RES MILITARIS
REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

The Application of Just-in-Time production by using Fishbone Diagram: A Case study in the Baghdad Soft drinks company (IBSD)

By

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Abstract

The company's aim for using the (Just-in-time) production is to reduce non-profitable activities and make the manufacturing system eliminate the associated Costs of Carrying and maintaining the inventory. Therefore, the philosophy of Just-in-time is designed to achieve high-volume production through eliminating waste and continuous improvement.

Keywords: Just- in- Time production, kaizen, fishbone diagram.

Introduction

The philosophy of Just- in- Time production based on eliminating "waste" So there is another way to view the (JIT): is to think of it as a philosophy of Value-added manufacturing (Reid & Sanders, 2019). So, Just –in- Time production is not just another term in the Lean management, But (JIT) is a Journey to Zero waste and Cost-efficiency (Yang, Xie, Yu, & Liu, 2021). The Japanese used (the kaizen) approach Because of the aim of Continual small improvements and involving everybody in the company, which means they involve everybody from the CEO to the Lowest-Level unskilled workers (Suárez-Barraza, Ramis-Pujol, & Estrada-Robles, 2012). Therefore (JIT) Production system identifies the hidden problems in the value chain and reduces the production waste of the system while increasing the throughout (Sales- Row Materials Cost) (Lu & Bodek, 2018). Most companies use the Methodology of the Lean manufacturing technique depending on (Just in Time) supply chain Integration by using Cellular manufacturing Kaizen (Palange & Dhatrak, 2021). This study depended on the fishbone diagram to analyze the problems faced by the company. The fishbone diagram helps identify all potential or probable Causes and Select the best cause that contributes to the problem/effect (Saja, Woźny, & Bednarova, 2021). So the fishbone (Cause-and-effect) diagram was used by a Japanese manufacturing firm to facilitate Continual improvement in the workplace (Goetsch & Davis, 2010).

Just –in- Time production: A Literature review

According to Reid [JIT], production is the element of [JIT] that Focuses on the production system to achieve Value-added manufacturing (Reid & Sanders, 2019). So Just- in-Time (JIT) is an "as needed" inventory management strategy manufacturers use to increase efficiency, decrease waste, and reduce inventory costs. "The process should order and receive materials only as the company needs for attained the production process (Fatehi & Franza, 2020). Companies also spend much less on uncooked materials due to the purchases to make

full-order products. The firm is practicing this technique to attain a greater inventory by holding costs in return for focusing on the gross sales (Aityassine et al., 2021). According to Foster, JIT eliminates a Large part of the Companies purchasing and empowers suppliers to attain their purchase orders (Foster Jr, Wallin, & Ogden, 2011). The Toyota production system is a way of manufacturing that is referred to as a "Lean manufacturing" or a "Just-in-Time" system, which has become well-known worldwide (Chiarini, 2012). The just-in-time system makes the company start manufacturing/purchasing once the customer orders the good, effectively making Zero inventories, So the (JIT) environment materials are purchased and produced when needed. The idea of (JIT) is based on promises when an order is placed by the Customer (Hussein & Zayed, 2021).

Just-in-time is a system that manages the demand at a particular prior production (Ozalp, Suvaci, & Tonus, 2010). The Toyota production system (Tps) has established a global reputation as the Leading business philosophy to deliver measurable benefits in efficiency and quality within the manufacturing process. Therefore Just-in-Time approach makes only what is needed when it is needed, and the amount needed is delivered Just as they are needed (Chiarini, 2012). There are many methods of Just-in-Time:

1. Elimination of defects and waste.
2. Balancing the flow and scheduling the output.
3. Multi-skilled Labor force to carry out specific operations.
4. Maintenance of equipment and machinery for flaw operations.
5. Cellular manufacturing.

