USED PRINTER DISASSEMBLY PLANNING USING AGGREGATE PLANNING APPROACH AT RCM KOMPUTAMA

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Abstrak

Indonesia menghasilkan sekitar 2 juta ton limbah elektronik. Angka ini diperkirakan akan meningkat menjadi 3,2 juta ton pada tahun 2040. Printer sebagai salah satu limbah elektronik dapat merusak lingkungan. Oleh karena itu, untuk mengurangi dampak lingkungan dari pembuangan printer dan jumlah limbah elektronik yang berakhir di tempat pembuangan akhir, printer harus didaur ulang sebelum dibuang. Ini melibatkan pembongkaran printer dan mendaur ulang bagian serta komponennya. Proses pembongkaran lebih menantang untuk direncanakan dan dilaksanakan karena jenis produk yang dikembalikan dapat bervariasi dari produk yang sudah mencapai akhir masa pakai atau rusak. Perencanaan pembongkaran adalah langkah pertama untuk merencanakan proses pembongkaran, yang penting untuk mengoptimalkan proses daur ulang. Toko perbaikan printer berada di garis depan upaya ini, sehingga memastikan kegiatan mereka berjalan lancar adalah hal yang sangat penting. Perencanaan agregat klasik digunakan dalam proses pembongkaran, mengingat kemampuannya untuk mengoordinasikan dan merencanakan sumber daya untuk memenuhi permintaan pelanggan. Penelitian dilakukan di RCM Komputama, sebuah toko perbaikan printer di Depok. Penelitian ini bertujuan untuk mengimplementasikan perencanaan agregat klasik pada proses pembongkaran agar toko dapat memaksimalkan jumlah unit yang dibongkar dan meminimalkan biaya proses pembongkaran. Setelah menerapkan perencanaan pembongkaran menggunakan pendekatan perencanaan agregat, waktu pemrosesan yang dibutuhkan berkurang sambil tetap memenuhi permintaan.

Kata kunci: *e-waste, pembongkaran, perencanaan agregat, printer bekas*

Abstract

Indonesia generated an estimated 2 million tons of e-waste. This is expected to increase to 3.2 million tons by 2040. Printers as one of electronic waste (e-waste) can be harmful to the environment, then to reduce the environmental impact of printer disposal and the amount of e-waste that ends up in landfills, printers should be recycled before they are disposed of. This involves disassembling the printer and recycling parts and components. The disassembly process is more challenging to plan and execute due to returned product type may vary from product that have been at end-of-life or damaged. Disassembly planning is the first step is to plan the disassembly process, which is important for optimizing the recycling process. Small repair shops are at the forefront of this endeavor, so ensuring their activities run smoothly is of utmost importance. The classic aggregate planning was introduced in disassembly process, considering its capability to coordinate and plan resource to satisfy customers' demand. The research took place at RCM Komputama, a small printer repair shop in Depok. This research aimed to implement classic aggregate planning in disassembly process, so the repair shop could maximize the number of disassembled units as well as minimize the costs of the disassembly process. After implementing disassembly planning using aggregate planning approach, the processing time needed decreased while satisfying the demands.

Keywords: *aggregate planning, disassembly, e-waste, used printers*

INTRODUCTION

Indonesia is a rapidly growing country with a large population. As the economy grows, so does the demand for electronics. This means that Indonesia is likely to generate a significant amount of e-waste in the future. In 2021, Indonesia generated an estimated 2 million tons of e-waste. This is expected to increase to 3.2 million tons by 2040 [1]. As seen as in Figure 1, printer sales in Indonesia increased significantly in the third quarter of 2022. The total sales in the year in question also exceeded the preceding years. This is likely due to the easing of the pandemic and the return to full capacity in offices and schools, which has increased demand for printers. Printers are considered electronic waste (e-waste) because they contain materials that can be harmful to the environment and human health, such as lead, mercury, and cadmium [2, 3]. However, the materials in printers, such as plastic, metal, and glass, can be recycled and reused to create new products.

To reduce the environmental impact of printer disposal and the amount of e-waste that ends up in landfills, printers should be recycled before they are disposed of [4, 5]. This involves disassembling the printer and recycling parts and components. The recycled parts can be used for remanufacturing or reused as a source for raw materials, such as plastic and metal. Recycling can significantly reduce the environmental pollution caused and conserve resources by reusing potential resources in waste products that lead to reducing waste [6].

