PROCEEDING

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Universitas Kristen Petra

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Methods Improvement for Manual Packaging Process

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Abstract: This article discusses the methods improvement in packaging department at traditional herbal pharmacy company. In this department, all processes are still done manually using human power, consist of labeling process, pillbox packaging process, and dozen packaging process. The consequence, a good standard method should be needed to do these processes. The Two-Hand Process Chart and micromotion study are used to analyze the present method. Based on this analysis, the methods improvement is done to find a better method to do the packaging process. The improvements include the revision of hand motions that are categorized as ineffective motion in each process and the design of temporary box as a tool for dozen packaging process. Experiments of the proposed method showed the cycle time reduction of labeling is 0.64 seconds (28%) per bottle and the combination of pillbox and dozen packaging is 17.46 seconds (25.83%) per dozen.

Keywords: Packaging process, two-hand process chart, micromotion study, methods improvement

Introduction

Almost all areas in manufacturing industries need work methods improvement to do their activity in a better way. In most cases, work methods or methods study or methods engineering is referring to a technique for increasing the production per unit of time or decreasing the cost per unit output – in other words, productivity improvement (Freivalds and Niebel [2]). The field of work methods consists of the analysis and design of tasks of jobs involving human work activity (Groover [3]). Work methods is the systematic examination of the methods of carrying on activities so as to improve the effective use of resources and set up standards of performance for the activities being carried out (ILO [4]). Thus, work methods includes examining the way an activity is being carried out, simplifying or modifying the method of operation to reduce unnecessary or excess work, and setting up a time standard for performing the activity.

This research is conducted in packaging department at traditional herbal pharmacy company. The packaging department in this company has responsibility to give external packaging after the pills is filled into a bottle. This department has the longest time to conduct their processes among the other departments. Hence, the improvement in this department will affect to the number of finished product. This department has three processes. They are labeling process, pillbox packaging process, and dozen packaging process. All operators of each process do the task manually using their hands. Based on early observation, all operators have their own methods to do the process, because this department still did not have a standard method to do the process. Thus, the number of output are very various among the operators. This situation make the company could not maximize their production capacity. This research aims to analyze the present work methods of operators in each process and do the improvements to find a good standard method of each process.

Methods

The Nature of Work

Groover [2] define work as an activity in which a person physical and mental effort to accomplish a given task or perform a duty. Furthermore, Groover describes the pyramidal structure of work. Work consists of tasks. A task is an amount of work that is assigned to a worker. Each task consists of several work elements, and each work element consists of basic motion elements. Basic motion elements are actuations of the limbs and other body parts while engaged in performing the task. In this research, basic motion elements are used to analyze the work methods of operators, because the motion of two hands will be observed in detail.

Motion and Micromotion Study

Motion study is the careful analysis of body motion employed in doing a job. The purpose of motion study is to eliminate or reduce ineffective movements, facilitate and speed effective movements. Because of the limitation of human eye, ear, and hand to record real-time data and analyze short cycle jobs, enforce the development of motion picture studies using

video camera, known as micromotion study. In other words, micromotion study is motion study using video camera. Micromotion study is a detailed recording of the motions involved in performing a job (Mundel [5]). The detailed breakdown of micromotion study is designed for routine application to short cycle jobs, which involve mainly hand motions. Micromotion study and motion study are recorded on a Two-Hand Process Chart using therblig elements. Micromotion study is used in this research, because the hand motion of operators are very fast and only need short cycle time to do the processes.

Frank B. Gilbreth, in his early work in motion study, developed certain subdivisions or events which he thought common to all kinds of manual works. He coined the word "Therbligs", which refer to 17 elementary subdivisions or basic motions (Barnes [1]). The Therbligs can be either effective or ineffective. Effective therbligs directly advance the progress of the work. They can frequently be shortened, but typically cannot be completely eliminated. Ineffective therbligs do not advance the progress of the work and should be eliminated if possible. Table 1 shows the 17 therbligs along with their definitions and symbols.

