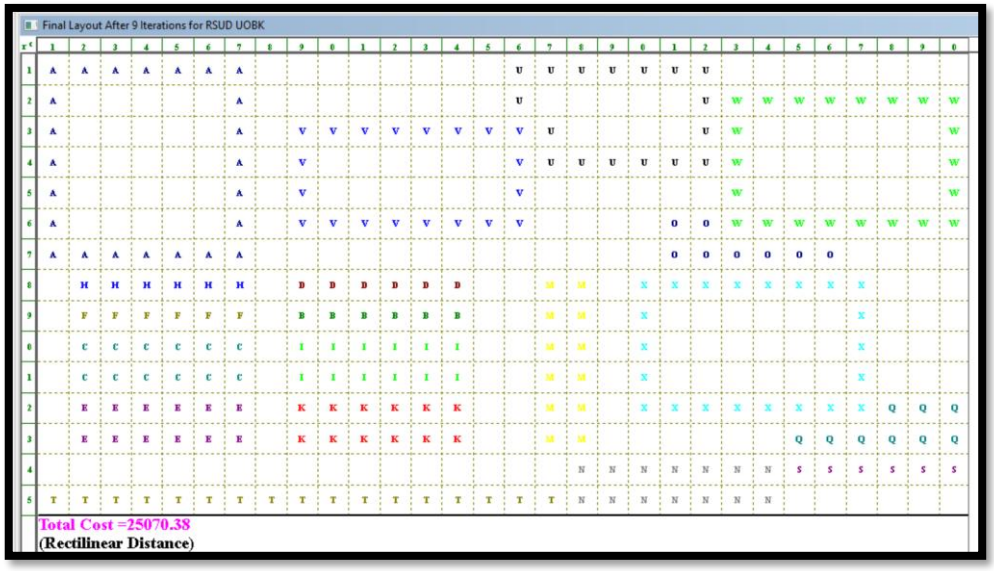

Figure 9. The best relocation of *Initial Layout*

And Figure 10 showed the calculation referring to the layout recommendation model (after improvements) with the lowest total cost of 19195.23 through the 2-way exchange option.

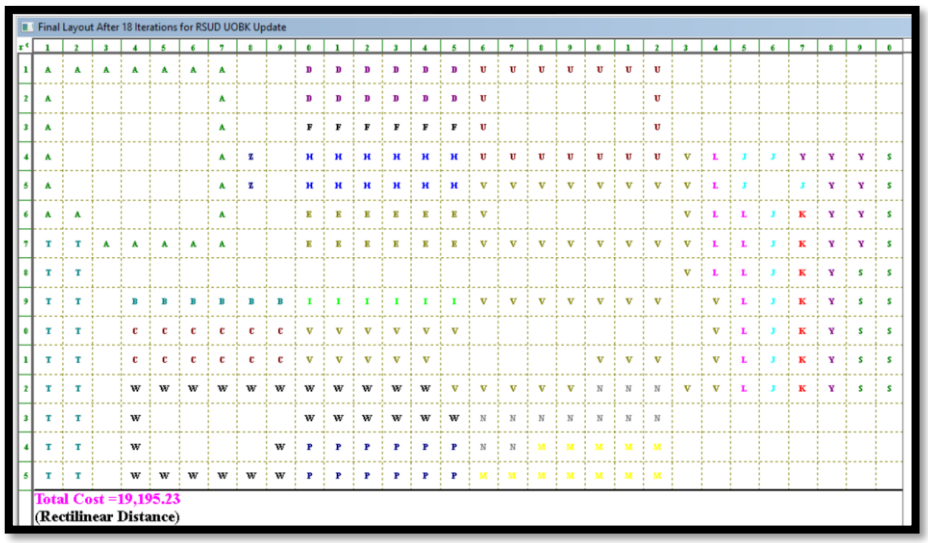

Figure 10. Relocation best *Layout* recommendation

Table 7 showed that from the layout recommendation model in Figure 5 and input in Table 6 with a flow value of 2841, the lowest total cost of movement could be obtained with a value of 19195.23. And Table 8 provided the from-to-chart distance value.

Table 7. *Total Cost of Movement*

12-11-2025 03:37:41	Department Name	Center Row	Center Column	Flow To All Departments	Cost To All Departments
1	Z	4.50	8	2035	13,669.17
2	A	3.87	4.11	0	0
3	B	9	6.50	154	924
4	C	10.50	6.50	150	1125
5	D	1.50	12.50	58	435
6	E	6.50	12.50	135	877.50
7	F	3	12.50	130	780
8	H	4.50	12.50	100	450
9	I	9	12.50	25	225
10	J	7.17	25.92	0	0
11	K	9	27	0	0
12	L	7.75	24.58	0	0
13	M	14.58	19.42	0	0
14	N	12.92	19.08	0	0
15	P	14.50	12.50	0	0
16	S	8.71	29.64	0	0
17	T	11	1.50	50	650
18	U	2.50	19	0	0
19	Y	7	28.21	0	0
20	V	8.83	18.56	4	59.56
21	W	13.20	8.31	0	0
	Total			2841	19,195.23
	Distance	Measure:	Rectilinear		