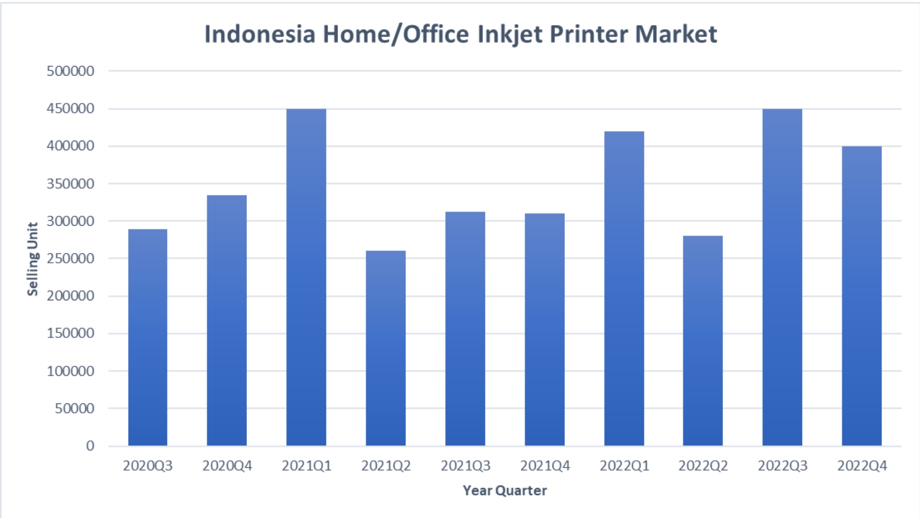

Figure 1. Indonesia Inkjet Printer Sales [7]

Disassembly is the process of taking apart a product into its individual components. This is an important step in the recycling, remanufacturing, and reusing of waste products [8]. When a product is disassembled, the individual components or parts can be inspected and repaired. This can help extend the product's lifespan and reduce the amount of waste that is sent to landfills. Furthermore, the disassembly process could change product waste into raw material that could be reused in the manufacturing process or sold to third parties [9]. In conclusion, disassembly is the key link to realize recycling, remanufacturing, and reusing of waste products [10, 11]. It helps to reduce waste, conserve resources, and extend the lifespan of products.

The disassembly process is not as simple as the reverse of the assembly process. The material supply of the assembly line is well-defined, while the material supply of the disassembly line is highly uncertain in terms of product structure and quality [12, 13]. This is because product supply for the disassembly process mostly returns products that are often obsolete, damaged, and have been used in a variety of ways, or simply the product does not meet a customer’s needs. The product returned was driven by several reasons at each stage of the supply chain. Figure 2 described how products could be returned and disassembled in each process stage.

Returned product types may vary from products that have been at end-of-life or damaged. It may also have been modified or repaired, which can make it difficult to disassemble [15, 16]. This uncertainty in the material supply makes the disassembly process more challenging to plan and execute. Gungor and Gupta defined disassembly as a process of systematically separating a product into its constituent parts, components, and subassemblies. Disassembly can be partial or complete and destructive or non-destructive [17]. Table 1 shows the difference between each disassembly process.

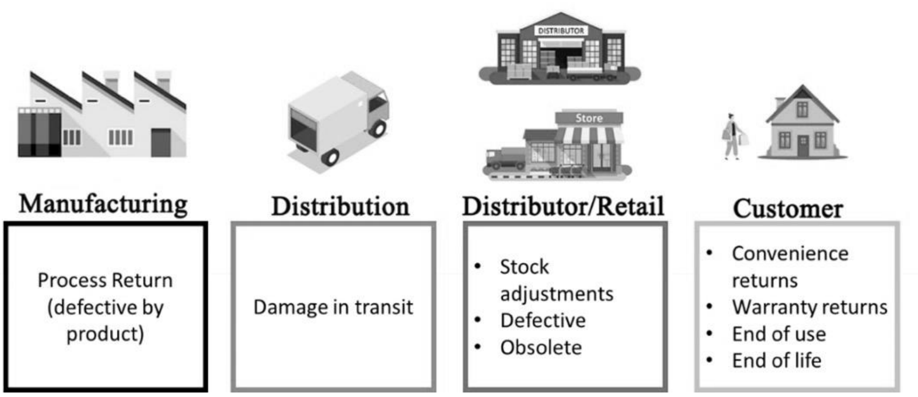

Figure 2. Types of products from each process stage [14]