Table 1. Gilbreth's Therbligs

Therblig	Symbol	Description	Category
Reach	RE	Motion of empty hand to or from object	Effective
Move	M	Movement of loaded hand	Effective
Grasp	G	Closing fingers around an object	Effective
Release	RL	Relinquishing control of object	Effective
Preposition	PP	Positioning object in predetermined location for later use	Effective
Use	U	Manipulating tool for intended use	Effective
Assemble	A	Bringing two mating part together	Effective
Disassemble	DA	Opposite of Assemble	Effective
Search	S	Eyes or hands groping for object	Effective
Select	SE	Choosing one item from several	Ineffective
Position	P	Orienting object during work	Ineffective
Inspect	I	Comparing object with standard	Ineffective
Plan	PL	Pausing to determine next action	Ineffective
Unavoidable Delay	UD	Beyond the operator's control due to the nature of the operation	Ineffective
Avoidable Delay	AD	Operator solely responsible for idle time	Ineffective
Rest to Overcome Fatigue	R	Appears periodically, not every cycle, depends on the physical workload	Ineffective
Hold	H	One hand supports object while other does useful work	Ineffective

(Source : Adapted from Freivalds and Niebel)

Two-Hand Process Chart

The Two-Hand Process Chart is a motion study tool. This chart shows all movements and delays made by the right and left hands, and the relationships between them (Freivalds and Niebel [2]). The purpose of this chart is to identify inefficient motion patterns. Once the Two-Hand Process Chart has been completed for present method, the improvements could be introduced. This chart facilitates changing a method so that a balanced two-handed operation can be achieved that keeps both delays and operator fatigue to a minimum.

Results and Discussion

Labeling Process

After the filling process of the pills into a bottle, the next process is labeling. Labeling process is a process to attach product label to each bottle. The label is made from plastic, which shows the brand name of the medicine, ingredients, and other information about the medicine. Operators take the label and attach it to the outside of the bottle, then place the labeled bottle into the basket. After the basket is full, operators transport is to shrink machine for drying up the label at certain temperature. The machine runs automatically, thus the analysis of motions is stopped at the placement of labeled bottle into the box. There are six operators in this process. Early observation showed those six operators used three different methods. The analysis is focused on three operators with three different methods using Two-Hand Process Chart. Figure 1 shows the Two-Hand Process Chart of operator who has minimum cycle time and the best work methods to conduct the process among the others. The cycle time of the present method is 2.29 seconds per bottle. The analysis and improvement of the hand motions (as shown in Figure 1) are described as follows:

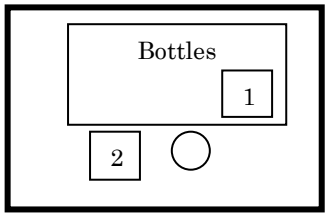
- Hold motions of the left hand (see the circled mark) in total amount of 1.39 seconds (61% of cycle time) are unnecessary, because they are

TWO-HAND PROCESS CHART

Operation	: Labeling Process
Department	: Packaging
Number	: 01
Analyst	: Herry
Date	: 10 October 2012

Present

Proposed



1 : Labels on table

2 : Basket on chair

: Operator

Left Hand	Dist. (cm)	Time (seconds)	Symbol		Time (seconds)	Dist. (cm)	Right Hand
Get bottle	10	0.5	RE,G, M	Re,G, M	0.5	10	Get label
Hold bottle, Hold label (help to open the label)	-	0.84	H	M, U	0.84	-	Open label
Hold bottle (the bottle cap position on the top)	-	0.55	H	M, P, RL, A	0.55	10	Assemble label into the bottle (push down the label into the bottle)
Put bottle into the basket	15	0.4	M, RL	RL	0.4	-	Release bottle
Total	25	2.29			2.29	20	

Summary	
Cycle time	2.29
Piece per cycle time	1
Time per unit	2.29

Figure 1. Two-Hand Process Chart of labeling process before improvement

ineffective motions and could be eliminated. Hold motion of bottle could be replaced with use motion to help the other hand to do the assembling process. Hold motion of label could be eliminated because the operator only needs one hand to open the label.

- It is better that the operator uses the right hand to get and assemble the bottle and label, because the right hand of operator has more energy than the left hand.
- The direction of the assembling position should be changed from bottle cap position on the top into opposite direction. The idea is based on gravity principle. Hence, the energy that uses to assemble the label and the bottle is less. Based on this improvement, the assembling process is conducted with all two hands at once. The left hand push the label up, and at the same time the right hand push the bottle down. Thus, the assembling process could be done easier and faster. Figure 2 shows the change direction of the position of bottle before and after improvement.
- The position of the basket at the left side of operator (see the layout in Figure 1) makes the operator is rather difficult to do the release motion. To do this motion, the parts of hand that are used by operator include finger, wrist, and lower arm. Also, the lower arm rotates to the left direction, not in neutral posture. It is an extreme motion. Operator uses more energy to do this motion and she will be exhausted earlier. It is better if the basket is placed on the table. Thus, the parts of hand that are used by operator include finger and wrist, and the rotation motion is not necessary.

