Industrial Engineering Production Management Study for Company A

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Abstract. Taking Company A as an example, this paper analyzes the current situation of production management of the company by using the theory and method of industrial engineering, and finds out the existing problems and their real causes. On the basis of considering the actual situation and work particularity of the company, the new ideas of production management of Company A were explored, and a set of scientific, effective and production management system in line with the actual situation of the company was designed and established to solve the problems of low production efficiency and waste. This paper introduces the basic concepts, methods and applications of industrial engineering, and uses the knowledge of industrial engineering to rectify and improve the workshop layout and production assembly of Company A, and proposes a new and better workshop and workbench layout. In the end, through research and improvement, we succeeded in reducing the waste of raw materials and labor and improving efficiency. This paper aims to explore the establishment of organizations and more effective management methods in line with China's national conditions, and provide reference for the scientific development of enterprises.

Keywords: Balance the production line · Layout optimization · Flow mode

1 Introduction

Industrial engineering originated in the United States at the beginning of the 20th century, and from the end of the 19th century to the beginning of the century, it entered the "scientific management era" and the period of creation of industrial engineering. The book "Principles of Scientific Management", published by the American engineer Taylor in 1930, covers manufacturing processes, labour organisation, specialised division of labour, standardisation, work methods, job measurement, wage incentive systems and functional organisation, etc. It is a representative work of this era and a classic work on industrial engineering. Taylor also pioneered the time study method for production sites. Starting around 1910, the Gilbreths in the USA engaged in action research and workflow studies, and also set out the basic factors for kind of action. They created the scientific basis for the improvement of work and operating methods and later predetermined time standards, providing the basic methods that are still used today. Taylor and Gilbreth are best known as the founders of industrial engineering.

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In developed Western countries and Taiwan, industrial engineering has been given more attention and developed earlier, so the current status of industrial engineering development in these places is better. The current situation of industrial engineering in many developing countries, on the other hand, is not optimistic. In China, the start of industrial engineering is relatively late. It was only in the early 1990s that industrial engineering was introduced with the entry of foreign-funded enterprises.

The promotion of industrial engineering techniques has only just begun with the entry. However, after the development in recent years, the achievements have been remarkable. According to incomplete statistics, hundreds of Chinese enterprises such as FAW-Volkswagen Ltd, Haier Group, Midea Group, FAW Group and Guangdong Kelong Group are applying industrial engineering technology to different degrees. Many private enterprises in the southeastern coastal provinces of Zhejiang, Jiangsu and Guangdong, for example, use industrial engineering as an important means to improve the management level of their enterprises, and all have achieved very significant results.

This thesis will use the example of Company A and theories related to the layout of facilities and work studies in industrial engineering.

The basis is to analyse the current situation of production management in Company A, to identify the problems that exist and to reveal the real reasons behind them. And according to the actual situation of the company and the special characteristics of the work, explore new ideas of production management in Company A, design and establish a set of scientific and effective production management system that can reflect the actual company, but also fully improve production efficiency and save production costs. Solve the company's production efficiency is not high, there is waste and other problems. Promote the scientific development of the company and create more wealth with lower consumption and less input.

2 Concepts and Techniques of Industrial Engineering

Industrial Engineering (IE) is a cross-cutting discipline based on the continuous development of manufacturing technology, management science and systems engineering [1]. From a disciplinary point of view, industrial engineering can be divided into the following branches: biomechanics, cost management, data processing and systems design, sales and marketing, engineering economics, facilities planning, materials processing, applied mathematics, organisational planning and theory, production planning and control, practical psychology, methodological research and operational measurement, human factors, payroll management, ergonomics, safety technology, occupational health and medicine [2]. In recent years, the field of industrial engineering has incorporated the latest achievements in natural and social sciences such as operations research, systems engineering, management science, computer science and modern manufacturing engineering, and has developed into a comprehensive discipline that includes the knowledge of many modern sciences [3]. The basic theories of industrial engineering are relatively extensive, and its professional and technical system is constantly developing and expanding, but the four aspects of human factors and efficiency engineering, production and manufacturing system engineering, modern management engineering, and industrial system analysis methods and technology are the most basic contents [4]. The supporting technologies of industrial engineering can be divided into three main categories [5].

