DEVELOPMENT OF CYCLE COUNTING MONITORING DASHBOARD WITH BUFFER TIME MANAGEMENT FOR COCOA COMPANY

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Abstract— PT XYZ is a cocoa manufacturing company that produces 4 types of finished goods: Cocoa Butter, Cocoa Powder, Cocoa Mass, and Cocoa Cake. As one of the few company that produced this types of goods in a large scale in Indonesia, PT XYZ has to meet a high demand every day. Warehouse managers need a reliable inventory monitoring dashboard that could help them monitors the item inside their warehouse. This research presents a case study of inventory control in cocoa company. This research aims for Inventory monitoring dashboard that could perform cycle counting process which also implementing a specific concept of Theory of Constraints (TOC) which is Buffer Time Management. This concept applying buffers on a certain period of time for each of items inside the warehouse, the monitoring dashboard then could alarm the user the condition of each items in the warehouse with color indicators. The user then can schedule the 'alarmed' items into the Stock capture sheets where the item will be counted when the company is performing cycle counting. By using this application it is expected that the inventory accuracy in PT XYZ may improve.

Keywords— Cycle Counting, Buffer Time Management, Cocoa, Monitoring, Dashboard.

I. INTRODUCTION

Inventory control is an activity of managing inventory inside the warehouse, stockroom, or store [1]. Inventory control ensures the company's operational needs to be fulfilled on time and ensures the use of inventory optimally.

Inventory accuracy is critical for effective planning and customer service, Inventory accuracy does not concern with financial impact or stock loses, but with the business system reflecting in terms of different inventory records [2].

There are few methods to do inventory check, the popular method is by doing stock take, there are two popular method of stock take: Periodical inventory stock taking, and Cycle Counting [3], the first practice are more commonly used, but it requires for the company to physically perform a full stock take to the inventory, which means the company must close the warehouse until the company done performing the periodical inventory stock taking [4], the second practices are steadily become more favored since it is not requires the company to full perform but simply takes a portion of the item inside inventory and do the stock count in a determined cycle time [5]. Both practices are dependent on information from their company's ERP System (Enterprise Resource Planning).

Enterprise Resource Planning system is a software system where it integrates all the components of information inside one of company into a centralized portal where information gathered can flow between departments[2]. ERP system can be used to manage product, scheduling, purchasing, customer support, order tracking, as well inventory levels.

Periodical Inventory Stock Taking can be defined as the physical verification of the quantities and condition of items held inside the inventory, the are 2 goals of Periodical Inventory Stock taking[6]: the first is to satisfy the financial auditors that inventory records accurately reflect the actual physical inventory, the second is provide inventory planners an opportunity to correct inventory inaccuracies in the record. It does have disadvantage, first, it's not focused on the inventory but rather focused on financial valuation of the inventories, second is often the company must be closed down during the count[5].

A more effective method of continuously ensuring the accuracy of inventory is by using Cycle Counting, Cycle counting is a periodic inventory system-audit which only counts portions of the items or stocks inside the warehouse in cyclic manner rather than once a year. The main idea of cycle counting is it assumes that the more items that transacted through the company, the more margin of error in calculation that could be occurred, which means the fast moving or the more expensive are prioritized to be counted first.[6]

Periodical inventory Stock Taking and cycle counting has their own benefits and restriction, this gives an idea of implementing Theory of Constraints (TOC) to the inventory accuracy problem, namely Buffer time Management, the main idea of TOC is to give a trigger to replenish the system when the buffer that assigned is reached certain amount, the purpose of Buffer time Management is to protect the schedule of operations and activities.[2]

PT XYZ, a Cocoa Manufacturing company in Indonesia, produced 4 types of finished goods: Cocoa Butter, Cocoa Powder, Cocoa Mass, and Cocoa Cake. As a company that able to produces these types of product in a constant rate, PT XYZ has lot of demands to meet. Which means the company need to be able to do their stock counting activity effectively.

At the practices, PT XYZ only done Stock Take activity every month while their items are usually moves fast inside the warehouse, PT XYZ doesn't have any monitoring systems to help them monitor the condition of the items.

It is suggested to the company to develop a cycle counting application that can help the company to monitor the condition of their stock item inside the warehouse and aid the users to schedule which SKUs to counted, this application also implementing Buffer time management where the application will alarm the users which items are in due time for the next cycle count.

II. LITERATURE REVIEW

2.1 Inventory

Inventory is a physical asset that a firm holds in stock with the intent to selling it or transforming it into products that, in turn, are used for further processing or sale to the customer[7]. In PT XYZ, the products are categorized as a Finished Goods, as the products are ready for shipment to the customers without any further processing.

