Redesign of Workstation Layout in Noodle and Sauce Bagging Process

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ABSTRACT

Korat noodle is a very popular product in Thailand. Shortage of this product occurs from time to time due to improper weather and manual work in process. This leads to slow delivery and lose of customers. The objective of this study is to redesign of workstation layout in a small plant which produced instant noodle with sauce using ECRS technique. The goal of redesign workstation layout is improving production speed. The improvement of noodle and sauce bagging process was carried out as follows: 1) eliminate stock of sealed sauce bags on the table and put them in the noodle bags in the next workstation, 2) combine the area of bag stock and the area of bagging noodle and sauce to reduce time and distance in transportation, 3) rearrange workstations to reduce complication of transportation among workstations. The redesign of workstation layout was made since the company wanted to move the process of bagging to the new plant. The results of workstation layout redesign reduced transportation among the workstations from 21.24 m. to 7.19 m. The total reduction of transportation distance was 14.05 m., corresponding to 66.15%. Therefore, it was concluded that ECRS helped reduction of waste and increasing productivity.

Keywords: *Redesign, Layout, Workstation, ECRS*

1. INTRODUCTION

Korat noodle is local food in Korat, Thailand which has been very popular for long time (Chulilung et al., 2019). Its important components are noodle and sweet and spicy sauce. Currently, Korat noodle is made in big and small factories to serve high demand. Therefore, productivity improvement is of importance for those factories. This research has been done in a small factory of Korat noodle. Production of noodle and sauce in this factory is mainly human-based and no automation. Shortage of this product occurred from time to time, especially in raining season since humidity affected texture of noodle. Moreover, most workers were in middle age, resulting in slow production of noodle and sauce bagging. At present, the area of noodle and sauce bagging was crowded and a new plant was considered. Therefore, design of workstation layout was needed. The objective of this study was to redesign workstation layout in bagging process to improve productivity. ECRS is a technique for productivity improvement and consists of elimination, combination, rearranging, and simplification (Freivalds and Niebel, 2014). ECRS has been heavily used to improve productivities by several researchers (Ongkunaruk and Wongsatit, 2014, Narayanan et al., 2016, Sriyom and Chantawee, 2018, Wajanawichakon, 2019).

2. EXPERIMENT

2.1 Method of Noodle and Sauce Bagging

The scope of this study was the improvement of noodle and sauce bagging process. The process of bagging consisted of 10 elements. Firstly, the worker put sauce in small plastic bags and weigh them for a specific weight. Then, she sealed the sauce bags and stored them. Next, she putted the expiry date on food labels and store these labels. Another worker weighed noodle for a specific weight and then putted it in plastic bags. Then, she moved the stored sauce bags and food labels to the noodle bag. After that, she putted sauce bag in noodle bag and putted food label on the noodle bag. Later, the worker moved the noodle bags to seal them and putted 20 noodle bags in a big bag and stored big bags for customers.

Figure 1 and 2 show the working conditions in bagging process. The working area was quite small for workers since almost half of area was used for raw material inventory and stock of finished goods. Ten elements of bagging process and their transportation distances are concluded in Table 1 and the flow of this process is shown in Figure 3. From Table 1, the element number 4 shows greatest distance of 7.69 m., corresponding to the longest arrow line in Figure 3. The second greatest distance of transportation was the element number 5, which was 4.9 m. However, the element number 1 showed no transportation.

Fig. 1. Working area of noodle and sauce bagging process.

Fig. 2. Noodle storage area and noodle bagging process

Table 1. Work elements and distance of transportations in bagging process.

