

# A Case Study of Just-In-Time System in the Chinese Automotive Industry

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**Abstract**—Just-In-Time (JIT) has been a very popular operations strategy partly because of its success in the Japanese industry. Various benefits, for example, inventory reduction, improved in operations efficiency, and faster response, have been studied widely in previous research. Therefore, successful implementation of JIT is vital to many companies. The main objective of this research is to make use of a case study to present various issues surrounding implementation of JIT for an automotive company. This case study also provides evidences for supporting the benefits of employing JIT. Semi-structured interviews were organized and thus relevant data can be collected. The conclusion of this research indicates that JIT system is successful, and operating JIT system can lead to many advantages to the case company.

**Index Terms**—Just-in-time, automotive, manufacturing systems, cases study.

## I. INTRODUCTION

JUST-IN-TIME (JIT) theory has been operating widely in the Japanese automobile industry and the electronics industry, though more and more applications can be found in many industries over the world [1]. The ideology of JIT is ‘producing the necessary item in the necessary quantity at the necessary time is an eternal diver of production and operations management’ [2]. In addition, there are many production planning and control methods, like Kanban systems [3], have been developed in order to achieve the objectives of JIT. The ultimate objective of JIT is to enhance flexibility of the whole system, which is one of the competitive factors in future manufacturing and services systems [4-5].

Definition of JIT is quite consistent in many studies (or even textbooks) to the one mentioned in previous section. For example Bozarth & Handfield [6] defined JIT as: ‘A philosophy of manufacturing based on planned elimination of all waste and on continuous improvement of productivity. In the broad sense, it applies to all forms of manufacturing and to many service industries as well’. JIT requires elimination of waste which means that JIT systems could lead to delivery of ‘perfect’ products or services at the ‘exact’ time they are required [7]. In this connection, the

main purpose of JIT systems is to identify and to eliminate as many kinds of wastes as possible through improving production activities within a company. A JIT system could be an ‘effective tool’ for assisting a company to reduce cost and then to obtain higher profits [2, p. 1].

Bozarth & Handfield [6] defined lean manufacturing as follows, which is essentially the same to JIT: ‘Lean is a philosophy of production that emphasizes the minimization of the amount of all the resources (including time) used in the various activities of the enterprise’. The aim of lean operation is to achieve a stable flow of products and services that could be delivered to customer at the quality level and time they want in order to satisfy customers’ needs. In addition, lean operation could guarantee the production process to be more flexible when the demand is uncertain.

JIT can be considered as one of the variants of production planning and control systems, which are pivotal management tools for satisfying increasingly high client demands and expectations in the business market [8], although traditional production planning and control systems are ‘push’ in nature, which means planning department decides the production schedule and transmits to all production processes according to forecast of the demand of market. Rhodes [7] advocates that a proper information system can facilitate JIT system by communicating quicker among departments. Recently, electronic Kanban has become a trend in modern JIT system [9] and this study will also reveal how such a computer-based kanban system, and also information technology in general, can facilitate implementation of JIT. This is the first research objective of this paper.

Obviously, the ‘pull’ nature of JIT helps companies to reduce safety or idle inventory because of the collection of more accurate demand information. In other words, companies do not need to keep excessive inventory. McLachlin [10] reported a list of advantages and benefits claimed for industries implementing JIT system. These include reduced lot sizes, lower inventory, improved quality, reduced waste and rework, improved motivation, greater process yield, increased productivity, increased flexibility, reduced space requirement lower overhead, reduce manufacturing cost, reduced lead-time, elimination of certain tradeoffs such as cost and quality and improved problem solving capabilities. However, steady demand and production planning is almost a pre-requisite for any JIT systems. Thus, the practicability of steady production planning could affect the JIT performance. Therefore, another research objective in this study is to address whether or not steady production system is achievable in the case

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company. In addition, whether or not ‘zero inventory’ can be achieved will be examined.

Another important element in JIT systems is quality management [11, p. 73]. Obviously, if many defective products are produced, that could affect normal production schedule in order to rectify the mistakes. This will definitely affect the requirement on steady production schedule as mentioned above. Therefore, the fourth research objective in this study is to understand how JIT can be implemented together with a good quality management system in the case company. This is also somehow related to the cooperation between the company and the suppliers since the quality of the final products may be affected by the sources of the components [10]. In addition, capability of the suppliers can also affect availability of the components. Thus how to maintain a good supplier relationship is another element that will be investigated in this study, which is the final research objective of this study.