The motions of the proposed method are recorded on Two-Hand Process Chart. Figure 3 shows both right and left hand motions of labeling process after improvement. It could be seen, the motions of both hands are effective, except position motion in the

right hand. However, it is not a problem because this motion is only for a short time. The cycle time of the proposed method is 1.69 seconds per piece. The proposed method could reduce cycle time 0.6 seconds per piece compare to the present method.

Pillbox and Dozen Packaging Process

After the labeled bottle is dried out in shrink machine, the next process is pillbox packaging process. Pillbox packaging process is a process to put the labeled bottle into the pillbox. Operators get the labeled bottle and product leaflet and put both of them into the pillbox, then placed the pillbox to the basket. After the basket is full, operators transport it to dozen packaging process. There are six operators in this process. Those six operators used three different methods. The analysis is focused on three operators with three different methods using Two-Hand Process Chart. Figure 4 shows the Two-Hand Process Chart of operator who has minimum cycle time and the best work method to conduct the process among the others. The cycle time of present method is 3.51 seconds per piece or 42.12 seconds per dozen.

The next process is dozen packaging process. At this process, operators put the pillbox one by one until 12 pillboxes and then the brochure into the dozen plastic packaging. Then, operators transport them to shrink machine for drying up the plastic at certain temperature. The drying up process using shrink machine is excluded from hand motion analysis. There are three operators in this process. Those three operators used two different methods. The analysis is focused on two operators with two different methods using Two-Hand Process Chart. Figure 6 shows the Two-Hand Process Chart of operator who has minimum cycle time and the best work method to conduct the process among the others. The cycle time of present method is 17.26 seconds per dozen.

The main idea of the improvements is to combine both processes become one work station, because the transportation from pillbox packaging process to dozen packaging process is not necessary and should be eliminated. Therefore, the improvements are based on the combination of both processes. The analysis and improvements of both processes are described as follows:

- Hold some leaflets of the left hand along the process (see the circled mark in Figure 4 and Figure 5) are not necessary, because those motions delay the left hand of operator to do other motions. Operator could not optimize her left hand. The other unnecessary motion is the move motion of the right hand to get one leaflet from the left hand. Those unnecessary motions are nonproductive and make this process could not be finished faster. Thus, hold leaflets motion should be eliminated in order to optimize and balance the using of both hands. The improvement that should be done is the right hand gets the leaflet first, then the bottle, and at the same time, the left hand gets the pillbox.
- To eliminate the unnecessary transportation, a temporary box (the box) has been designed as a tool to place the pillbox for temporary. The basket for placing the pillboxes is not necessary. After operator put the labeled bottle into the pillbox, then place the pillbox into the box. The box is made from acrylic, which its material is very elastic. Thus, operator could easily place the pillboxes into the box and easily move the pillboxes from the box to dozen plastic packaging. The box could cover all 12 pillboxes at once. Figure 8 shows the design of the box and its dimension.
- At dozen packaging process, the left hand motion to move one pillbox, while the right hand gets one pillbox from the left hand are unnecessary (see the circled mark in Figure 6). Figure 7 shows more clearly about these motions. These motions occur three times in one work cycle. Besides, there are some unnecessary hold motions in the left hand (Figure 6). These motions are happened because of operator could not put all her hands at once during place the pillboxes into the plastic. When the right hand put the pillbox into the plastic, the left hand should hold the plastic. Therefore, the use of the box would be helpful the operator using her both hands to place the pillboxes easier (Figure 9a). Thus, the hold motion would not be happened again during the placement of the pillboxes. After the placement of one dozen is completed, operator moves the box into the plastic (Figure 9b).

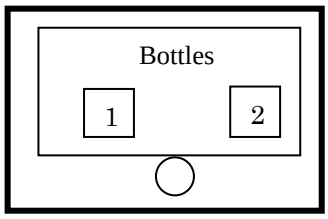
The motions of the proposed method are recorded on Two-Hand Process Chart. Figure 10 shows both left and right hand motions of the proposed method, which combine both pillbox and dozen packaging process. The cycle time of the proposed method is 54.03 seconds per dozen. The proposed method could reduce cycle time 5.35 seconds per dozen compare to the total cycle time of pillbox process and dozen packaging process of the present method. All motions are effective, except two hold motion at the end of work cycle (see the circled mark in Figure 10). The first one occurs around 5 seconds, when operator moves the box into the plastic. The right hand pushes the pillboxes into the plastic, at the same time the left hand hold the plastic (see Figure 9b). The second one occurs around 1.2 seconds, when operator pulls out the box from the plastic.