2.2 ABC Analysis

ABC Analysis are used to classifying the item based on value that items holds in certain periods. ABC Analysis classifies the items based on the investments for each item, from the Highest Value (Class A) into the Lowest Value (Class C). here are calculation steps to classifying the items[8]

Calculate the Stock Value by multiplying unit cost of product with Quantity items on hand

$$Stock\ Value = Actual\ Cost\ of\ SKU\ \times Quantity\ on\ Hand\ of\ SKU.$$
(1)

Then, to categorize the SKUs the stock value is needed to be transformed and positioned on a scale 0-1. To do this, it requires both minimum and Maximum SKU Values of all the stock items in the inventory.

$$Stock\ Value\ Transformed = \frac{SKU\ Value - Min\ value}{Max\ Value - Min\ Value}$$
(2)

Last step is classifying the SKU, Category A items are generally making up for 80% of total cumulative value of all stock items inside the inventory. Category B will make up for 81%-95%, and category C make up for 95%-100% of total cumulative value of all stock items in inventory [8]

2.3 Inventory Control

Inventory Control is an activity of managing the inventory that is already in the warehouse, stockroom, or store [1]. Inventory control ensure the operational needs to be fulfilled on time and can use the inventory optimally. The advance of information technology already changing the possibilities to develop and applying inventory control techniques. This resulting more concepts can be featured in the inventory control system that has been developed, which is Buffer Time Management.

2.3 Stock Take

Stock Take can be defined as the physical verification of the quantities and condition of items held inside the inventory or warehouse [3]. There are 2 accepted practices of doing stock take: Periodical Inventory Stock Taking, and Cycle Counting.

2.4 Periodical Inventory Stock Taking

One of the popular methods in stock take, It calculates the entire inventory in a short time and usually performed once a year or once every month. In the implementation, the company usually need a lot of worker to count the entire warehouse, even hires outsource to help the counting activity, also when the periodical inventory stock taking is performed, the warehouse needs to be closed until the activity is finished [5].

2.5 Cycle Counting

A more effective stock take method to continuously ensuring the accuracy of the inventory record is by doing cycle counting. Cycle Counting is an inventory accuracy audit technique where the inventory rather be counted periodically, it counted in a determined cyclic schedule. What makes it different than the periodical inventory stock taking, Cycle Counting only counts a portion of their total inventory, which means the company doesn't need to close their inventory while the cycle counting performed. The purpose of this method is to identify and then perform root-cause analysis of any error [6].

As for the counting frequency that attached to each category of the item for cycle counting, it is determined by the management of the company. Here is the counting frequency that will be used by the company based on ABC Analysis:

Table 1. Counting Frequency

ABC Class	Count Frequency
A	Weekly
B	Monthly
C	Quarterly

2.6 Theory of Constraints

Theory of Constraints (TOC) is basically a scheduling and inventory control philosophy, it proposes as a chain of interdependent links (departments, functions, resources) some of which may potential for greater performance but cannot realize it because of a weak link which is external or internal and every firm has at least one, TOC focuses on improvement on those weak links, TOC is an effective method to find the bottleneck in the system [9]

2.7 Buffers

Often used in TOC, Buffer are placed before the controlled constraint, ensuring the constraint to never on shortfall. It ultimately buys time before work reaching its constraints, thus it is also called "Buffer Time", there should always enough gap of work time before the constraint occurs.

There are many ways to apply buffers, but the most often used are by visualizing the buffer system in colors: Green (Okay), Yellow (Caution), and Red (Action Required). By creating this kind of visibility, it allows the whole system to work aligned.

2.8 Buffer time management

Regarding to the cycle counting method, Buffer time can be defined as the time (Days, Months, Quarter, Years, etc.) between when the last time cycle count was performed and the deadline when the next cycle count will be performed. The main purpose of Buffer time management is to protect the schedule of operations and activities. There are several uses of buffer time management [10]

- Serves as an alarm system that spots serious and urgent problems.

- Provides support for short to mid-range decisions.

- Indicates weak areas in the schedule, thus prioritizing the necessary improvement in the shop floor.

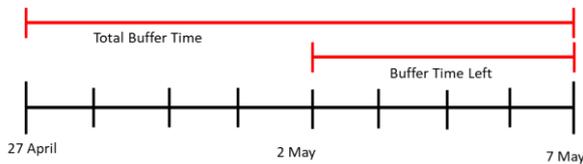The figure below depicts the concept of buffer time management:

Figure 1. Buffer Time Management

Buffer time left depleted as each day it passes, the percentage of buffer time remaining each day can be calculated as [2]:

$$\% \, buffer \, time \, left = \frac{Days \, left \, of \, buffer \, time}{Total \, buffer \, time} \times 100\%. \quad (3)$$

2.9 Dashboard Systems

A good dashboard can provide a unique and powerful means to present information, that affects the user's productivity and efficiency [11]. Dashboards are a visual digital display containing key measures and important selected information essential to achieve company's goals and objectives [11]. Dashboards allow the manager to monitor the contribution of the various departments in their company by providing information in a graphical form and other elements such as charts, tables, and gauges. These elements cut the time needed to analyze the data inside the database, thus makes a faster decision-making process to the manager.