1. Design and improvement category: techniques include work studies, facility planning and logistics analysis, ergonomics, and organisational design.
2. Analysis and Decision Making: Techniques include engineering economic analysis, reliability engineering, market forecasting, and human resource management.
3. Control: Techniques include production planning and control, quality control, cost control, and information control.

2.1 The Current Situation of Production Management in Company A and the Problems That Exist

This thesis is a study of the use of industrial engineering technology in Company A, so it is important to know something about the company and to give the following introduction to the company. This chapter is based on an analysis of the current state of production management in terms of the layout of the company's workshops and workstations, and the identification of problems and deficiencies.

Company A Introduction.

Company A is a Japanese-invested company, mainly producing auto parts, whose head office is Yazaki Soyo Co. It is the tenth company of the Yazaki Group in China [6]. The company mainly deals with auto parts and moulds, manufacturing of auto parts, equipment development, design, production, sales of self-produced products and after-sales service [7]. The products are mainly supplied to Toyota, Honda, Mitsubishi and other automobile manufacturers [8].

As a Japanese company, the company takes industrial engineering very seriously. The company has an industrial engineering research team that specialises in the improvement of production through industrial engineering. It operates mainly on a tree structure with a hierarchy of responsibilities [9]. Its management style is based on the more advanced 6s approach to site management. The company's aim is to focus on the interests of the customer, based on the community; to focus on corporate efficiency and to serve the community [10]. At the same time, the company also uses the Kanban management method, which makes the company's production management clearer and more intuitive; it also reduces the management costs of the company [11].

The current situation of the workshop layout and workbench layout in Company A.

The production method of company A is the assembly line production method, and the production line management is the use of the more advanced Kanban management [12]. The use of industrial engineering techniques is very important, and 6s management, as a representative of advanced factory management techniques, is also widely used in this company. In general, Company A has advanced production, standardised management and smooth logistics. It is a relatively modern company. The company uses SLP technology in the layout of the plant, and the division of labour between the various workshops is reasonable [13].

The production hall for the jig I am studying is located in the centre of the entire factory and is very important. It connects the entire.

The production of each workshop in a factory. In this workshop, 6s management and Kanban management are integrated throughout the production line [14].

The production process is carried out with workers working at their respective jobs as required. The layout of the workshop is done on a one-to-one basis.

Production, which means that a raw material supply point supplies raw materials to a workbench and also has a subsequent inspection.

The test point inspects the manufactured product (as shown in Fig. 1). The layout of the workbench is based on a rectangular table top, with all tools and raw materials placed in sequence on the table (as shown in Fig. 2).

Problems of Company A.

Although the management methods of Company A are advanced among many enterprises, there are many defects and deficiencies in on-site management, and there is much room for improvement. This is mainly reflected in the lack of efficiency, excessive product backlog and long waiting times for some workers [15]. For example, in the layout of the workshop, there are irregularities in the flow of materials, and there is a lack of coordination between the supply and demand of raw materials and assembly. For example, in the layout of workstations, there are cases where material boxes are placed too far away, resulting in a waste of workers' time, and workstations are not arranged in a standard way, resulting in duplication of work. Although Japanese companies pay more attention to industrial engineering and make full use of industrial engineering technology, there are still areas for improvement. In this paper, improvements will be made based on the shortcomings that exist [16].