Element	Description of work	Distance (m.)
1	Put sauce in small bags	0
2	Move to the sealing machine and seal sauce bags	0.55
3	Move sauce bags to store	0.19
4	Move labels to put expiry date	7.69
5	Move plastic bag to noodle area	4.9
6	Put noodle and food label in bag	1.97
7	Put sauce bag in noodle bag	1.51
8	Seal the noodle bag	0.54
9	Put 20 noodle bags in a big bag	0.53
10	Move to store	1.65
	Total	21.24

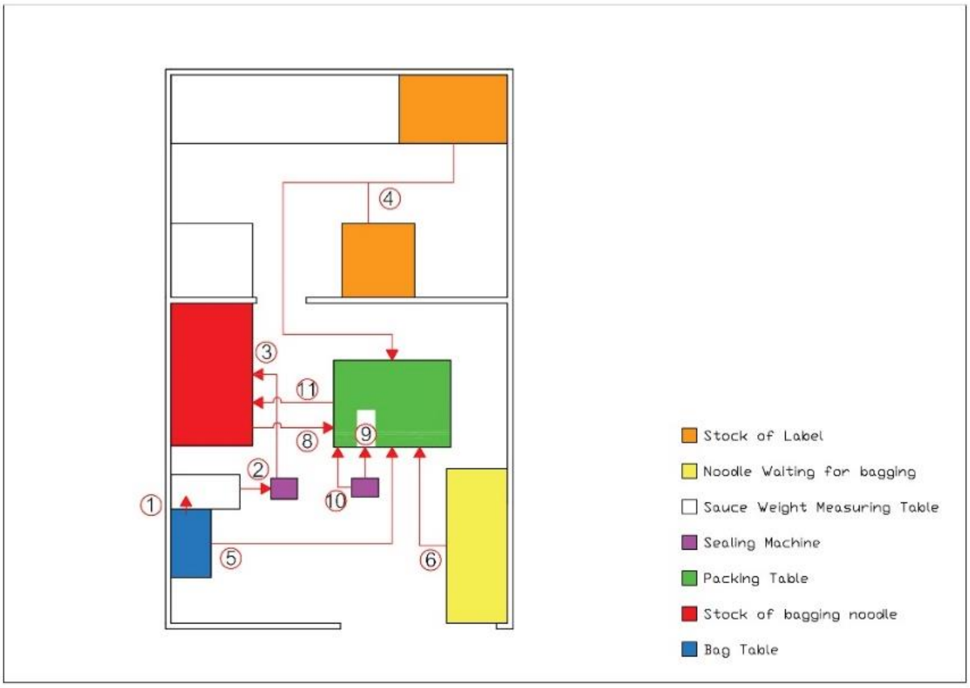

Fig. 3. Layout and flow diagram before improvement.

2.1 Apparatus

For data collection, equipment used were: 1) measuring tape for measuring distance between work elements, and 2) camera for recording pictures and video.

3. ANALYSIS

Layout analysis

As mentioned earlier, Figure 3 shows complicated flow of process and this indicated transportation waste. Therefore, ECRS was introduced mainly to reduce unnecessary element and transportation as follows.

E (Eliminate): The area of sauce bag store was eliminated. As a result, after the worker sealed the sauce bags, she sent the sauce bags to the next workstation for putting in the noodle bag.

C (Combine): There are two combined areas. First, the area of storing sauce bags was combined with the area of putting sauce and noodle in the bag. Second, the area of label pump was combined with the area of label storage. This resulted in reduction of transportation distance and time.

R (Rearrange): Workstations were rearranged. Since layout before improvement made flow of work complicated, the worker moved between the workstations unnecessarily. Therefore, workstations were rearranged according to motion economy.

S (Simplify): The layout of workstation was simplified by set the flow of process in one direction. Therefore, raw materials were stored close to the entrance gate and finished goods were stored close to the exit gate.

Using the above concepts as guidelines to redesign workstation layout, the improved layout is shown in Figure 4. It is obvious that the arrow lines representing transportation are less than the previous layout.