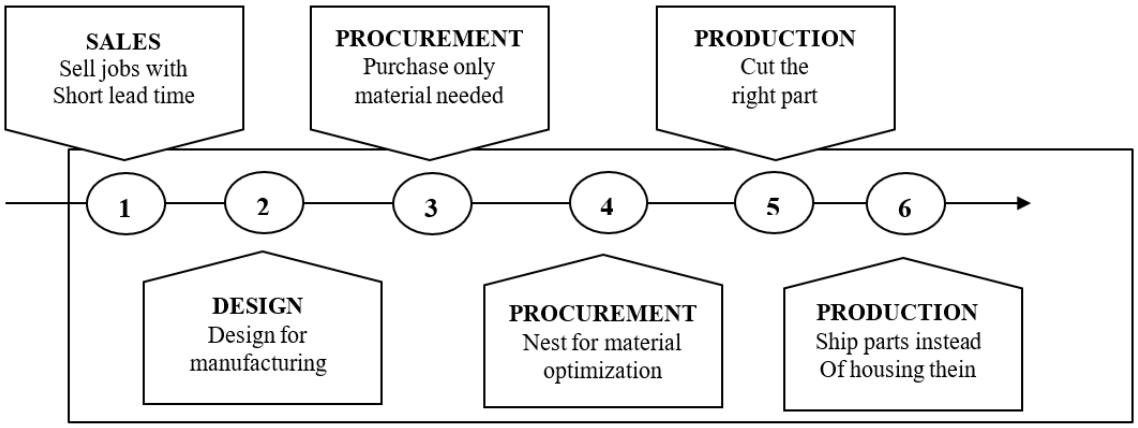

Figure (1) Summarized the steps of (JIT) in the company.
Source: (Ye, Suleiman, & Huo, 2022)

Figure (1). steps of (JIT)

Figure (1) defines two competitive advantages of the company: -

First: Establishing a pull system: by allowing the organization to create a pull system and apply it in the Current production process.

Eliminate waste by using a pull system will make your team deliver work items only if they have been requested (Lino et al., 2022).

Finally (Just-in-Time) means each process produces only what is needed by the next process in a Continuous flow (Saja et al., 2021).

The goal of (JIT) is to Lower Costs by preserving sufficient stock readily available to fulfill immediate production wants (Yang et al., 2021).

The pull system that depends on (JIT) approach is the process based on customer demand. The Concept is that each process manufactures each component with another department to build a final part to the exact expectation of delivery from the Customer (Apreutesei, Arvinte, Suciu, & Munteanu, 2010). According to (Reid) Kanban means "signal" or "Card" in Japanese, which is defined as A Card that specifies the exact quantity of product that needs to be produced (Apreutesei et al., 2010), (Sabry) focuses on the "Six Rules for an effective Kanban System which they are: 1- Customer "downstream" processes whit items, 2- Supplier "upstream" produces items, 3- N0 items are made without moved a Kanban, 4- Kanban should accompany each item, 5- Defect amounts are never sent, 6- The number of Kanban is reduced Carefully to Lower inventories (Apreutesei et al., 2010).

Kaizen philosophy

Kaizen is a name given to the concept of Continual incremental improvements: "Kai" means "change," and "Zen" means "good." According to (Goetsch) who defined the term "Kaizen,": it means making changes for the better on a continual, never-ending basis (Talib, 2013). Kaizen event process follows Deming's (PDCA) process approach, as shown in figure (2).