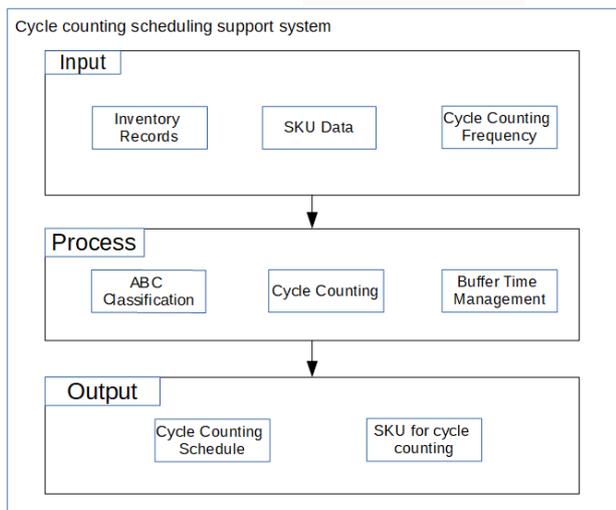## III. RESEARCH METHODOLOGY

3.1 Conceptual Model

Figure 2. Conceptual Model

The Figure above shows all the necessary data to conduct the research, the data inputs are:

1. SKU data, consisting of Item Category, Item Code, and Unit Cost

2. Inventory Records, consisting date last stock count, and number of items

3. Cycle Counting Frequency, are determined by the management, to calculate days left before the next stock count.

For the procedure:

1. By using ABC Analysis, it classifying the items into class A, B, or C based on their value

2. Cycle Counting, after classifying the stock items, it decides which item are going to be checked in a determined cycle counting frequency from the management.

3. Applying buffer time management into the Cycle counting Process.

As for output of the system are:

1. Up to date cycle counting schedule.

2. Suggested SKU to be checked for next cycle counting.
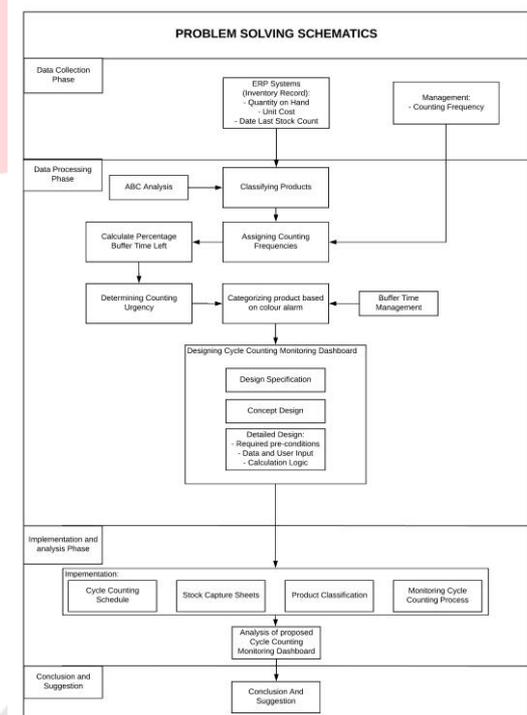
3.2 Problem Solving Schematics

Figure 3. Problem solving schematics

3.3 Classifying Products

Product classification is the first step on doing cycle counting, the method that will be used to classify the product is by using ABC Classification method.

By using the equation (1), and equation (2) and classifying the items. This is the results:

Table 2. ABC Classification

Category	Stock Code	Warehouse	Quantity On Hand	Unit Cost (Rp)		Stock Value (Rp)		Stock Value (Transformed)	ABC Class
Cocoa Butter	DF 200_25	MGR	442	Rp	40,000,000.00	Rp	17,680,000,000.00	1.000	C
Cocoa Butter	DF 100	MGR	358	Rp	40,000,000.00	Rp	14,320,000,000.00	0.810	B
Cocoa Powder	DF 700-11M_60D	MGR	553	Rp	7,500,000.00	Rp	4,147,500,000.00	0.234	A
Cocoa Mass	DF 300_20	MGR	119	Rp	31,000,000.00	Rp	3,689,000,000.00	0.208	A
Cocoa Mass	DF 3200	MGR	104	Rp	31,000,000.00	Rp	3,224,000,000.00	0.182	A
Cocoa Powder	DF 720-11	MGR	332	Rp	7,500,000.00	Rp	2,490,000,000.00	0.140	A
Cocoa Butter	DF 102	MGR	46	Rp	40,000,000.00	Rp	1,840,000,000.00	0.103	A
Cocoa Butter	DF 200_15	MGR	32	Rp	40,000,000.00	Rp	1,280,000,000.00	0.072	A
Cocoa Powder	PD 4011	MGR	168	Rp	7,500,000.00	Rp	1,260,000,000.00	0.070	A
Cocoa Mass	C.MASS NATURAL_20	MGR	39	Rp	31,000,000.00	Rp	1,209,000,000.00	0.068	A
Cocoa Powder	PD 3011	MGR	10	Rp	7,500,000.00	Rp	75,000,000.00	0.003	A
Cocoa Powder	DF 700-11SUT_25	MGR	3	Rp	7,500,000.00	Rp	22,500,000.00	0.000	A
Cocoa Powder	DF 8GY-11	MGR	3	Rp	7,500,000.00	Rp	22,500,000.00	0.000	A
Cocoa Powder	DF 720-11BR	MGR	3	Rp	7,500,000.00	Rp	22,500,000.00	0.000	A
Cocoa Powder	DE 5000-11_25	MGR	2	Rp	7,500,000.00	Rp	15,000,000.00	0.000	A

From the table above, it shows that the category A has the highest sum stock value with Rp.36,756,000,000.00, followed with category B with sum of stock value

Rp.14,320,000,000.00 and category C with Rp.17,680,000,000.00.