Table 8. From-To Distance

Rectilinear Distances After 2-way Exchange for RSUD UOBK Update

12-11-2025 13:51:37	To Z	To A	To B	To C	To D	To E	To F	To H	To I	To J	To K	To L	To M	To N	To P	To S	To T	To U	To Y	To V	To W	Sub Total
From Z	0	4.52	6	7.50	7.50	6.50	6	4.50	9	20.58	23.50	19.83	21.50	19.50	14.50	25.86	13	13	22.71	14.89	9.01	269.41
From A	4.52	0	7.52	9.02	10.77	11.02	9.27	9.02	13.52	25.10	28.02	24.35	26.02	24.02	19.02	30.38	9.73	16.27	27.24	19.41	13.54	337.76
From B	6	7.52	0	1.50	13.50	8.50	12	10.50	6	21.25	20.50	19.33	18.50	16.50	11.50	23.43	7	19	23.71	12.22	6.01	264.48
From C	7.50	9.02	1.50	0	15	10	13.50	12	7.50	22.75	22	20.83	17	15	10	24.93	5.50	20.50	25.21	13.72	4.51	277.98
From D	7.50	10.77	13.50	15	0	5	1.50	3	7.50	19.08	22	18.33	20	18	13	24.36	20.50	7.50	21.21	13.39	15.89	277.03
From E	6.50	11.02	8.50	10	5	0	3.50	2	2.50	14.08	17	13.33	15.00	13	8	19.36	15.50	10.50	16.21	8.39	10.89	210.28
From F	6	9.27	12	13.50	1.50	3.50	0	1.50	6	17.58	20.50	16.83	18.50	16.50	11.50	22.86	19	7	19.71	11.89	14.39	249.53
From H	4.50	9.02	10.50	12	3	2	1.50	0	4.50	16.08	19	15.33	17	15	10	21.36	17.50	8.50	18.21	10.39	12.89	228.28
From I	9	13.52	6	7.50	7.50	2.50	6	4.50	0	15.25	14.50	13.33	12.50	10.50	5.50	17.43	13	13	17.71	6.22	8.39	203.86
From J	20.58	25.10	21.25	22.75	19.08	14.08	17.58	16.08	15.25	0	2.92	1.92	13.92	12.58	20.75	5.27	28.25	11.58	2.46	9.03	23.64	304.09
From K	23.50	28.02	20.50	22	22	17	20.50	19	14.50	2.92	0	3.67	13.17	11.83	20	2.93	27.50	14.50	3.21	8.61	22.89	318.24
From L	19.83	24.35	19.33	20.83	18.33	13.33	16.83	15.33	13.33	1.92	3.67	0	12	10.67	18.83	6.02	26.33	10.83	4.38	7.11	21.72	285.01
From M	21.50	26.02	18.50	17	20	15.00	18.50	17	12.50	13.92	13.17	12	0	2.00	7.00	16.10	21.50	12.50	16.38	6.61	12.49	299.68
From N	19.50	24.02	16.50	15	18	13	16.50	15	10.50	12.58	11.83	10.67	2.00	0	8.17	14.76	19.50	10.50	15.05	4.61	11.05	268.74
From P	14.50	19.02	11.50	10	13	8	11.50	10	5.50	20.75	20	18.83	7.00	8.17	0	22.93	14.50	18.50	23.21	11.72	5.49	274.12
From S	25.86	30.38	23.43	24.93	24.36	19.36	22.86	21.36	17.43	5.27	2.93	6.02	16.10	14.76	22.93	0	30.43	16.86	3.14	11.21	25.81	365.41
From T	13	9.73	7	5.50	20.50	15.50	19	17.50	13	28.25	27.50	26.33	21.50	19.50	14.50	30.43	0	26	30.71	19.22	9.01	373.70
From U	13	16.27	19	20.50	7.50	10.50	7	8.50	13	11.58	14.50	10.83	12.50	10.50	18.50	16.86	26	0	13.71	6.78	21.39	278.42
From Y	22.71	27.24	23.71	25.21	21.21	16.21	19.71	18.21	17.71	2.46	3.21	4.38	16.38	15.05	23.21	3.14	30.71	13.71	0	11.49	26.10	341.82
From V	14.89	19.41	12.22	13.72	13.39	8.39	11.89	10.39	6.22	9.03	8.61	7.11	6.61	4.61	11.72	11.21	19.22	6.78	11.49	0	14.61	221.52
From W	9.01	13.54	6.01	4.51	15.89	10.89	14.39	12.89	8.39	23.64	22.89	21.72	12.49	11.05	5.49	25.81	9.01	21.39	26.10	14.61	0	289.69
Sub-Total	269.41	337.76	264.48	277.98	277.03	210.28	249.53	228.28	203.86	304.09	318.24	285.01	299.68	268.74	274.12	365.41	373.70	278.42	341.82	221.52	289.69	5,939.07

Conclusion

Eventually, this study was not to create a Blocplan or CORELAP model because the relationship couldn't be describe using ARC and ARD. Unlike workstation relationships for items which processed sequentially across multiple workstations. Each material in this study was just an independent item and it became difficult to represent the connection between any materials with each other. However, this study still provided a quantitative approach using the CRAFT algorithm, which referred from-to-chart using the winQSB software. This study provided an example of how the winQSB software was applied to calculate the optimum value of the movement. An iteration would swap positions until the minimum cost was reached and stop when there was no significant improvement on the total material handling cost. The optimum value of layout recommendation was 19195.23 (Figure 10). This study implied that the layout recommendation reduced until 77% of total material handling cost and demonstrated better value than its initial layout. This study could be an example how location of facility calculation contribute warehouse management system. Further, it could be a reference for technical support document of warehouse management at UOBK Regional Hospital.

Suggestion

ARC and ARD provided better input to the model, research with ARC and ARD as inputs could be described if there was a close relationship between the movement of materials on each shelves such as items that move because they went through the process between workstations. In this study there were also laboratory equipments and chemicals that still included in the scope of the Non-Medical Warehouse, so further study was still needed whether these two things could be distinguished from the scope of the Non-Medical Warehouse.

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Biography Short Writer

The author is a practitioner with main experience on Risk Management, as well as Production Planning and Inventory Control. The author currently a lecturer of Industrial Engineering at Universitas Islam Kadiri and an active resource person in management training at PT PKP Petrokimia Gresik.