In this connection, this study aims at investigating the five issues (the five research objectives mentioned above) surrounding a real-life implementation of JIT system. In this study, the JIT system of an international automotive company with a factory located in China, Company X, is analyzed. The objectives of this study include identifying the profile of the JIT system in Company X, examining their pre-implementation and implementation experiences, assessing the reasons for and the potential advantages associated with its adoption of JIT and highlighting the JIT practices targeted for future implementation.

The main objective of this research is to study the issues surrounding an implementation of a JIT system for an international automotive company. The factory in question is located in China, one of the many branches of the aforementioned company. This study will reveal how the JIT system could improve the case company’s competitive strength, and how the company tackled various issues surrounding the implementation. In short, the study relates to the following research questions: (1) How is JIT system operating in the company? and (2) What are the benefits of employing the JIT system? In order to answer the questions, five key research themes have been identified and semi-structured interviews with some managers of the case company were organized in order to collect relevant information.

The rest of this paper is organized as follows. Next section will present the background of the case and research method, followed by a section on discussions of the interview results. The final section concludes this paper.

## II. BACKGROUND OF THE CASE AND RESEARCH METHOD

With reference to the growth of Chinese manufacturing industry in the last two decades, it is not surprising that Chinese manufacturers have realized the need to build advanced production systems like JIT in order to maintain, and even upgrade, their operations effectiveness. Company X was set up in 2002 and had implemented JIT with such background. One year after the company’s establishment, they sold 50,000 cars to achieve top ten motor companies in terms of its sales in China. The company had extended the

production capacity to 150,000 cars in 2004, and to 300,000 in 2006, which means the company has become top five motor companies in the Chinese automotive industry market. Despite the growth, the company would like to maintain the market position or even move ahead by introducing JIT system. This is also the reason why the company is selected for this study, which hopefully to provide managerial insights regarding successful implementation of JIT.

Robson [12, p. 178] defined case study as ‘a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence’. Saunders et al. [13] also summarized that the method of case study could answer the exploratory and descriptive or analytic research question- ‘why’ and ‘how’. In addressing the research objectives as mentioned in previous section, case study is thus employed for data collection so that interrelated elements as identified in Section I will be examined, as well as their influence on the performance of JIT system of Company X.

More specifically, a single case will be used in this study as Company X is a good representative of a critical case that wants to improve its competitive strength through JIT system [13]. In order to collect data, semi-structured interviews were organized, which is a very common method in the operations and supply chain management domain [14]. The purpose of interviewing is ‘to understand the experience of other people and the meaning they make of that experience’ [15, p. 3]. The use of interviewing could help researchers gather valid and reliable data from interviewees that relate to research questions and objectives [13]. Interviewees could give their personal experience to the author according their working experience. In addition, the interviewing will be progressed as one-by-one form which is the most appropriate method and relatively easy to arrange [16]. There are five interviewees chosen from the case company who have professional experiences in managing or implementing JIT system of the company. Their background is summarized in Table I.

Through reviewing and analyzing the context of interviews, the author made some notes and recorded the range of reactions to questions explained, which can be categorized under the five themes as identified in Section I and are reproduced in Table II. Findings under these themes are explained in detail in the next section.

TABLE I  
BACKGROUND OF INTERVIEWEES

| Interviewees | Department and Position   |
|--------------|---|
| Mr. A        | Components Development Department, Director of Development          |
| Miss B       | Components Development Department, Director of Development          |
| Miss C       | Quality Control Department, Warehousing Components Quality Director |
| Mr. D        | Production Management Department, Director of Material              |
| Mr. E        | Production Management Department, KD Support Chief                  |

TABLE II  
 FIVE KEY RESEARCH THEMES

| Key Themes |                      |
|------------|----------------------|
| Theme I    | Information system   |
| Theme II   | Production planning  |
| Theme III  | Inventory management |
| Theme IV   | Quality management   |
| Theme V    | Suppliers management |

### III. DISCUSSIONS

#### A. Information System

Most interviewees support that proper design of information systems could assist JIT systems. They pointed out that information system is a technological foundation and its application to JIT is an elevated method for implementing JIT production system. The case company established a close dynamic corporation alliance via the Internet from upstream to downstream of the whole supply chain in order to realize the interaction among the company, suppliers and customers. In addition, information technology could assist the case company for building seamless connection between order information of upstream and resource information of downstream in order to reduce inventory by sharing information between both sides. Thus, the case company could enhance quicker response of the supply chain to ensure materials could be supplied smoothly. More specially, the company employs electronic Kanban system to facilitate the flow of information.