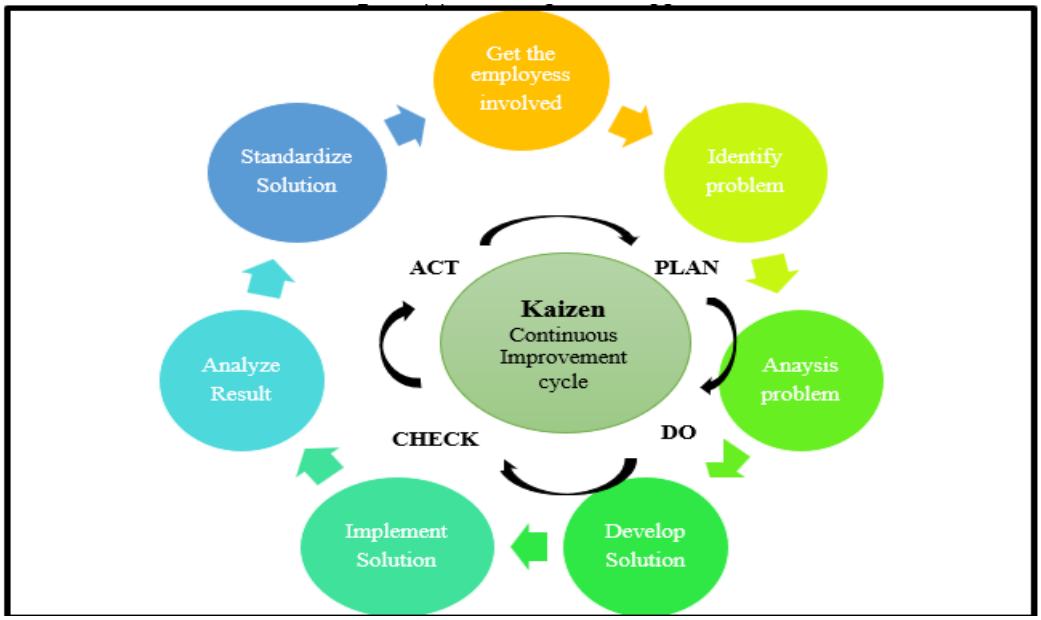

Figure (2). PDCA process approach
Source: (Craig, Rand, & Hartman, 2022)

Kaizen is a process of identifying problems at their source. It involves every employee making small improvements continuously. Therefore kaizen can be translated into Continuous improvement. This approach is a combination of two words, "Kai" and "Zen," which means "repair," "renew," and "change," or "power" kaizen is more than improving processes. The reality of this system is how the company could apply the principles of continuous improvement (Tyagi, Singh, Gautam, & Sharma, 2020). The philosophy of kaizen, when

adopted by the Company, Creates a Culture of Continuous improvement (Prayuda, 2020). Doing kaizen means changing things one at a time because this system is a practice of continuous improvement. It is recognized worldwide as an important pillar of an organization's Long-term Competitive strategy. Kaizen's philosophy is developing a Culture for people's engagement in improving the organization through small-small continuous improvements in daily work. The important rules in the Kaizen approach are kaizen (guiding principles) which are summarized in the following steps: * Always work as a team, * It is everybody's business, * Good processes lead to good results, * To grasp the current situation you have to go and see for yourself, finally * Identify the root cause of problems, and Speak whit data and manage by facts. This study discussed the final step, which focuses on the Root Cause of problems in the practical side of the study.

The company which implements the Kaizen system should implement three types of kaizen:

1. Kaizen elimination, 2- kaizen by Reduction, and 3- kaizen by change.

That implementation will attain the benefits of kaizen in the workplace: * to make the Job easier, safer-reduce and more efficient, by focusing on * Saves Time, Reducing of production and Reducing the production Lead time.

According to (Trout), kaizen refers to Lean Manufacturing by using brain brainstorming ideas and implementing daily activities that Continuously improve processes.

Therefore (Goetsch) focused on (Kaizen) strategy, the single most important concept in Japanese management- the Key to competitive success. Depending on the above, the philosophy of kaizen involves building a workplace culture that encourages active engagement in developing improvements and implementing new standards.

Therefore (Reid) related (Kaizen) system to continuous improvement by explaining that it is a philosophy of never-ending improvement. But (Trout) Concentrates on the multiple ways that the Kaizen system can be applied in the production and manufacturing organization by using the following types of kaizen:

1- Point Kaizen: which is a popular way to implement the philosophy depending on a quick approach,
2- system Kaizen: this system is used to address system-Level problems within the company,
3- Line Kaizen: which refers to utilizing Lean techniques in both upstream and downstream departments or processes, Plane Kaizen: which is referred to as value streams and is a level above Line Kaizen,
4- Cube Kaizen: refers to a situation where all points of the planes are connected, resulting in Lean processes across the entire company.

