

# Improvement Plant Layout Based on Systematic Layout Planning

W. Wiyaratn, A. Watanapa, and P. Kajondecha

**Abstract**—The purpose of this research was to modify the present plant layout of canned fish. The alternative plant layout of canned fish in term of material flow, activity relationship the optimum process areas and locations has been designed by systematic layout planning (SLP) method. Factors studied in canned fish factory were consisted of numbers of machines, space requirements, and process area. The problem in term of material flow of each operation section was indentified. With the SLP method, alternative plant layout significantly decreased the distance of material flow.

**Index Terms**—Systematic layout planning, plant layout, material flow, canned fish factory.

## I. INTRODUCTION

As generally known, Thailand has been through several situations affecting the economic crisis such as the H1N1 flu and the impact of the US sublime. The occurred economic crisis forced many local food manufacturers to close down due to decreasing sales and revenues in contrast to the same remaining costs. Therefore, the industry is in need of development to raise Thailand's economic. This includes plant layout design development since good plant layout design can help reduce the time consumed during the product transferring. Hence, the products will be prompt for the delivery to customers and the unnecessary work could be eliminated, creating more efficient manufacturing process. In the present, there are several methods for plant layout design such as systematic layout planning (SLP) [1] - [2], algorithms [3]- [4], and arena simulation [5] can apply to design plant. Nowadays few researches for SLP because using program computer to simulate is more popular. However SLP method seems interesting to design the plant layout, it is basic fundamental and quite simple method, including it can use into practice. Yujie *et al.* [1] studied SLP method to design the overall layout of log yards, the result showed the good workflow and was possible rearrangement pant layout under significance. Wisitsree *et al.* [2] designed the plant layout of iron manufacturing based on SLP for increased productivity, the result showed the new plant layout significantly decrease the distance of material flow from billet cutting process until keeping in ware house. Therefore, plant layout is possible way to improve the production. Hence, the first step for plant

layout improvement should be started with identifying the problems of the current plant layout in order to maximize the productivities at the minimized investment. Later the SLP method has been used to design the plant layout of canned fish factory, which was case study. The original plant layout, alternative plant layout, material flow analysis, including area and distance between unit operations, through canned fish were studied.

## II. PROCEDURE FOR PLANT LAYOUT

### A. Plant Layout Design

First, the data were collected; including the number of machines/equipments was counted in terms of the direction for raw materials and product. Second, the each area of operation unit was measured. Third, the process for product production the operation process chart and flow of material was studied. Last the fundamental of plant layout based on SLP was studied and the problems of the current plant layout were analyzed.

### B. Final Stage

This case is based on a canned fish, where located in Thailand. Canned fish typed sardine and tuna were produced 30,000, 35,000 pieces of day, respectively. The total production pieces were based on customer's order. This factory has been design the plant layout based on process layout. The initially canned fish production, frozen fishes from freezing were moved to thawing store, along with butchering fish, packing, pre-cooking at 95 °C,1-2 bar for 60-90 min, cooling and added oil or seasoning, cleaning can, arranging can , retorting, final cooling ,then their canned fish moved to pallet and labeling and packaging and moved to warehouse to wait for the delivery to customers. The details of present plant layout were described as follow. The work flow for canned fish production was displayed in Fig. 1 respectively. In addition, the size and number of equipments was related to area as shown in Table I.

- 1) Each of equipment was large and permanently placed. The area management in placing the equipments did not fit in the manufacturing process, resulting in no standard in equipment placement and long and continuous distance for product transferring.
- 2) As the warehouse and packing sections were in the same area, the trucks cannot move finished cans for packing at the same time due to the limitation of the space which forced the truck to be able to operate only one at a time.
- 3) The workers pathway was not clearly identified.
- 4) There were insufficient lights in some of the plant area since the planted was separated into 2 parts. The first part

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dealt with the process from frozen to canned fish and the second part concerning the packing and the finished product storage. It was found that the lights in the second part process was not enough as the light cannot get through the roof and the limited space caused the products to be stored in higher piles and concealed the light from the light bulb.

- 5) There was the problem of waiting since the workers spent long time packing large quantity of products from huge pallet, causing truck workers to wait for the packing to be done in order to move the products to the warehouse at the quantity which match the pallet's size. This waiting occurred because there is an intention to make the least transferring cost but it wastes the truck workers' working time.