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Table 1. Type of disassembly process [18]

Type	Definition	Use
Partial disassembly	breaking down a product into its major component/assembly Less invasive process	Often for repair or refurbishment
Complete disassembly	breaking down a product into all of its individual component More invasive process	Extraction of raw material Remanufacturing
Destructive disassembly	involves the use of tools or equipment that damage the product in the process of disassembly	Recover valuable material
Non-destructive disassembly	involves the use of tools or equipment that do not damage the product in the process of disassembly	Refurbish product

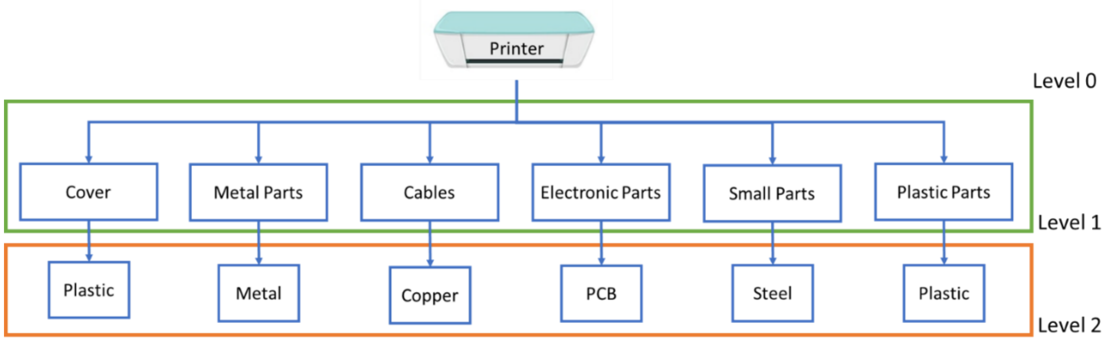

Figure 3. Printer Disassembly Level

Printers can be disassembled in two ways. The first method is partial and non-destructive, which means that the printer is not damaged during disassembly. This method is used when the printer is still in good condition and can be repaired. The second method is complete and destructive, which means that the printer is completely disassembled, and the components are recycled or disposed of. This method is used for printers that are at the end of their life. Printer disassembled into 6 parts: cover, metal parts, cables, electronic parts, small parts, and plastic parts [19]. The cover is the housing of printers. Metal parts on printers include the main bracket, bracket, and rollers. Cables usually consist of copper. Electronics parts include Printed Circuit Board (PCBs). Small parts were screws and springs. The printer disassembly has two levels: the first level dismantling six parts, and the second level is extraction material from parts. Figure 3 shows the printer disassembly level.

In developed countries, e-waste is typically managed through formal collection, recycling, and disposal systems. However, in developing countries, e-waste management is often informal, which can lead to its disposal in landfills or through burning, releasing harmful substances into the environment. In Indonesia itself, the government has a program to collect and recycle electronic waste. The program is called e-Recycle, and it is implemented by the Ministry of Environment and Forestry.

The key factors in recycling e-waste, including printers, are collection, sorting, and disassembly [20]. The collection process involves collecting returned printers from customers. This includes collecting printers from households, businesses, and other sources. After printers are collected, it is sorted based on the condition of the printer. If the printer is repairable, a partial and non-destructive disassembly process occurs. Printers and parts that are still working are tested before being sent to the secondary market or back to the customer.

Recycling printers has a positive impact on the environment, as it reduces the amount of waste that goes to landfills. A recent study of recycling e-waste in Indonesia mentions how superior the informal sector of recycling [21]. In printer recycling, the informal sector is represented by small shops or repair centers that provide service for electronic products. This service center also provides a buyback scheme for unwanted printers. The main process in this service center is disassembly of printer and repair process.