The Kaizen approach is broken into six steps

1- Brainstorm/ standardize, 2- Measure, 3- Compare, 4- Innovate, 5- Standardize, 6- Repeat. [16] as shown in figure (3)

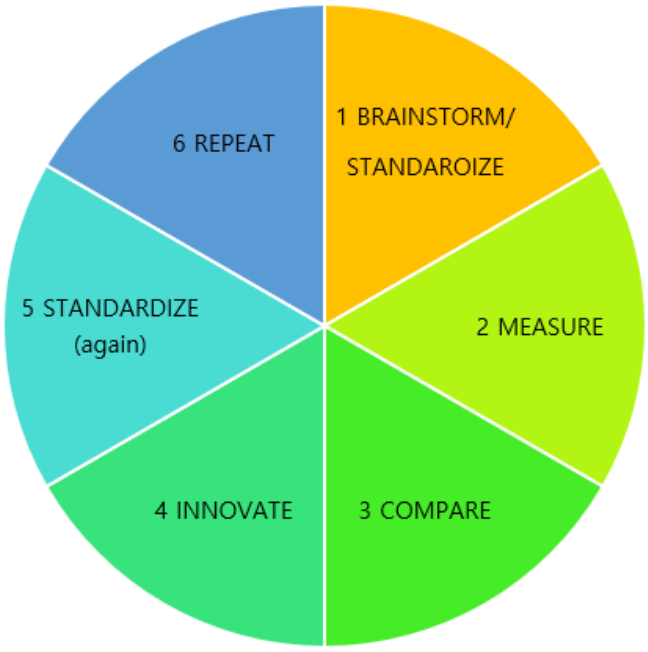

Figure (3) [16] The figure explains how to drive continuous improvement using the kaizen approach.

The fishbone diagram

The fishbone diagram is a diagram that shows the possible causes of a specific event or a problem (Coccia, 2018). The fishbone diagram has the shape of a fish skeleton, which has the problem defined in its head and the causes of the problem feeding (Luo, Wu, & Duan, 2018). As the explaining by (Waddill), fishbone diagrams are causal mapping diagrams that can be used to map the causes of a specific event to different categories (Shinde, Ahirrao, & Prasad, 2018). But (Frey) added that the fishbone diagram is especially useful during the problem definition segment of brainstorming sessions, where it helps individuals and teams deconstruct problems and challenges (Elangovan, Jusoh, Yusuf, Ismail, & Din, 2021). The goal of fishbone diagrams is to help the company move beyond symptoms to uncover the root cause of the problem. In manufacturing, the problem is usually linked to the (Six Big Losses).

According to (Waddill) the problem is the fish's head, with the causes extending to the left as fishbones, while they fall into six main categories:

* method *Equipment *Man *Environment *material and *Measurement. [19], Fishbone diagrams, also Known as Causes and effect or Isikawa diagrams, are useful for determining the root cause of a problem or challenge (Elangovan et al., 2021).

The fishbone diagram defined the problems in its dead, But the causes of the problem fed into the branches. Therefore the level of the branches depends on the requirements under each category. So the most commonly used concept is defined as the (6M's) including the following: *Man *Machine *Material *Method *Measure and *Mother nature (Environment). But (Frey) concentrate on the point that without such a visual analysis, a team may waste Time brainstorming solution to what is the problem.

In the manufacturing sector, all the causes are usually divided into (6) main branches, as shown in figure (4).