3.4 Assigning counting frequency

The counting frequency is allocated at each category that are already determined by management. Respectively, the classification that being used for counting frequencies are ABC Classification. The counting frequency information from table below then allocated to each SKU based on their classification.

Table 3. Counting Frequency

Category	Stock Code	ABC Class	Count Frequency
Cocoa Butter	DF 200_25	C	Quarterly
Cocoa Butter	DF 100	B	Monthly
Cocoa Powder	DF 700-11M_600	A	Weekly
Cocoa Mass	DF 300_20	A	Weekly
Cocoa Mass	DF 3200	A	Weekly

3.5 Calculate Percentage Buffer Time Left

To calculate percentage buffer time left, there several steps that needs to be done first, it needs to calculate stock count due date, the stock count due date is gathered from the sum of Last Date Stock Count with days between count from counting frequency. After that by using equation (3) the result of percentage buffer time left can be found. Here is the part of the result of percentage buffer time left:

Table 4. Calculate percentage buffer time left

Category	Stock Code	Count Frequency	Days Between Count	Date Last Stock Count	Stock Count Due Date	Days Left	%Buffer Time Left
Cocoa Mass	DF 300_20	Weekly	7	1-Jan-18	8-Jan-18	1	14.29%
Cocoa Mass	DF 3200	Weekly	7	4-Jan-18	11-Jan-18	4	57.14%
Cocoa Powder	DF 720-11	Weekly	7	1-Jan-18	8-Jan-18	1	14.29%
Cocoa Powder	DF 705-11	Weekly	7	7-Jan-18	14-Jan-18	7	100.00%
Cocoa Butter	DF 102	Weekly	7	1-Jan-18	8-Jan-18	1	14.29%

3.6 Determine Counting Urgency

After determining the percentage of buffer time left, the result then can be classified for the counting urgency. The conditions of counting urgency are:

Table 5. Determining Count Urgency

Counting Urgency	%Buffer time left
Low	>=66.66%
Medium	<66.66%
High	<33.33%
Critical	<0%

3.7 Categorize product based in color code

After determining the counting urgency, the classification using buffer time management can begin. Buffer time management classifies the product by visualizing the item with the color codes [10].
The conditions for categorizing the items are:

Table 6. Categorization based on color code

Counting Urgency	Colour Code
Low	Green
Medium	Yellow
High	Red
Critical	Black

Here is the part of the result categorizing the product.

Table 7. Categorization Result

Category	Stock Code	Count Frequency	Days Between Count	Date Last Stock Count	Stock Count Due Date	Days Left	%Buffer Time Left	Count Urgency
Cocoa Powder	DF 705-11	Weekly	7	7-Jan-18	14-Jan-18	7	100.00%	Low
Cocoa Butter	DF 102	Weekly	7	1-Jan-18	8-Jan-18	1	14.29%	High
Cocoa Mass	DF 304_20	Weekly	7	1-Jan-18	8-Jan-18	1	14.29%	High
Cocoa Powder	DF 700-11BR	Weekly	7	4-Jan-18	11-Jan-18	4	57.14%	Medium
Cocoa Powder	DF 700-11M_600	Weekly	7	7-Jan-18	14-Jan-18	7	100.00%	Low
Cocoa Mass	DF 300_20	Weekly	7	1-Jan-18	8-Jan-18	1	14.29%	High
Cocoa Mass	DF 3200	Weekly	7	4-Jan-18	11-Jan-18	4	57.14%	Medium
Cocoa Powder	DF 720-11	Weekly	7	1-Jan-18	8-Jan-18	1	14.29%	High

3.8 Designing Cycle Counting Monitoring Dashboard

There are several steps to designing the application in excel macros VBA.