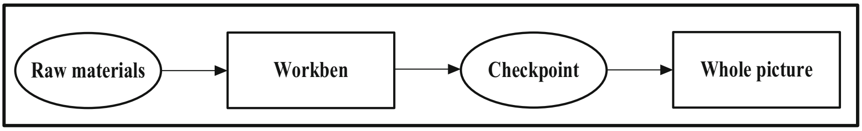

Fig. 1. Layout of the workshop

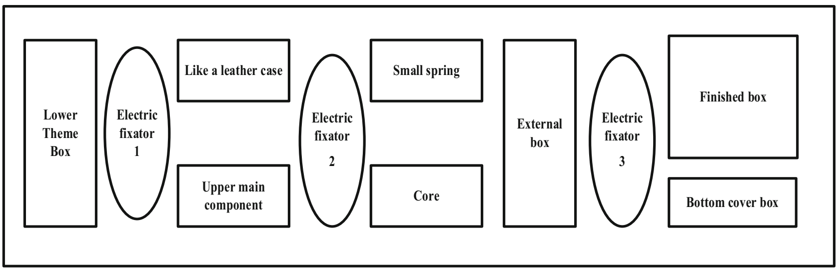

Fig. 2. Workbench arrangement

3 Company A Layout Study

The design of facility layouts occupies an important place in facility planning and has traditionally received a great deal of attention. Take the plant layout.

As an example. It has a direct impact on the logistics, information flow, production capacity, productivity, production success of the whole system.

The cost and safety of production. The cost of construction for the different plant layouts chosen for the infrastructure of a company is significant.

The differences are not great, but the quality of the plant layout has a direct impact on the cost of production operations and production efficiency.

A good plant layout can reduce material handling costs by around 20%, making it one of the determining factors in improving productivity in the USA.

When building a completely new plant or other facility, designers can use effective methods to find the right location for each of the plant's component units and equipment, as they conceive it. However, more design work is done to rearrange existing facilities for reasons such as changing product design, improving process methods, expanding production capacity, adding new products, reducing costs and improving management. This is more difficult than the layout of new facilities due to the limitations of the original site area and shape, or the limitations of the building walls, columns, doors, windows, foundations and pipework.

3.1 Analysis of the Company's Facility Layout

Firstly, a brief analysis of the principles of facility layout, the basic form of the layout and the flow patterns of company A.

The company produces one product per workshop, so there is a single product for a workshop. The product principle should be used for the general layout planning. The entire production line is divided into several sections: raw material supply, production and assembly, inspection and integration. Among the raw materials, the rubber sleeve and the small bullet are purchased from outside.

The entire production line is always centred on the product assembly process and is arranged according to the product principle, which has obvious advantages: smooth logistics, continuous up and down processes, low work-in-progress; short production cycles and specialised operations; and simple production planning. The company's flow diagram is shown in Fig. 3.

The assembly office is the main workshop. The whole workshop is made up of many assembly workstations, each of which is used by one worker for assembly work. This arrangement is an assembly line arrangement, which is more suitable for the production

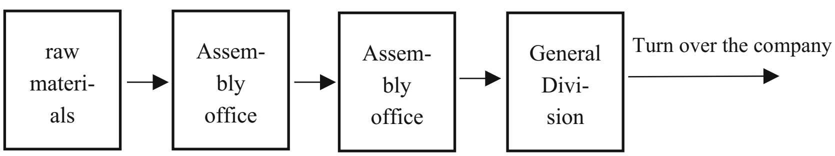

Fig. 3. Schematic diagram of Company A's processes

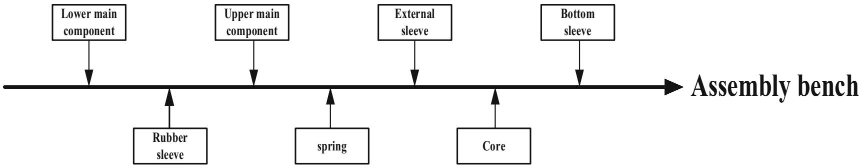

Fig. 4. General assembly line diagram

of a small variety of high-volume products and the composition of the total assembly line. This is shown in Fig. 4.

In the assembly shop, the rubber sleeve and small spring purchased from outside plus the factory's own upper and lower main parts, inner core, outer sleeve and bottom sleeve enter the assembly table, thus completing the whole assembly and finally the inspection process.