(a) before improvement

(b) after improvement

Figure 2. The position of bottle before and after improvement

TWO-HAND PROCESS CHART							
Operation : Labeling Process							
Department : Packaging							
Number : 01							
Made by : Herry							
Date : 4 November 2012							

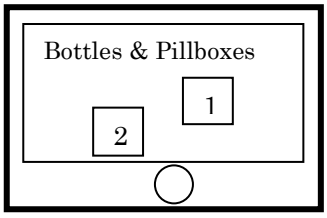


1 : Labels on table
2 : Basket on table
○ : Operator

Left Hand	Dist. (cm)	Time (seconds)	Symbol		Time (seconds)	Dist. (cm)	Right Hand
Get label	10	0.52	RE,G, M	RE,G, M	0.52	10	Get bottle
Open label and assemble (push the label up)	-	0.84	U, A	P, RL, A	0.84	-	Assemble label and bottle (push the bottle down)
Release bottle	-	0.33	RL	M, RL	0.33	10	Put bottle into the basket
Total	10	1.69			1.69	20	
Summary							
Cycle time	1.69						
Piece per cycle time	1						
Time per piece	1.69						

Figure 3. Two-Hand Process Chart of labeling process after improvement

TWO-HAND PROCESS CHART							
Operation : Pillbox Packaging Process							
Department : Packaging							
Number : 02							
Analyst : Herry							
Date : 10 October 2012							



1 : Basket on table
2 : Leaflets on table
○ : Operator

Left Hand	Dist. (cm)	Time (seconds)	Symbol		Time (seconds)	Dist. (cm)	Right Hand
Hold some leaflets	-	0.82	(H)	RE, G	0.43	5	Get bottle
				M, RE, G	0.39	5	Get leaflet from the left hand
Get pillbox, Hold some leaflets	10	0.62	RE, G, M (H)	H	0.62	-	Hold bottle and leaflet
Open pillbox, Hold some leaflets	-	0.61	U (H)	M, P, RL	0.61	5	Put bottle and leaflet into the pillbox
Close pillbox, Hold some leaflets	-	1.05	U (H)	U	1.05	-	Close pillbox
Release pillbox, Hold some leaflets	-	0.41	RL (H)	M, RL	0.41	15	Put pillbox into the basket
Total	10	3.51			3.51	30	

Summary	
Cycle time	3.51
Piece per cycle time	1
Time per piece	3.51

Figure 4. Two-Hand Process Chart of pillbox packaging process before improvement

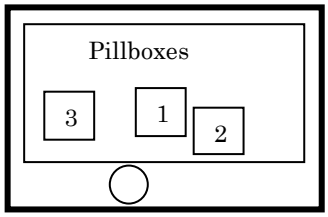
Figure 5. Operator holds leaflets in her left hand along the pillbox packaging process

TWO-HAND PROCESS CHART

Operation	: Dozen Packaging Process
Department	: Packaging
Number	: 03
Analyst	: Herry
Date	: 10 October 2012

■ Present

□ Proposed



1 : Plastics on table

2 : Brochures on table

3 : Piles of dozen packaging

◯ : Operator

Left Hand	Dist. (cm)	Time (seconds)	Symbol		Time (seconds)	Dist. (cm)	Right Hand
Idle	-	0.55	D	RE, G, M	0.55	5	Get plastic
Open plastic	-	1.53	U	U	1.53	-	Open plastic
Hold plastic, split the 2 pillboxes using fingers to the left and right side of plastic	-	3.42	H, U, H	RE, G, M, P, RL	2.48	10	Put 2 pillboxes at once into plastic
				RE, G, M, P, RL	0.94	10	Put 1 pillbox into plastic (at the center side)
Get 1 pillbox and Hold plastic	10	1.02	RE, G, M, H	RE, G, M, P, RL	1.02	10	Put 2 pillboxes into the plastic
Move 1 pillbox to right hand	5	0.88	M, RL	RE, G, M, P, RL	0.88	5	Get 1 pillbox from left hand and put it into the plastic
Get 1 pillbox and Hold plastic	10	0.97	RE, G, M, H	RE, G, M, P, RL	0.97	10	Put 2 pillboxes into the plastic
Move 1 pillbox to right hand	5	0.87	M, RL	RE, G, M, P, RL	0.87	5	Get 1 pillbox from left hand and put it into the plastic
Get 1 pillbox and Hold plastic	10	0.97	RE, G, M, H	RE, G, M, P, RL	0.97	10	Put 2 pillboxes into the plastic
Move 1 pillbox to right hand	5	0.95	M, RL	RE, G, M, P, RL	0.95	5	Get 1 pillbox from left hand and put it into the plastic
Hold packaging	-	3.02	H	RE, G, M, P, RL	3.02	15	Put brochure into the plastic
Move to piles of dozen packaging	20	3.08	RE, G, M, RL	RE, G, M, RL	3.08	20	Move to piles of dozen packaging
Total	65	17.26			17.26	105	