Disassembly planning is the first step is to plan the disassembly process, which is important for optimizing the recycling process [22]. Disassembly planning has been identified as an important area of research [23, 24]. However, it is often difficult to find an optimal disassembly strategy, as there are many constraints that need to be considered. In disassembly planning, it is generally difficult to find an optimal strategy [25]. Effective disassembly planning is often used to analyze how to make the disassembly process cost to be minimum.

Aggregate planning is a method for planning and scheduling production over a medium-term horizon. It is used to determine the optimal production levels and workforce levels in order to meet demand while minimizing costs [26]. In the context of disassembly planning, aggregate planning can be used to determine the optimal number of workers needed to disassemble returned products [27]. The goal is to minimize the cost of disassembly while meeting the demand for disassembled products. The paper proposes a new approach to aggregate planning for disassembly. The proposed approach uses the classic aggregate planning model, but it is adapted to the specific constraints of disassembly. This paper will focus on the disassembly process in the printer recycling process. This research was conducted in a small printer repair shop located in Depok, Indonesia. The disassembly process of returned products was investigated, and an aggregate plan was developed based on the available manpower.

The proposed research is based on the concept of repair and recycling of printers. The objective of this research was to introduce classic aggregate planning in the disassembly process. With this simple mathematical model, the repair shop could maximize the number of disassembled units as well as minimize the costs of the disassembly process. The result of this research could encourage more small businesses to recycle printers and gain more profit from the recycling process, as now they have a method to help plan their activities.

RESEARCH METHOD

This research was conducted with three major steps: literature review, data collection, and analysis. Figure 4 shows an overview of each step. In the first step, the literature on e-waste and printer sales in Indonesia was reviewed. The sales data was used to estimate the potential amounts of printers that could end up in landfills as e-waste. The number of printers that could end up in landfills is found significant. This suggests that printer recycling is a promising method for reducing the environmental impact of printers. The disassembly process of printers can be difficult to plan because the condition of the printers that are received for recycling can vary. This means that the disassembly time can vary depending on the condition of the printer. Additionally, the disassembly process can be time-consuming and labor intensive. Then this matter is important for planning the disassembly process in printer recycling activities.

The second step involved collecting data on the disassembly process of printers. This case study was concluded in RCM Komputama, a printer repair shop in Depok, Indonesia. The business dealt with used printers from customers that are broken and need to be repaired or unwanted printers that want to be sold. Several data will be collected, this includes the amount of printer received, how printer processed, time needed for disassembly, time needed for repair, cost for the disassembly process, cost for the repair process, and how many workers are available. This data will be used to analyze the disassembly process at the business.

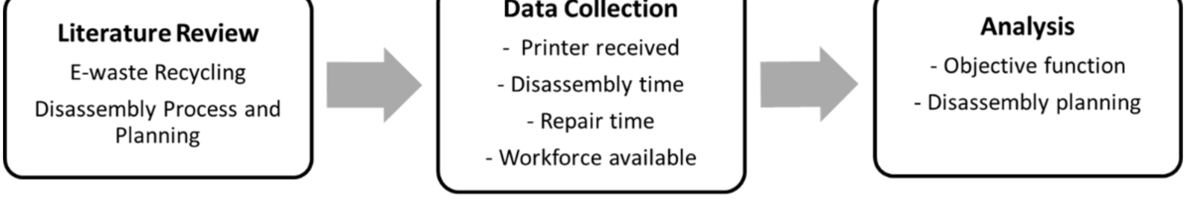

Figure 4. Research methodology

The third step involved analyzing the results by making the objective function for the recycling process at the business and planning the disassembly process. To analyze and plan the disassembly process, we used aggregate planning approach. Classic aggregate planning was often used for calculating production level in manufacturing firms. Various basic parameters/variables such as demand, inventory, backorder, production capacity, and costs were required to create an aggregate plan [28]. The decision variable, usually production level, was calculated in way that would satisfy the customer's demand. According to [29], the general model for aggregate planning was based on three main variables: quantity of supply in period *t* (Q_t^S), demand in period *t* (Q_t^D), and the level of stock of finished product at the end of period *t* (S_t). Equation (1) showed the relationship between the three variables.