Fig. 1 shows the old system of the case company, which did not make use of a proper information system so that suppliers cannot report the delivery situation to Company X quickly and timely. Therefore, Company X had to employ many workers to check when and how many goods were provided. That disadvantage could lead to excess inventory in the factory. In addition, this makes Company X very

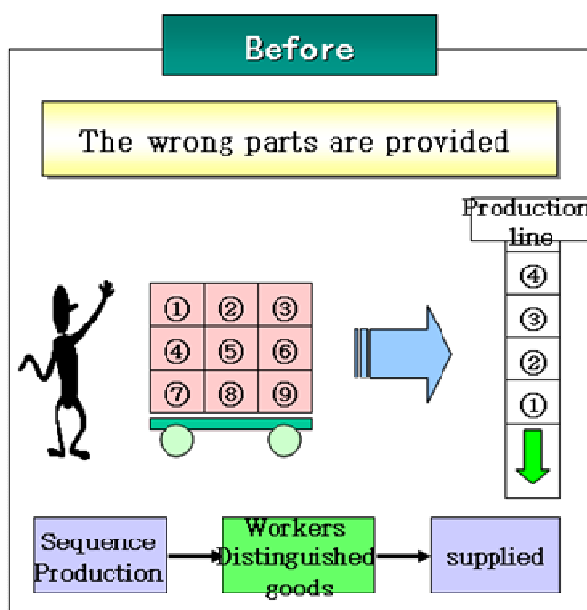


Fig. 1. Old information system of Company X.

difficult to control the production process and hence production efficiency is also low. The main problem of the old system is that wrong parts or components could be provided to the production line, which has a great influence on the whole production line. Implication of manual inspection is that efficiency was very low.

Fig. 2 depicts the new JIT information system, utilizing bar-code system to monitor the flow of parts. The system could prevent wrong parts being used in the production line and could guarantee that the production line is uninterrupted. This system could also improve the production efficiency and reduced the labor cost by updating production information instantly. Through using electronic data interchange technique to link Company X and its suppliers, Company X could get the information from the suppliers through a monitoring system. The new JIT information system could achieve quick response in production line and build a very close relationship between Company X and its suppliers.

#### B. Production Planning

Themes II relates to the question on how JIT system can affect production planning in the case company. According to the interviews, Kanban is a primary management method in the case company's JIT model. Therefore, information can be conveyed throughout the production process and hence is more visible to the whole production process. Thus, daily schedule could be carried out and the production sequence plan is operated from a JIT perspective. As a consequence, excessive or insufficient production capacity could be avoided and also the waste of production resources or loss of orders could be eliminated. This supports the three production philosophies, namely, synchronization of production, balanced production and rationalization of resources distribution. Particularly, Miss C believed that:

*“Balance production is the premise condition for achieving the JIT production”.*

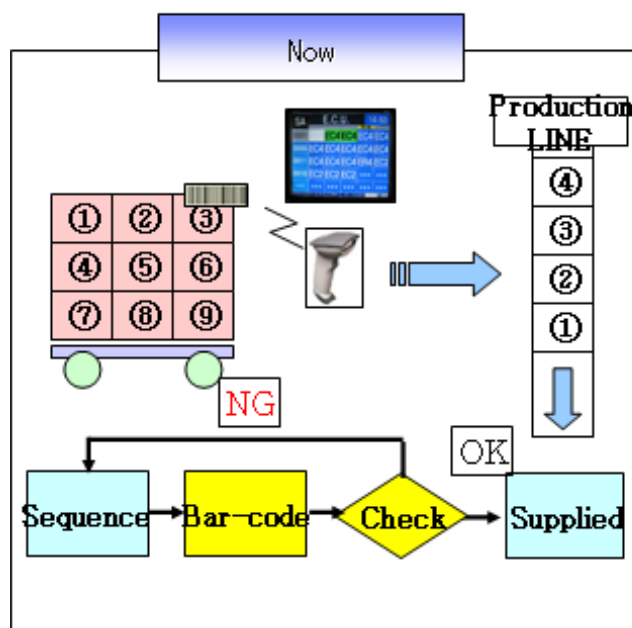


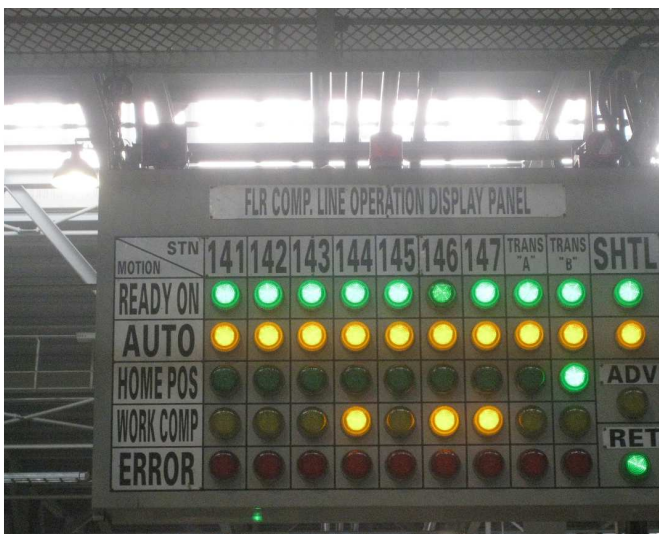
Fig. 2. New information system of Company BH.