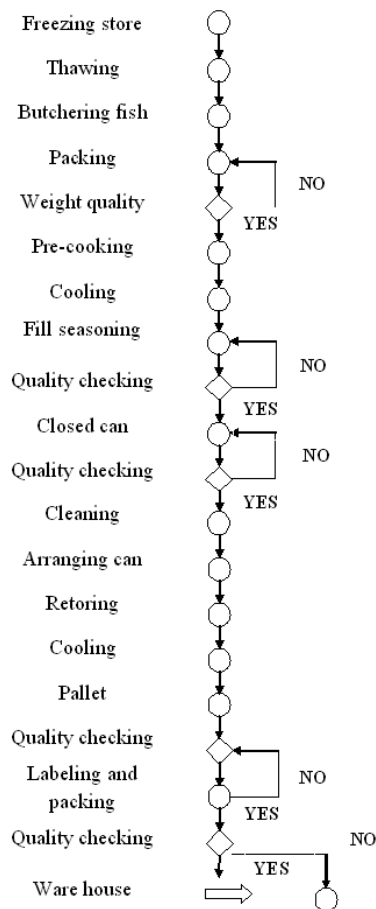


Fig. 1. Work flow for canned fish.

Analysis of plant layout based on SLP. SLP is a method of plant layout design of project, which described step-by-step of method. The information of P, Q, R, S, T, is product, quantity, route, support and production timing as the given basic elements. Many of tables, graphs, as analytical tools, carry out the design through the layout methods. The procedure of SLP is shown in Fig. 2 [6]. After studying on the mentioned information, the new plant layout design is analysis by SLP method. According to the study of the manufacturing process, it was found that the long distance could be reduced for moving raw materials and the problem about useless area could be solved. The way to improve the plant was to apply SLP method to make the work flow continually by arranging the important sequence of the

manufacturing. The initially, from to chart was studied, which showed the relationships between departments in each process. The entries in the chart represented the number of material between departments in each process of each day. Then the relationship of each activity in closeness area was considered to make the relationship of each activity, and the closeness value are defined as A =absolutely, E = especially important, I = important, O= ordinary closeness, U= unimportant. The details for each activity and amount, sequence for canned fish with canned sadine, tuna were described in Table II, as follow.

TABLE I: RELATIONSHIP BETWEEN EQUIPMENT SIZE AND AREA.

Department	Total working area (m <sup>2</sup> )	Number of equipments and machines
Freezing fish store	290	-
Soaking	90	-
Thawing store	90	6
Spray fish	90	6
Butchering fish	320	16
Packing	270	5
Pre-cooking	190	5
Cooling	130	5
Fill seasoning	80	5
Cleaning can	80	9
Arranging can	30	5
Retorting	1,100	36
Cooling	390	18
Pallet	260	8
Labeling and Packing	310	30
Warehouse	1,500	-

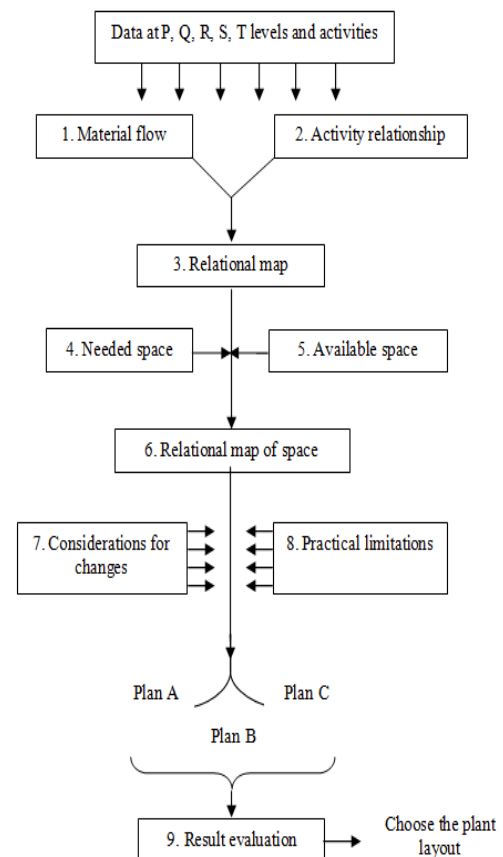


Fig. 2. The procedure of slp [6]-[7].