$$S_t = S_{t-1} + Q_t^S - Q_t^D \quad \textbf{(1)}$$

As the Equation (1) showed, the plan would revolve around balancing stock, production level (supply), and demand. Multiple aggregate plans with different strategy could be compared to obtain the optimal plan with the lowest cost. In practice, an aggregate plan could be calculated in a table, by listing the customer's demand and other variables. The calculation process began with selecting the strategy for the plan. Basic strategies for aggregate planning were level strategy and chase strategy. Level strategy employed a proactive approach by changing inventory levels through the planning period while maintaining a fixed level of production. Chase strategy employed a more reactive approach by varying production levels, so the production output in every period matched the amount of customer's demand [30]. Examples of these strategy and calculations could be seen in Table 2 and 3, as the difference between the two strategies could be seen in bold.

Table 2. Aggregate planning with level strategy example

Period	0	1	2	3	4	5	6
Demand (unit)		6000	4800	7840	5200	6560	3600
Net Demand (unit)		5600	4800	7840	5200	6560	3600
Production Rate (unit)		**5600**	**5600**	**5600**	**5600**	**5600**	**5600**
Inventory/Stockout	**400**	**0**	**800**	**-1440**	**-1040**	**-2000**	**0**
Inventory		**0**	**800**	**0**	**0**	**0**	**0**
Stockout		**0**	**0**	**1440**	**1040**	**2000**	**0**
Workforce required		**210**	**210**	**210**	**210**	**210**	**210**
Workforce Hiring/Firing		0	0	0	0	0	0
Workforce Hired		0	0	0	0	0	0
Workforce Fired		0	0	0	0	0	0

Table 3. Aggregate planning with chase strategy example

Period	0	1	2	3	4	5	6
Demand (unit)		6000	4800	7840	5200	6560	3600
Net Demand (unit)		5600	4800	7840	5200	6560	3600
Production Rate (unit)		**5600**	**4800**	**7840**	**5200**	**6560**	**3600**
Inventory/Stockout	400	0	0	0	0	0	0
Inventory		0	0	0	0	0	0
Stockout		0	0	0	0	0	0
Workforce required		**210**	**180**	**294**	**195**	**246**	**135**
Workforce Hiring/Firing		**0**	**-30**	**114**	**-99**	**51**	**-111**
Workforce Hired		**0**	**0**	**114**	**0**	**51**	**0**
Workforce Fired		**0**	**30**	**0**	**99**	**0**	**111**

These two basic strategies are not necessarily the go-to strategy as firms tend to formulate and fit the plan according to their situation. This type of strategy could be regarded as a mixed strategy. After the decision variables and other variables has been calculated, the total cost occurred for the plan is calculated. The total cost mainly consists of total labor cost, total inventory cost, and total production cost. The basic formula could be seen in Equation (2).

$$TC = TCL + TCI + TCP \quad \textbf{(2)}$$

Where:

TC = Total Cost

TCL = total cost for labor, usually consists of total hiring cost and total firing cost.

TCI = total cost for inventory.

TCP = total cost for production, usually consists of total material cost and/or total salary cost.

In some particular situations, other costs such as overtime production cost, subcontracting cost, and stockout cost could be included in the calculation. Each plan then can be compared to obtain the optimal one.

In this research, we tried to adapt the aggregate planning approach for disassembly planning purpose, as the goal of both production and disassembly process is similar in coordinating the proper number of resources to meet demand. While the activities are not the same between manufacturing process and disassembly process, the planning process still revolves around supply, demand, and stock. The constraints are adapted to the disassembly planning problem. The calculation and planning process was done in a set of tables filled with various variables and constraints. From the data collection process, it can be concluded that the total cost for processing received printer is the sum of total checking cost, added by total disassembly cost, added by total repair cost, added by total testing cost, and added by total transportation cost to the second market for un-reusable parts. The formula could be seen in Equation (3).

$$TPC = TCC + TCD + TCE + TCT + TCP \quad (3)$$

Where:

TPC = total cost for processing printers

TCC = total cost for checking the printer to determine its condition.

TCD = total cost for disassembling the printer either for repairable or unrepairable

TCE = total cost for repairing the printer.

TCT = total cost for testing the printer to ensure that it is working properly.