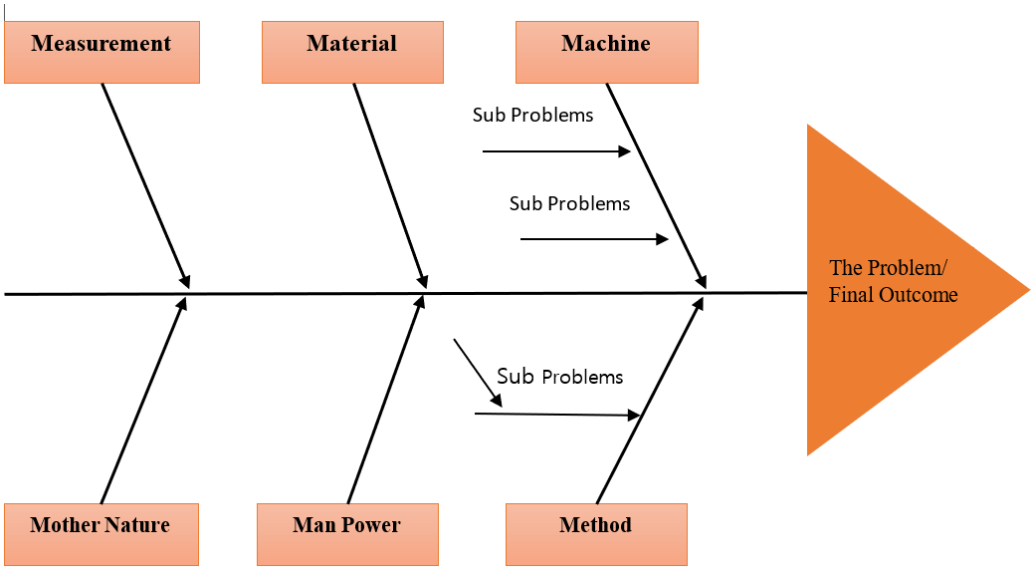

Figure (4) [17] The (6M) factors analysis helps the organization attain the problem-solving to focus on the quality problem and sort out interactions among factors for a cause.

Methodology of the study

The practical side of the study was attained in "Baghdad soft drinks company"- (IBSD). This company produces and markets soft drinks in Iraq. This company had a contract with Pepsico, allowing Baghdad to work in Iraq and Marketing Its products. Baghdad company distributes its products Like *Pepsi, seven-up, and Meranda. This study will analyze the company's problems by using the fishbone diagram to define the root reasons that prevent this company from implementing the (Just-in-Time) approach and use kaizen to treat the problems of production and distribution of Pepsi products.

Analysis of the Issue

The Issue of Baghdad company is concentrated on the production Lines of the products. In contrast, the company had eight Lines of production contained *Pepsi products * Seven-up, and * Meranda, all of which are soft drinks.

First: The researcher used the fishbone diagram to show the root reasons for the inability of the company to use Just-in-time production. First, the company has eight Lines of production, which depends on a large Inventory divided to the eight lines' requirements. So the soft drinks' raw materials must be delivered to all these lines smoothly. Therefore there is no plan to offer the material depending on the schedule to every line. Therefore the company needs huge Inventories for all types of soft drinks.

Second: also there is a problem in attaining the measurements because the company needs a high level of measurements to enter the world's competitive market.

Third: the company needs to renew the machines used in the eights lines of the

production of the three types of soft drinks. There is another problem which referred to (milieu/ mother nature), the company needs to attain the: (ISO 14001-2015) to avoid the problems of the environment, this around to the fourth step of root analysis of fishbone, fifth: the man power, the company needs a multiskills employee to attain the competitive advantage around this products. Finally, the company's method needs to be renewed to be a modern method for producing this type of product.

The researcher analyzed the problems of this company by using the fishbone diagram as shown in figure (5).