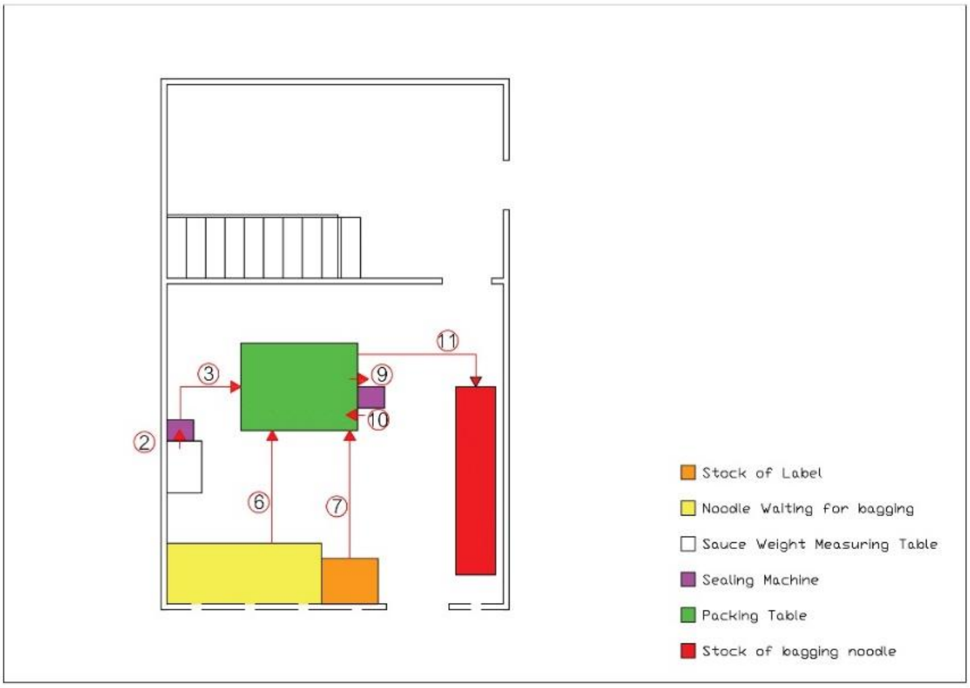

Fig. 4. Layout and flow diagram after improvement.

4. RESULTS AND DISCUSSION

After using ECRS technique for redesigning layout, the result of improvement is shown in Table 2. The transportation distances before and after improvement were compared. After improvement, the area of storing sauce bags was combined to the area of putting sauce and noodle in the bag. Also, the area of label pump was combined to the area of label storage. Therefore, there was no workstation for element 1, 4, and 5. Furthermore, there was no transportation in work element 2. Likewise, work elements 9 and 8 had no transportation. As a result of improvement, the total transportation distance after improvement was 7.19 m, compared to 21.24 m. of distance before improvement. Thus, the reduction of transportation waste was 66.15%, leading to productivity increase as propose

Table 2. Comparison of transportation distances between before and after improvement.

Element	Description of work	Transportation distance (m.)	
		Before improvement	After improvement
1	Put sauce in small bags	0	-
2	Move to the sealing machine and seal sauce bags	0.55	0
3	Move sauce bags to store	0.19	1.13
4	Move labels to put expiry date	7.69	-
5	Move plastic bag to noodle area	4.9	-
6	Put noodle in bag	1.97	1.97
7	Put food label in bag	-	2.24
8	Put sauce bag in noodle bag	1.51	-
9	Seal the noodle bag	0.54	0
10	Put 20 noodle bags in a big bag	0.53	0
11	Move to store	1.65	1.85
Total distance		21.24	7.19
Distance reduction		14.05	
Percentage of transportation waste reduction		66.15%	

5. CONCLUSIONS

Using ECRS as a tool for improving productivity by reducing transportation waste was demonstrated in noodle and sauce bagging process. The redesign of workstation layout can reduce transportation waste by 66.15%

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NOMENCLATURE

(if necessary, it is included.)

a : distance [m]

PHOTOS AND INFORMATION

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