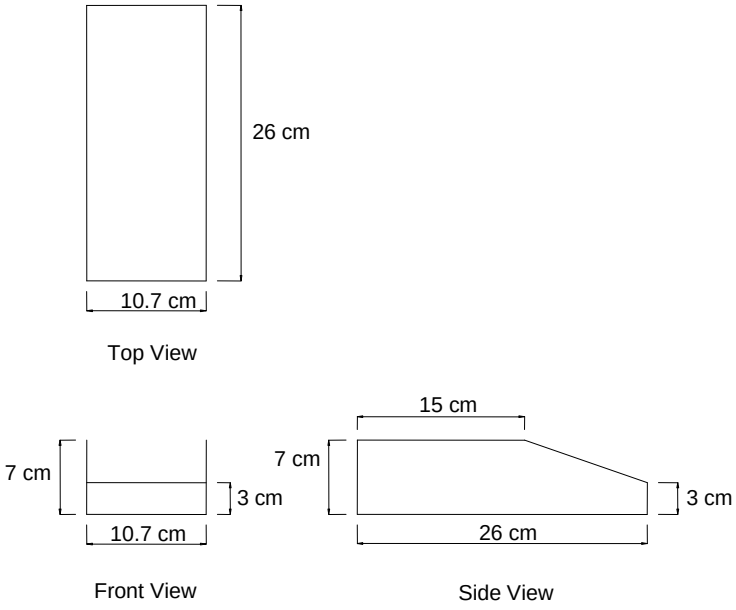
Summary	
Cycle time	17.26
Piece per cycle time	1
Time per piece	17.26

Figure 6. Two-Hand Process Chart of dozen packaging process before improvement

(a) Right hand puts two pillboxes into the plastic

(b) Left hand moves 1 pillbox to right hand

Figure 7. The existing method of dozen packaging process



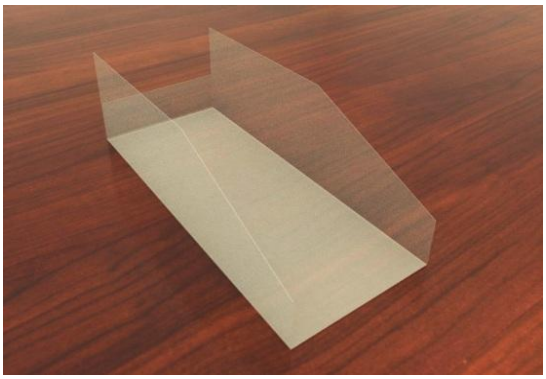


Figure 8. The design of the temporary box and its dimension

(a) Operator places the pillboxes into the box

(b) Operator pushes the pillboxes into the plastic

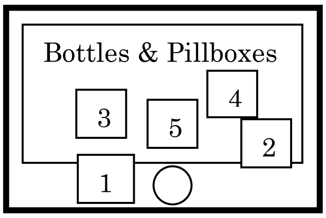
Figure 9. The proposed method of the combination of pillbox and dozen packaging process

TWO-HAND PROCESS CHART

Operation	: Pillbox & Dozen Packaging Process
Department	: Packaging
Number	: 04
Analyst	: Herry
Date	: 5 November 2012

Present

Proposed



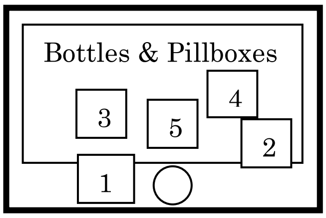
1 : Plastics
2 : Brochures
3 : Piles of dozen packaging
4 Leaflets
5 Temporary box
○ : Operator