TCP = total cost for transporting the printer to the second market for un-reusable part.

As the focus of this paper was the disassembly process, thus only disassembly, repair, and testing costs were considered. Transportation costs to the second market are not considered because most of the time RCM Komputama's partners will collect the item once every week. Holding/inventory cost was not considered because, with the small size of the printer parts, the firm could store them at their warehouse without additional cost. The total cost calculation was shown in Equation (4).

$$TC = \sum_{i=1}^{I}\sum_{t=1}^{T} RP_{it}\,CD_{it} + \sum_{i=1}^{I}\sum_{t=1}^{T} UP_{it}\,CE_{it} + \sum_{i=1}^{I}\sum_{t=1}^{T} UP_{it}\,CR_{it} + \sum_{i=1}^{I}\sum_{t=1}^{T} OP_{it}\,CU_{it} \quad (4)$$

Where:

TC = total cost occured

I = number of types of printers

T = number of periods of time

RP = number units of received printer

UP = number units of repairable printer

OP = number unit of obsolete printer

W = number of worker or labor

CD = disassembly cost

CE = repair cost

CR = testing cost for repairable printer

CU = testing cost for unrepairable printer

The constraint of this objective function is labor hours in a period. With this objective function, the business could measure the disassembly process cost that occurred.

RESULTS AND DISCUSSION

Business Process of RCM Komputama

As a printer repair shop, RCM Komputama conducted various activities in doing their business. The business' printer acquisition process can be seen in Figure 5.

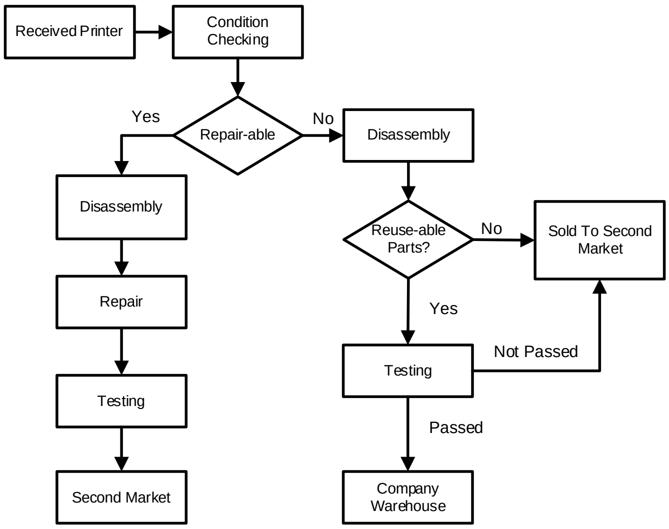

Figure 5. Printer Acquisition Flow at RCM Komputama

When a printer is received, it is sorted and disassembled based on its condition. The sorted printers are divided into two categories: repairable and obsolete printers. Repairable printers are received from customers who need their printers repaired, as well as from customers who are selling their damaged printers. Obsolete printers are received from customers who are selling their old or end-of-life printers. Obsolete and non-working printers are sought for parts cannibalization (in the context of component reuse) and selective retrieval of parts for recycling, while repairable printers will be sent to the repair department to be fixed.

The printers received at the front desk will undergo a quick condition check. If the printer is deemed repairable, they will proceed with the disassembly process. The disassembled printer then will undergo a repair process according to the damage. The repaired printer then will be tested. Printers that pass the testing process then will be sold to the second market. Printers that are deemed obsolete, however, will undergo a slightly different process. After the disassembly process, the worker will examine the printer for re-usable parts. If there are no parts from the printer that are deemed reusable, then the obsolete printer will be directly sold to the second market. If there are parts that are deemed usable, the usable parts will be tested, then the parts that pass the testing process will be stored inside the firm's warehouse to be used in the future repair processes.

Disassembly Planning

Data of received printers was collected from RCM Komputama for 12 weeks' time period between January and March 2023. The weekly period was chosen because of its convenience for the smaller firm, as opposed to aggregate planning's usual monthly time period in larger companies. The data of received printers is presented in Table 4.