1. Design Specification

There are several requirements on Cycle Counting Monitoring Dashboard:
- As a standalone application, where it is used only by the end user.
- Aid the end user on scheduling the activity for the cycle counting
- Monitor the condition of item.
- Allowing the user to update the number of stock items.
- Warn the user when the due date to do cycle count is near.
- Perform the calculation to classify the item automatically and attach the classification into each of stock item.
- Aid the user to compile the stock capture sheets.
- Provide the user with the summary of the calculation in the form of dashboard visual display.
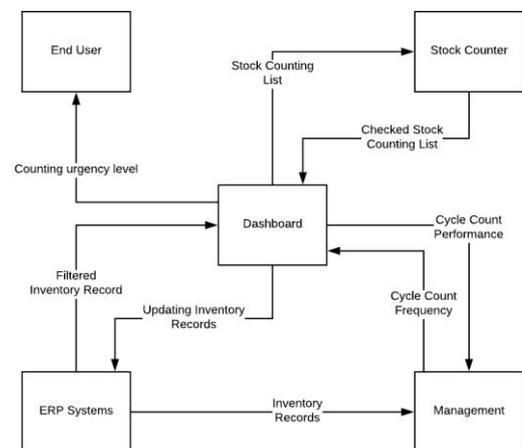
2. Concept Design

Figure 4. Concept Design

The concept design is based on the design by JP Broodryk, This is the proposed data flow for cycle counting scheduling, there are two sources of input here, the ERP systems and the Management.

The ERP Systems provides the inventory records in the form of raw data, because there are some field of unnecessary data to the dashboard, therefore the unnecessary data will be filtered and then the filtered information will be sent to the dashboard. As for the Management, it provides the cycle count frequency that calculated based from ERP System's inventory records to the dashboard that later will be used on classifying the stock items. After all the information required

are gathered, then the items are classified into A, B, or C according to the classification calculation. After the classification , the next step is calculate the remaining time scheduled to each SKU. The result will be used on determining the counting urgency and will be summarized in the form of bar graph. The end process will resulting a dashboard that will be used for monitoring. The result on the dashboard then will be used on the makings of the stock capture sheets, the stock capture sheet then will be used by the stock counter and then sent the result back where the user will input the updated data again. The updated data will be send into the ERP systems, and then will be reported again to the manager for future decision and calculating on counting frequency.

3. Detailed Design

Any application that being developed always requires an input, and then processed, resulting an output. While that is the basic model for an application, there is always an external factor that directly or indirectly influencing these process [12]. There is supporting systems from the company that enhances the overall input, process, and the output. Also, there is several environmental factors that needs to be accounted to ensure the success of the systems, Therefore the systems will be describes as the figure below:
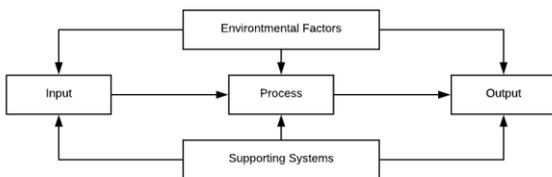

Figure 5. Input-Process-Output

- Inputs:
  o Microsoft Excel (2010/2013/2016)
  o Inventory Records from ERP Systems

- Process:
  o Proper Module Calculations
  o Accurate Classification of data

- Output:
  o Product Classification
  o Cycle Counting Schedule
  o Stock Capture Sheets
  o User Friendly interfaces

4. Calculation Logic

After the required data are gathered, the calculation and prototyping will be done on Microsoft Excel Macros VBA. The result will only show the summarize result from the calculation on the Microsoft excel and then being shown on the macros VBA.

There are several calculations that needs to be done in Microsoft Excel formula before the model can be produced.

o Stock Value
$$= Unit\ Cost\ \times Quantity\ on\ Hand$$

o Stock Value Transformed $= \frac{SKU\ Value - Min\ value}{Max\ Value - Min\ Value}$

o ABC Classification
=IF (Stock Value <500,"D", IF(Stock Value Transformed<0.8,"A", IF(Stock Value Transformed<0.95,"B","C")))

o Counting Frequency
=IF(ABC Class ="A","Weekly",IF(ABC Class="B","Monthly",IF(ABC Class ="C","Quarterly","Special")))

o Days Between Count
=IF(ABC Class="A",7, IF(ABC Class="B",30, IF(ABCClass="C",91,"Special value")))

o Stock Count due Date
= Date Last Stock Count+Days Between Count

o Days Left
=Stock Count Due Date – Current Date

o Percentage Buffer Time Left
$$= \frac{Days\ left\ of\ buffer\ time}{Total\ buffer\ time} \times 100\%$$

o Counting Urgency
=IF(%Buffer Time Left<0%,"Critical", IF(%Buffer Time Left<33.33%,"High", IF(%Buffer Time Left<66.66%,"Medium","Low")))

The result of these calculation will be used to determine the counting urgency to each SKU. Each SKU then will be categorized into one of the color codes based on counting urgencies and % Buffer time left calculation.