3.2 Company Set-Up Layout Planning

The plant layout of company A has been analysed above as a design for a product principle arrangement. In contrast, the product principle layout has equipment and workshops serving specialised product lines. Therefore, within a product principle layout system, the process principle layout is much less difficult than the difficulties arising from the arrangement of the production departments in relation to each other and the positioning of the individual shift positions within that production department. However, in the case of a product principle arrangement in a particular situation, such as an assembly line arrangement, the facility layout designer will be faced with complex problems such as how to equalise the flow of the line so that the workers operating on the line have the least amount of downtime. This is often the case when two problems are faced.

1. Find the minimum number of workplaces for a given cycle time - layout problem.
2. Find the minimum cycle time for a given number of workplaces - schedule problem.

(A "workplace" is usually a specific location for a given workload, not necessarily always operated by a single operator; "cycle time" is the time it takes for adjacent products to pass through the assembly line.)

Generally, "cycle time" and "duty station" are combined to solve for this.

A production line is designed according to the product principle layout (the completion times given are assumed values, not actual measured values) as shown in Table 1.

4 Specific Improvement Programmes and Evaluations

4.1 Drawing Out the Network Diagram

See Fig. 5.

4.2 Determination of Specific Parameters

Daily demand (D): 5000 units

Working time per day (t): $7 \times 60\text{min} = 420\text{min}$

Total time for all tasks (T): 18s

$$\text{Cycletime(C)} = \frac{\text{Production time per day}}{\text{Plan production on a daily basis}} = \frac{60\text{t}}{\text{D}} = 5.04\text{s}$$

Number of theoretical duty stations:

$$(N) = \frac{\text{The total amount required to complete the job}}{\text{Cycle tine}} = \frac{\text{T}}{\frac{60\text{t}}{\text{D}}} = 3.57 \approx 4$$

Table 1. Upper production line data sheet

Task	Completion time/s	Illustrate	Tight front-end process
A	1	Put the holster on the lower main piece	
B	2	Install the main part on the lower main part	A
C	3	Attach two small springs	B
D	3	Put on your coat	B
E	4	Put in the inner core and fix it electrically	B
F	5	Install a low sleeve and fix it electrically	C, D, E
	18		

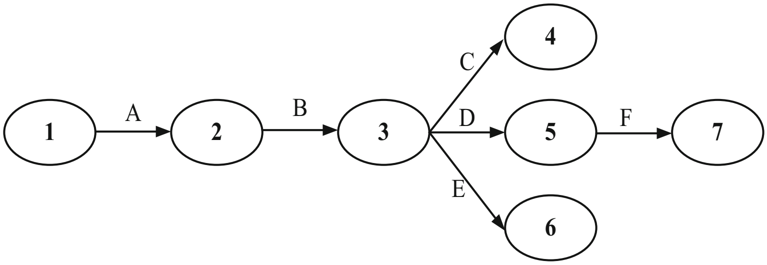

Fig. 5. Network diagram

Table 2. Scheduling tasks

Task	The number of subsequent tasks
A	5
B	4
C, D, E	1
F	0

If there were no procedural limitations to this problem, the arrangement of possible task operations should be 11. The number of locations calculated is but the number of locations must be an integer. In addition, the limitations of the back-and-forth relationship and the problem of trying to combine all the actions within each location make the actual number of workplaces much smaller than the theoretical calculation.

4.3 Rules for Determining Balanced Production Lines

Rule 1: Assign the tasks with more follow-up work first.

Rule 2: The task that takes the longest to operate is assigned first.

Use these two rules to arrange the tasks as shown in Table 2.

4.4 Analysis of Tasks at Each Duty Station

Balanced under rule I, with a duty station count of 5.

Balanced under rule II, the number of duty stations is 4.