Table 4. Received Printer

Time Period (Week)	Returned Printer (unit)		Average disassembly time per unit (minute)		Average repair time per unit (minute)	Average testing time per unit (minute)		Labor Hour Available (worker/minute)
	Re-pairable	Un-repairable	Re-pairable	Un-repairable	Re-pairable	Re-pairable	Un-repairable	
1	60	5	3.5	15.5	35	3.5	6	1800
2	50	8	5	20	30	5	7	1800
3	65	9	5.5	12.5	30	5.5	10	1800
4	58	9	4.8	15	45	4.8	6	1800
5	55	6	5	11	50	5	8	1800
6	50	10	4.5	13.5	40	4.5	9	1800
7	61	8	6	14	30	6	8	1800
8	62	6	3.8	16	45	3.8	6	1800
9	65	10	5.5	18	50	5.5	5	1800
10	56	4	5.2	16	45	5.2	8	1800
11	58	6	4.3	18.5	50	4.3	9	1800
12	62	12	5.8	19	30	5.8	10	1800

Other information about the business: 2 workers are available; there are 3600 minutes available in total for a single period; the disassembly process costs Rp. 10000 per repairable printer unit; the disassembly process costs Rp. 20000 per unrepairable printer unit; repair costs Rp. 50000 per unit, not including any parts that need to be changed; testing costs Rp. 5000 per repairable printer unit and Rp. 15000 per unrepairable printer unit due to the number of extra parts tested. Based on the collected data, disassembly planning will be delivered, as well as the cost of each step. Disassembly planning is used to plan the disassembly process using listed variables and to see whether the business's capacity is still sufficient to handle the process.

If the business's capacity is not sufficient, then the disassembly planning can be used to identify areas where capacity can be increased. The disassembly planning can be a valuable tool for RCM Komputama to manage their disassembly process. By identifying areas where the capacity can be increased and the disassembly process can be improved, the business can improve their bottom line and make better decisions about how to manage their printers. Table 5 shows disassembly planning for the received printer.

Table 5. Disassembly planning for received printer

Period (week)	1	2	3	4	5	6	7	8	9	10	11	12
Received repairable printer (unit)	60	50	65	58	55	50	61	62	65	56	58	62
Received un-repairable printer (unit)	5	8	9	9	6	10	8	6	10	4	6	12
Disassembly un-repairable printer (minute)	77.5	160	112.5	135	66	135	112	96	180	64	111	228
Testing un-repairable printer (minute)	30	56	90	54	48	90	64	36	50	32	54	120
Net disassembly repairable printer (unit)	60	50	65	58	55	50	61	62	65	56	58	62
Inventory (unit)	0	0	0	0	0	0	0	0	14	8	8	0
Disassembly repairable printer (minute)	210	250	357.5	278.4	275	225	366	235.6	280.5	291.2	249.4	359.6
Repair (minute)	2100	2100	1950	2610	2750	2000	1830	2790	2550	2790	2900	2100
Testing repairable printer (minute)	210	250	357.5	278.4	275	225	366	235.6	280.5	291.2	249.4	359.6
Total time needed (minute)	2627.5	2216	2867.5	3355.8	3414	2675	2788	3393.2	3418	3468.4	3563.8	3167.2
Total time available (minute)	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
Disassembly repairable cost (Rp 000)	600	500	650	580	550	500	610	620	510	620	580	700
Disassembly un-repairable cost (Rp 000)	100	160	180	180	120	200	160	120	200	80	120	240
Repair cost (Rp 000)	3000	2500	3250	2900	2750	2500	3050	3100	2550	3100	2900	3500
Testing repairable cost (Rp 000)	300	250	325	290	275	250	305	310	255	310	290	350
Testing un-repairable cost (Rp 000)	75	120	135	135	90	150	120	90	150	60	90	180
Total cost (Rp 000)	4075	3530	4540	4085	3785	3600	4245	4240	3665	4170	3980	4970

The disassembly planning was made according to an aggregate planning approach. The customer demand in this plan was the amount of received printers, both repairable and unrepairable, which was represented in the first two rows. The time needed for disassembling and testing unrepairable printers was represented in the next two rows.

After considering the time needed and the amount of received printers, the net amount of disassembled repairable printers was calculated in the next row. The inventory amount was calculated in the next row. Inventory incurred if there was a difference in the number of printers received and the amounts of printers that could be processed. The time available for each process was then calculated in the next 5 rows so that the total time available was obtained. The incurred costs were then calculated in the last 6 rows by multiplying the base cost of each variable with the number of printers processed.