Table 8. Categorization based on counting urgency and % buffer time left

Colour Code	Counting Urgency	%Buffer time left
Green	Low	>=66.66%
Yellow	Medium	<66.66%
Red	High	<33.33%
Black	Critical	<0%

After each SKU has been categorized into one of the four categories above, the results will be shown in the form of bar graph that shows the number of SKUs for each category, and all the results will be summarized in the proposed dashboard. The figure below shows the example of bar graph that categorize the SKU.
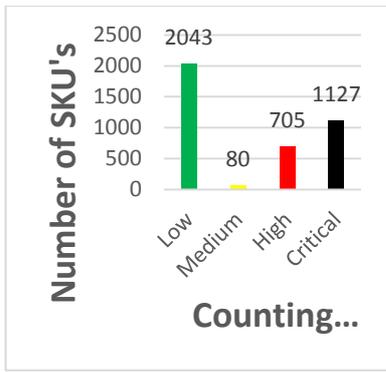
Figure 6. Bar Graph Example

IV. IMPLEMENTATION

4.1 Layout of the Dashboard

Here is the layout of the Cycle Counting Monitoring Dashboard, this dashboard below shows only the necessary data that could only be seen by the user, which are: Category, Stock Code, Location, ABC Class, Date Last Stock Count, Days Left, Counting Urgencies, and percentage buffer time left and print marks. The dashboard shows the Main Function Form, Calendar, Color sorting, and the print table. It also shows the Summarized Counting Frequencies bar graph which shows the sum of categorized item in each category based on buffer management concept where (Low = Green, Medium = Yellow. High = Red, Critical = Black). This categorization is from the result of percentage buffer time left and counting urgency.
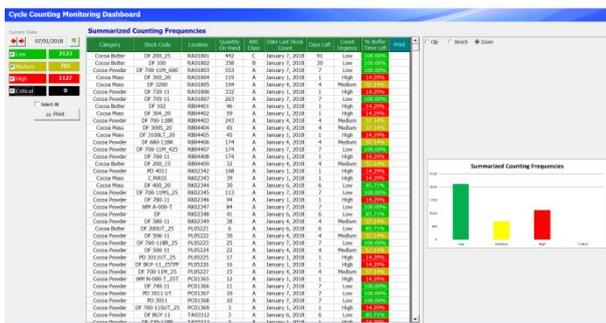

Figure 7. Layout of the Dashboard

1. Main Function Form

   This picture figure below is the Main control of the dashboard, from here the user can see date calendar, number of SKUs in color sorting, and print button for printing the counting sheets.
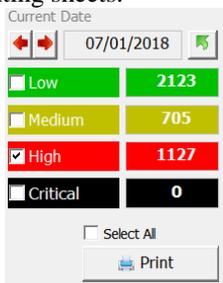

Figure 8. Main Function form

2. Calendar

If the user pushes the button, it will change the dates of the calendar, user also can change the Date, Month, and Year by presing button to open up the calendar.

Figure 9. Calendar

3. Color Sorting

By pressing the check list mark, it will only shows the respective data.

Figure 10. Color Sorting

Category	Stock Code	Location	Quantity On Hand	ABC Class	Date Last Stock Count	Days Left	Count Urgency	% Buffer Time Left
Cocoa Mass	DF 300_20	RA01804	119	A	January 1, 2018	1	High	14.29%
Cocoa Powder	DF 720-11	RA01806	332	A	January 1, 2018	1	High	14.29%
Cocoa Butter	DF 102	RB04401	46	A	January 1, 2018	1	High	14.29%
Cocoa Mass	DF 304_20	RB04402	59	A	January 1, 2018	1	High	14.29%
Cocoa Mass	DF 3100LT_20	RB04405	45	A	January 1, 2018	1	High	14.29%
Cocoa Powder	DF 760-11	RB04408	174	A	January 1, 2018	1	High	14.29%
Cocoa Powder	PD 4011	RK02342	168	A	January 1, 2018	1	High	14.29%
Cocoa Mass	C.MASS	RK02343	39	A	January 1, 2018	1	High	14.29%
Cocoa Powder	DF 780-11	RK02346	94	A	January 1, 2018	1	High	14.29%
Cocoa Powder	PD 3011UT_25	PL05225	17	A	January 1, 2018	1	High	14.29%
Cocoa Powder	DF BGY-11_25TPF	PL05226	16	A	January 1, 2018	1	High	14.29%
Cocoa Powder	WM N-000-T_25T	PC01365	12	A	January 1, 2018	1	High	14.29%
Cocoa Powder	DF 700-11SUT_25	PC01369	3	A	January 1, 2018	1	High	14.29%
Cocoa Powder	DF 720-11BR	TA03313	3	A	January 1, 2018	1	High	14.29%

Figure 11. Color sorting result

4. Print

By marking the items on the print cell and pushing the Print button, it will put the marked items into the Stock Capture Sheets.