In Company X, the major barrier of implementing JIT production planning and control is the uncertain factors of production planning and control, especially when the plan has to be adjusted so that its suppliers may not be able to make quick response due to such unexpected events. As a result, some parts could not be supplied at the right time.

As the whole supply chain of Company X includes lots of suppliers and process stages, the situation is even severe. In the case company, Kanban has been using in the production line to ensure synchronization of production. More specifically, Company X employs electronic signal Kanban system to resolve the problem. Fig. 3(a) illustrates a 3-lamp signaling system that has been built in each workshop. One signal lamp means that parts are being produced and the other one means that this production process has completed and the parts are going to be delivered to the next workstation. The last one means that there is an error in producing the parts or this workshop was stopped by the unexpected events or problems. According to the electronic Kanban signal, the subsequent workstations could understand the production situation from the former process



(a) 3-lamp signaling system



(b) Display panel

Fig. 3. Electronic Kanban System in Company BH

visually in advance. If errors have occurred at the former process, the subsequent workstations could use the safety inventory for production in order to ensure the production line is running smoothly. In addition, an operation display panel as depicted in Fig. 3(b) has been built in every sub-production process. The operation display panel shows the production process of every workstation in the production line. Managers could make production planning and control decisions based on the information displayed on this panel in order to ensure JIT production.

### C. Inventory Management

This section explains how the case company can (or cannot) achieve 'zero inventory' through implementing JIT system (and hence some barriers of achieving 'zero inventory'). The interviewees pointed out that the production process for JIT as mentioned in previous section has been implemented quite successfully. This means that production planning and material preparation are stable with respect to the end consumption. In other words inventory can be maintained at a reasonably low level.

Most interviewees, however, believed that 'zero inventory' is just a kind of ideal condition subject to the existing logistics and supply chain paradigm. Although inventory level for most of the components or parts is minimized by the implementation of JIT, and some parts could achieve zero stock in the case company but not all. In the mean time, some safety inventory cannot be eliminated completely from the system.

According to the interviews, there is a concern about safety inventory in Company X. Most of the interviewees pointed out that only a few spare parts could achieve 'zero inventory' after the implementation of JIT. That means most of the interviewees do not believe that 'zero inventory' can be achieved realistically in the case company. For example, Mr. D commented that:

*"Zero stock is just a kind of ideal condition ... It is nearly impossible to reach zero stock."*

### D. Quality Management

The interviewees considered that quality is a very important factor to assure successful JIT implementation. The concept of quality management is extended to all workers. In addition, to ensure the JIT systems can be implemented effectively, supplier quality management is of vital importance. Performance indicators have been employed to examine the achievement of suppliers in quality, on-time delivery etc., in order to encourage suppliers to participate in the JIT program.

### E. Suppliers Management

This section discusses the relationship between the case company and its suppliers and how the case company manages its suppliers. Some interviewees explained that choosing and evaluating the case company's suppliers objectively in JIT production system is crucial for the development. There are about 100 major suppliers in the case company and most of them (forty suppliers) have built their production facilities near the case company. Thus,

suppliers can reduce the time spent in distribution and can coordinate with the company tightly so that accurate information can be passed to the company quickly, and integrated JIT system could be achieved by the case company and its suppliers.

However, there are some barriers regarding choosing and evaluating suppliers. For instance, some interviewees pointed out that some selection criteria cannot be enforced because of subjective judgment of the top management, who gave preferences to the suppliers from their own country.

A problem has been put forward by the interviewees regarding supplier selection process. Because Company X is an international joint-venture company, some conflicts have occurred because of this during the supplier selection process. For example, Mr. A commented that:

*“We are too subjective in choosing suppliers ... So it is crucial to establish a complete supplier evaluation system to choose the potential suppliers”.*

#### IV. CONCLUSION

The research reveals some key findings in implementing JIT systems under five themes. They are further explained based on the case study and the authors hope that this study can help practitioners to implement or to improve JIT systems. In particular, the whole logistics system and the relationship with suppliers are of vital importance. In addition, this research also supports the benefits of applying JIT systems as advocate in many studies. One limitation of this study is that a single case study is employed. Future research can be conducted to study more companies so that the results can be generalized.

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