All received unrepairable printers undergo disassembly and testing processes. From Table 5, it was shown that in period 9, the time needed for a re-pairable printer is higher than the time available. Of the 65 repairable printers received, only 51 of the printers are disassembled, repaired, and tested. After disassembly planning was applied, in period 10, there are 62 printers disassembled (with an additional 6 printers from the previous period). In period 11, there are no additional printers, thus making the amount of inventory the same as in the previous period, which was 8 units. In period 12, 8 units that were not disassembled will be disassembled and repaired. Figure 6 shows the difference in time needed before and after disassembly planning is applied.

As it could be seen in Figure 6, the time needed after the disassembling process is lower than the time available, thus meaning that the plan successfully processed all the printers within the time constraint. Compared to the time before disassembly planning, where it could be seen that in period 9, the plan failed to deliver since it needed more processing time than the time available at the corresponding period.

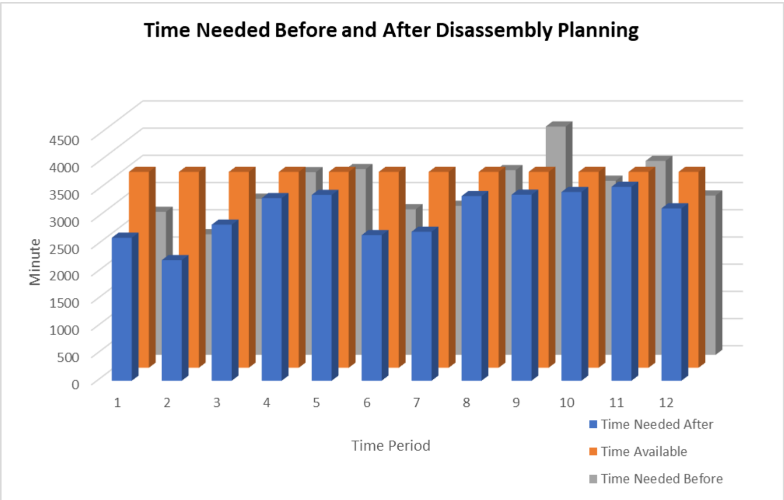

Figure 6. Time needed before and after disassembly planning

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https://doi.org/10.35760/tr.2024.v29i3.11940

After ensuring plan satisfy demand and time constraint, the cost occurred was calculated according to Equation (4). Total disassembly cost occurred was Rp. 8.880.000, total repair cost occurred was Rp. 35.100.000, total checking cost for repairable printer was Rp. 3.510.000, total checking cost for un-repairable printer was Rp. 1.395.000, and the total cost occurred was Rp. 48.885.000.

Disassembly planning is essential for optimizing the disassembly process. By planning, RCM Komputama can adjust the number of printers to be recycled in consideration of the time available. They can also predict when they need to adjust capacity by adding workers, and how much maximum printer they could recycle. This will help the business to be prepared to fulfill capacity by making strategies such as picking up printers from customers and using e-commerce or social media for promoting their repair service. Disassembly planning could improve efficiency by identifying areas where the disassembly process is more efficient. Furthermore, disassembly planning can increase profits for the business.

CONCLUSION

Based on RCM Komputama's business process, there are two categories of printers: repairable and unrepairable printers. Every received printer at the business undergoes a disassembly process. The mathematical function described the total cost of disassembly that includes disassembly, repair, and testing costs. The disassembly planning calculation successfully satisfied all the demands while decreasing the time needed to process the amounts of printers received. By using disassembly planning, the unprocessed printer could be carried as inventory to the next period, so the time can be adjusted not exceeding the business' capacity. The total cost occurred was Rp. 48.885.000.

In the future, it is important to consider all costs, including holding and transportation costs. The profit that occurred from selling unrepairable parts and components also needs to be accounted. This could make disassembly planning more accurate and dependable. Considering the decrease in processing time while maintaining satisfaction of the demand as shown on the plan, RCM Komputama could ensure that they are making the most profitable decisions about how to disassemble their received printers.

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