Category	Stock Code	Location	Quantity On Hand	ABC Class	Date Last Stock Count	Days Left	Count Urgency	% Buffer Time Left	Print
Cocoa Butter	DF 200_25	RA01801	442	C	January 7, 2018	89	Low	97.80%	
Cocoa Butter	DF 100	RA01802	358	B	January 7, 2018	28	Low	93.33%	
Cocoa Powder	DF 700-11M_600	RA01803	553	A	January 7, 2018	5	Low	71.43%	
Cocoa Mass	DF 300_20	RA01804	119	A	January 1, 2018	-1	Critical	-14.29%	●
Cocoa Mass	DF 3200	RA01805	104	A	January 4, 2018	2	High	28.57%	●
Cocoa Powder	DF 720-11	RA01806	332	A	January 1, 2018	-1	Critical	-14.29%	●
Cocoa Powder	DF 705-11	RA01807	263	A	January 7, 2018	5	Low	71.43%	
Cocoa Butter	DF 102	RB04401	46	A	January 1, 2018	-1	Critical	-14.29%	●
Cocoa Mass	DF 304_20	RB04402	59	A	January 1, 2018	-1	Critical	-14.29%	●
Cocoa Powder	DF 700-11BR	RB04403	243	A	January 4, 2018	2	High	28.57%	●
Cocoa Mass	DF 300S_20	RB04404	45	A	January 4, 2018	2	High	28.57%	●
Cocoa Mass	DF 3100LT_20	RB04405	45	A	January 1, 2018	-1	Critical	-14.29%	●
Cocoa Powder	DF 680-11BR	RB04406	174	A	January 4, 2018	2	High	28.57%	●
Cocoa Powder	DF 700-11M_425	RB04407	174	A	January 7, 2018	5	Low	71.43%	
Cocoa Powder	DF 760-11	RB04408	174	A	January 1, 2018	-1	Critical	-14.29%	●
Cocoa Powder	DF 200_15	RB04409	32	A	January 4, 2018	2	High	28.57%	●
Cocoa Powder	PD 4011	RK02342	168	A	January 1, 2018	-1	Critical	-14.29%	●

Figure 12. Marking Print Cell

Figure 13. Printing Result in PDF

4.2 Monitor Cycle Counting Process

Monitoring is a supervising activity to keep the activity on schedule to meets the objectives and performance target [13].

The assumptions were made that the company management must allocate the specific cycles to each category of items based on ABC classification. By assigning different cycles to each category, it provides the means of grouping SKUs into counting urgency categories. Which in turn can be used on the monitoring dashboard. Dashboard itself is a combination of different reports that gives a quick summary of business performance in charts, indicator, or color coded maps all in one page or view [14].

The main dashboard will provide the summarized data. And act as the main counting schedule monitoring system. Starting from here, several actions could be taken to further investigate the current state of the cycle counting schedule or to produce stock capture sheets.
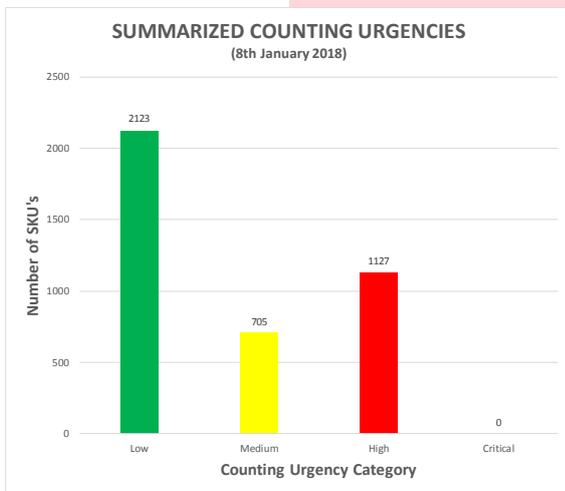
The main dashboard will show a bar graph like below:

Figure 14. Summarized counting urgencies at 8th January 2018

This figure shows the counting urgencies in 8th January, there are several findings that shown from this bar graph, if there is no black or red SKU's graph on it, it indicates that the counting capacity of the company is too high (too many workers performing cycle counts), or cycle times decided by management still incorrect, or the workers efficiencies are not on standard.
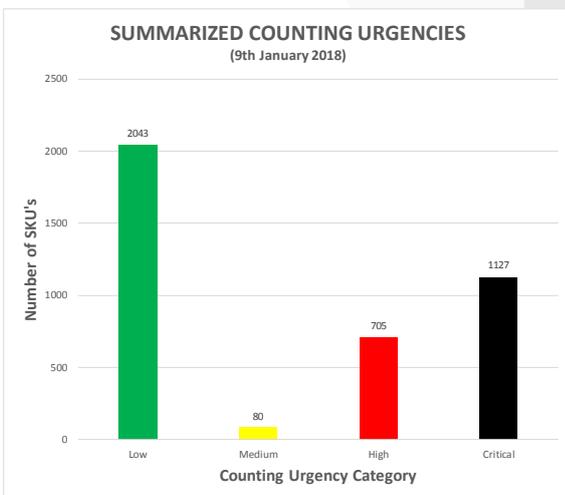