Left Hand	Dist. (cm)	Time (seconds)	Symbol		Time (seconds)	Dist. (cm)	Right Hand
Prepare temporary box	-	0.73	RE, G, M	RE, G, M	0.73	5	Get leaflet
Get pillbox	5	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.52	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.6	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.6	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.66	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.69	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle

Figure 10. Two Hand Process Chart of pillbox and dozen packaging process

TWO-HAND PROCESS CHART

Operation	: Pillbox & Dozen Packaging Process	
Department	: Packaging	
Number	: 04	☐ Present
Analyst	: Herry	
Date	: 5 November 2012	■ Proposed



1 : Plastics
2 : Brochures
3 : Piles of dozen packaging
○ : Operator
4 Leaflets
5 Temporary box

Left Hand	Dist. (cm)	Time (seconds)	Symbol		Time (seconds)	Dist. (cm)	Right Hand
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get pillbox	-	0.7	RE, G, M	RE, G, M	0.7	5	Get bottle
Open pillbox	-	0.54	U	P, RL	0.54	-	Put bottle into pillbox
Close pillbox	-	1.52	U	U	1.52	-	Close pillbox
Put pillbox to the box	5	0.67	M, P, RL	RE, G, M	0.67	10	Get leaflet
Get plastic	10	0.98	RE, G, M	RE, G, M, RL	0.98	10	Get and Put brochure
Open plastic	-	1.26	U	U	1.26	-	Open plastic
Hold plastic	-	5	H	RE, G, P, M, RL	5	-	Move pillboxes from box into the plastic

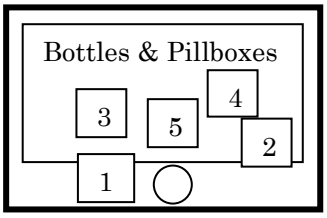
Figure 10. Two Hand Process Chart of pillbox and dozen packaging process (continued)

TWO-HAND PROCESS CHART

Operation	: Pillbox & Dozen Packaging Process
Department	: Packaging
Number	: 04
Analyst	: Herry
Date	: 5 November 2012

Present

Proposed



1 : Plastics
2 : Brochures
3 : Piles of dozen packaging
4 Leaflets
5 Temporary box
: Operator

Left Hand	Dist. (cm)	Time (seconds)	Symbol		Time (seconds)	Dist. (cm)	Right Hand
Hold plastic and pillbox	-	1.18	H	G, M, RL	1.18	-	Pull out the box
Move to piles of dozen packaging	15	3.05	RE, G, M	RE, G, M	3.05	15	Move to piles of dozen packaging
Total	90	54.03			54.03	210	

Summary	
Cycle time	54.03
Piece per cycle time	1 dozen
Time per piece	54.03

Figure 10. Two Hand Process Chart of pillbox and dozen packaging process (continued)

The Experiments Result

In order to know the impact of the proposed method, which are discussed in previous section, the experiments should be conducted for several times. Of course, the operator should practices until she is getting used to the proposed method. These experiments use the same operator with the present method in each process. The experiments of the proposed method are conducted for 30 - 40 times. Then, the cycle time of the experiments result is compared to the cycle time of collection data of the present method. Table 2 shows the comparison of both proposed and present method based on their cycle time and number of operator. The cycle time of labeling process of the proposed method is 1.65 seconds per bottle. It means the proposed method could reduce the cycle time 0.64 seconds (28%) per bottle. Also, the combination of pillbox and dozen packaging could reduce the cycle time 17.46 seconds (25.83%) per dozen. This cycle time reduction could be more, when the transportation time is considered, because the proposed method no need for transportation anymore. Furthermore, the combination of pillbox and dozen packaging could reduce one operator.

Table 2. The result comparison of the proposed and the present method

Process	Present		Proposed	
	Cycle Time	Num. of Operator	Cycle Time	Num. of Operator
Labeling	2.29 sec per bottle	1	1.65 sec per bottle	1
Pillbox Packaging	47.16 sec per dozen	1	50.14 per dozen	1
Dozen Packaging	20.44 sec per dozen	1		

Conclusion

The proposed method of each process is better than the present method because almost all motions of the proposed method in each process are effective and each process of the proposed method needs less cycle time. The proposed method of the labeling process and the combination of pillbox and dozen packaging process reduce the time percentage around 28% per bottle and 25.83% per dozen respectively. Also the number of operator in that combination process is reduced one operator. The proposed method would

be recommended for standard method in packaging department at this company.

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