4.5 Computational Efficiency

$$\text{(Role one)}\quad \text{Efficiency} = \frac{\text{The total amount required to complete thejob}}{\text{Number of actual duty stations time period}} = \frac{\text{T}}{\text{N} \times \text{C}} = \frac{18}{5 \times 5.04} = 71.4\%$$

$$\text{(Rule two)}\quad \text{Efficiency} = \frac{\text{The total amount required to complete the job}}{\text{Number of actual duty stafions} \times \text{time period}} = \frac{\text{T}}{\text{N} \times \text{C}} = \frac{18}{4 \times 5.04} = 89.3\%$$

4.6 Evaluation Programme

Rule 1 makes a balancing efficiency of 81.3% meaning that the assembly line is unbalanced or idle for 21.6% of the time.

Rule II makes a balancing efficiency of 93.3% and an assembly line unbalance or idle time of 10.0% indicating that the assembly.

Line balancing is better. However, which rule prevails when balancing different assembly lines is determined on a case-by-case basis.

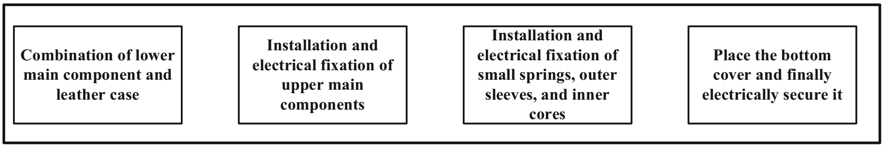

Fig. 6. Working arrangement table

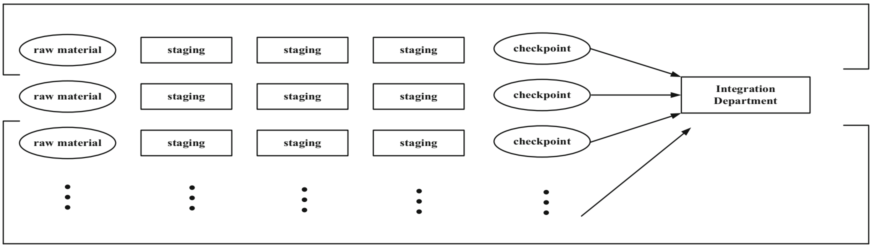

Fig. 7. Layout of the improved workshop

4.7 Improvements to the Company Layout

According to the above analysis and design, the number of working places on the workbench can be obtained as one. So the specific layout of the workbench can be drawn. This is shown in Fig. 6.

Once the workbench layout has been worked out, its entire workshop layout is relatively simple. It is only necessary to determine, depending on the total workload.

It is sufficient to determine the balance between raw material supply and production.

Also because the logistics flow is simple and unidirectional, only linear flow patterns need to be used to arrange the layout.

The raw material supply time and inspection time are both 6s and the total production time is 18s, so one raw material supply point has to supply raw materials to three assembly workstations, after which the three assembly workstations are put under one inspection point for inspection. The original layout of the workshop is a one-to-one arrangement, which is either too many raw material supply points and inspection points or too few workstations, so it is a waste of resources and needs to be improved, the workshop layout should be implemented 1-3-1 arrangement. The analysis and design of the improved workshop layout is shown in Fig. 7.

5 Conclusion

This design paper first introduces the basic concepts, methods, and applications of industrial engineering. The knowledge of industrial engineering is then applied to rectify and improve the workshop layout and production assembly of company A. A new and better layout of the workshop and workstations is derived. This is used to reduce waste and improve efficiency.

As industrial engineering technology is being applied in China, the question of how to establish an organisation that is in line with Chinese conditions and to implement more effective management of the application is one of the issues we face. Enterprises should start from their own reality, in accordance with the functions and principles to create an organisation adapted to their business management development needs. As a Japanese company, Company A pays more attention to industrial engineering and has set up its own organisation, but this does not mean that the company's industrial engineering is absolutely perfect and that there is no room for improvement. In the course of my design, I have conducted a rigorous understanding of Yazaki and on-site research, combined with knowledge of industrial engineering to improve the company, and drew up a new layout of the workshop and workbench arrangement. The layout drawings are given in the thesis.

The study of improvements has done well to reduce the waste of raw materials and labour and to increase efficiency.

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