Figure 15. Summarized counting urgencies at 9th January 2018

This figure shows the summary of counting urgencies at the next day (9th January). From this graph, it shows that the black graph or the red graph is present, it indicates that the company has a lack of counting capacity (few workers performing cycle counting) or the cycle times decided by management is still incorrect and the daily cycle counting list are too long.
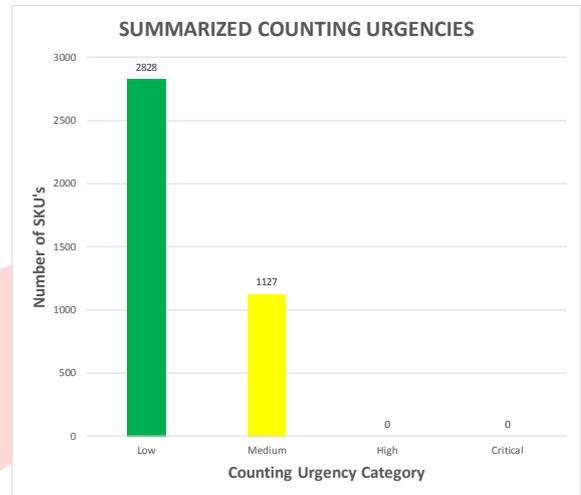

Figure 16. Ideal Summarized counting urgencies

The ideal graph is only shows the Yellow and green graphs, it means that the company did the cycle counting activity right.

4.3 Cycle Counting Schedule

The schedule for cycle counting is shown by the monitoring dashboard where it shows how many days left before the next cycle counting will be performed, this information can help the user to determine which item to be counted first and be put on stock capture sheets.

Date Last Stock Count	Days Left	Count Urgency	% Buffer Time Left
January 1, 2018	1	High	14.29%
January 1, 2018	1	High	14.29%
January 1, 2018	1	High	14.29%
January 1, 2018	1	High	14.29%
January 1, 2018	1	High	14.29%

Figure 17. Cycle Counting Schedule

4.4 Product Classification

The result of calculation on Product classification based on ABC Analysis are shown on dashboard layout, it also includes the categorization based on the color code, the color is shown on % Buffer Time Left Cells, the color of the each item will tell the user on how the condition of each item is.

Category	Stock Code	Location	Quantity On Hand	ABC Class	Date Last Stock Count	Days Left	Count Urgency	% Buffer Time Left
Cocoa Butter	DF 200_25	RA01801	442	C	January 7, 2018	91	Low	100.00%
Cocoa Butter	DF 100	RA01802	358	B	January 7, 2018	30	Low	100.00%
Cocoa Powder	DF 700-11M_600	RA01803	553	A	January 7, 2018	7	Low	100.00%
Cocoa Mass	DF 3200	RA01805	104	A	January 4, 2018	4	Medium	57.14%
Cocoa Powder	DF 705-11	RA01807	263	A	January 7, 2018	7	Low	100.00%
Cocoa Powder	DF 700-11BR	RB04403	243	A	January 4, 2018	4	Medium	57.14%
Cocoa Mass	DF 300S_20	RB04404	45	A	January 4, 2018	4	Medium	57.14%

Figure 18. Product Classification Result

4.5 Stock Capture Sheets

This stock capture sheets is a shortened or simplified list of stock of items that are going to counted, the items that going to the list are usually from the Red or Black zone.

Here is the example of stock capture sheets that are going to be used by the worker:

Stock Capture Sheet						
Counter:	Eriko Mahtamtama					
Warehouse:	MGR					
Shift:	2		9th January 2018			
No	Category	Stock Code	Location	Recorded quantity	Physical Count	Variance	Notes
1	Cocoa Mass	DF 300_20	RM03106	1	1	0	
2	Cocoa Mass	DF 3200	RM03107	1	1	0	
3	Cocoa Powder	DF 720-11	RM03108	1	1	0	
4	Cocoa Powder	DF 705-11	RM03109	1	1	0	
5	Cocoa Butter	DF 102	RM03110	1	2	1	double items
6	Cocoa Mass	DF 304_20	RM03111	1	1	0	
7	Cocoa Powder	DF 700-11BR	RM03112	1	1	0	
8	Cocoa Mass	DF 300S_20	RM03113	1	1	0	
9	Cocoa Mass	DF 3100LT_20	RM03114	1	0	-1	wrong location, at RM03110
10	Cocoa Powder	DF 680-11BR	RM03115	1	1	0	
11	Cocoa Powder	DF 700-11M_425	RM03116	1	1	0	
12	Cocoa Powder	DF 760-11	RM03117	1	1	0	
13	Cocoa Butter	DF 200_15	RM03118	1	1	0	

Figure 19. Stock Capture Sheet

V. CONCLUSION

From the development of cycle counting monitoring dashboard, a conclusion can be drawn:

1. Classifying each of SKU

It classifies the each types of SKU into A,B, or C Class using ABC Analysis. It is also categorize the product based on their counting urgency where the products are categorized into color types either Green (Low), Yellow (Medium), Red (High), and Black (Critical).

2. Monitoring Dashboard

The cycle counting monitoring dashboard are able to :

- Perform cycle counting process .

- Displaying Urgency Level.

- Displaying item classification.

- Displaying the summary graph of items.

- Set up cycle counting schedules.

- Aid the user on selecting SKUs to put in the stock capture sheet.

The key on keeping the module consistent is by keeping the inventory record up-to date from the ERP software. By keeping the inventory records consistent. It is expected that the inventory record accuracy can be improved.

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