TABLE II: THE AMOUNT AND SEQUENCE FOR CANNED FISH PRODUCTION.

Product	(Per day)	Routing
Sadine Can	30,000	A-B-C-D-E-F-G-H-I-J-K-L-M-N-O
Tuna Can	35,000	A-A'-B-B'-C-C-G-H-I-J-K-L-M-N-O

A : Freezing store	H : Canned closed
A' : Soaking	I : Washing can
B : Thawing store	J : Rotating
B' : Spray fish	K : Retorting
C : Butchering	L : Cooling
D : Packing	M : Pallet
E : Pre-cooking	N : Labeling and Packing
F : Cooling	O : Ware house
G : Filling seasoning media i.e. oil	

TABLE III: FLOW DIAGRAM OF PROCESS CHART FOR FISN CANNED PRODUCTION: PRESENT LAYOUT.

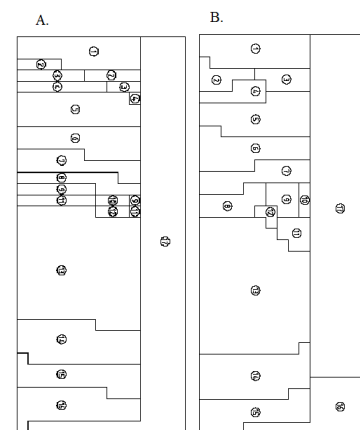
Department	Distance (m)	Time (s)
Moved fish from freezing store to thawing store	30	1.30
Thawing fish	-	300
Moved fish	2	0.30
Butchering fish	-	30
Packing	1	0.30
Weight	-	0.15
Pre-cooking	-	16
Cooling	-	1
Fill seasoning media i.e. oil	-	1
Quality checking	-	0.30
Closed can	-	0.20
Quality checking	-	0.30
Cleaning	-	1
Arranging can	30	1
Retorting	-	60
Cooling	-	480
Moved to Pallet	30	1.30
Quality checking	-	0.30
Labeling and Packing	-	10
Quality checking	-	1
Warehouse	15	1.30
Total	108	906.57

The important sequence of each activity was rearranged from the most important one to the least important one, followed the activity relationship chart. Based on SLP method the modifying plant layout and practical limitations was developed. The present and alternative plant layout displayed in Fig. 3 The original plant layout represents A, while alternative plant layout represents B. The rearrangement for good space was observed such as rotating section, ware house. In the present, canned closed section near retorting section, cooling section whereas alternative plant layout closed to ware house. Comparison the distance of work flow between the present and alternative plant layout

showed that the distance from the freezing until warehouse section was 108 m., reduced from 176 m. or reduced by 68 m. (Table III, IV). However reducing of time was not obvious difference because duration of each process of production unchanged. Thus, the alternative plant layout was possible to select.

TABLE IV: FLOW DIAGRAM OF PROCESS CHART FOR FISN CANNED PRODUCTION: ALTERNATIVE LAYOUT.

Department	Distance (m)	Time (s)
Moved fish from freezing store to thawing store	30	1.30
Thawing fish	-	300
Moved fish	2	0.30
Butchering fish	-	30
Packing	1	0.30
Weight	-	0.15
Pre-cooking	-	16
Cooling	-	1
Fill seasoning media i.e. oil	-	1
Quality checking	-	0.30
Closed can	-	0.20
Quality checking	-	0.30
Cleaning	-	1
Arranging can	30	1
Retorting	-	60
Cooling	-	480
Moved to Pallet	30	1.30
Quality checking	-	0.30
Labeling and Packing	-	10
Quality checking	-	1
Warehouse	15	1.30
Total	108	906.57



- 1.Freezing sore
- 2.Soaking
- 3.Thawing
4. Spray fish
- 5.Butchering
6. Packing
- 7.Pre-cooking
- 8.Cooling
- 9.Filling seasoning media
- 10.Canned closed
- 11.washing
12. Rotating
- 13 .Retorting
14. Cooling
15. Pallet
16. Labeling and packing
17. Ware house

Fig. 3. Plant layout of canned fish, a: present plant layout, b: alternative plant layout.

### III. CONCLUSION

This research presents the analysis of plant layout and process of canned fish based on SLP method. The sequence of work and work flow of canned fish production was rearranged, which the rearrange layout can decrease flow of material, resulting in significantly decreased distance of each operation and finally increased production.

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