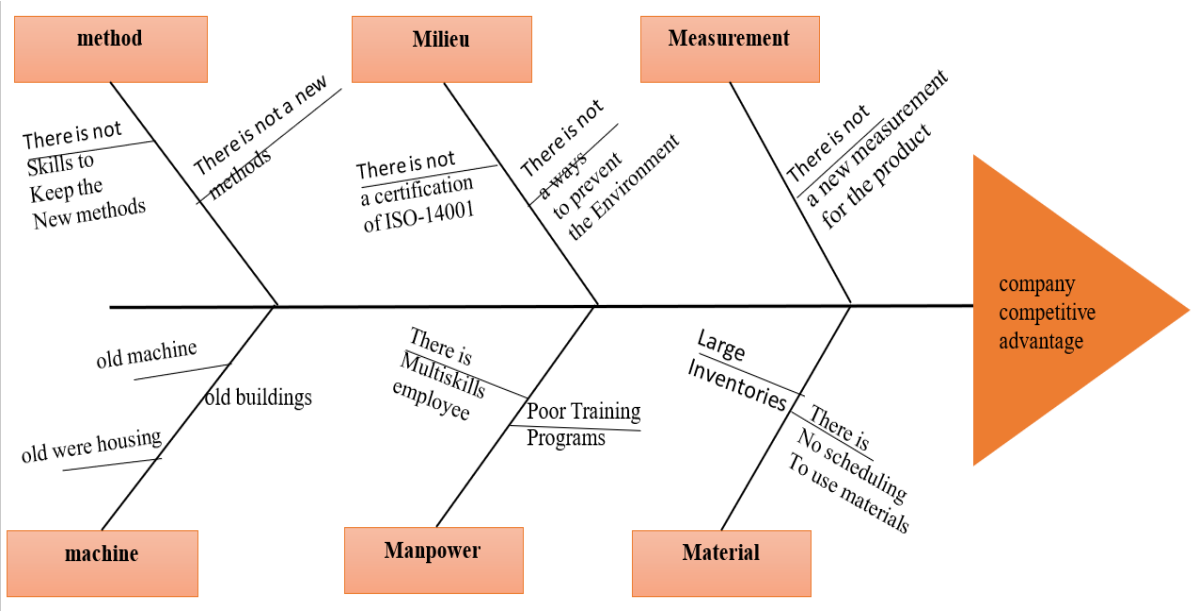

Figure (5)- source-by other

The researcher analyzed the root reasons using the fishbone diagram for the (6 M's), as shown in figure (5), to define the production Issue that prevented the company from attaining the Just-in-Time production.

Analysis of the checklist

The researcher used the checklist to analyze the data taken from the company (IBSD) after analyzing the root causes of the problem faced by the company, which prevents the application of the (Just-in-time) production by using the kaizen approach.

The checklist was designed to evaluate the conditions to applicate the (Just-in-Time) production in (Baghdad Soft Drinks Company), the checklist evaluated all the sides related to the departments of the factory in the first evaluation, and the second evaluation was to measure the ability of the factory to achieve the production operations with their requirements with the conditions of eliminate the defects and risks of the environment neither the internal environment nor the external environment. The analysis of the checklist needs to check all the sides related to the workforce and their skills and how they have treated the information from the top management.

The researcher analyzed the checklist shown in the table (1): -

Table (1). The third evaluation was to measure the checklist statement to reach the final results.

	practices for managing (JIT) production	Yes	No
1	Delegate responsibility to workers on the floor		√
2	Ensure that Line employees are properly trained	√	
3	Information systems must give employees a holistic view of operations		√
4	A flexible work face and flexible machines are both important to achieving JIT production		√
5	Visual controls are important to managing JIT production	√	
6	Accountability abs governance are key		√
7	stability in production operations in a requirement	√	
8	Adherence to defined processes across all manufacturing functions and processes		√
9	Elimination of defects and risks		√
10	Small manageable production lot sizes		√
11	Worker skill diversification across multi-functional workers		√
12	Controlling with time to increasing improve communication		√
13	Cellular manufacturing		√
14	Readily available designs and descriptions for complex process		√
15	Full control of the movement of materials		√

The results

By depending on the table (2) to analyze the size of the gap, the researcher reached the following results: -

The statement (1) related to the responsibility of workers was unapplied in the factory, so the measure was zero; therefore, the percentage of application was (0%) because the Delegate responsibility of the workers was not found with the employee in the factory, the statement (2) related to the training programs which were found the factory, and it was effective programs which resulted in (100%) percentage, the statement (3) Linked with the information systems which recorded (0%) because the statement confirms that the information systems must give the employees a holistic view of operations, which was not found in the factory because that was related to the managers in the top management of the factory, which prevent to applicate the condition of the evolvement of the employee.

The statement (4) record (0%) that relates to the flexible (workforce) and (flexible machines), this statement was not applied, which resulted in the prevention of achieving the (JIT) production. When it comes to statement (5) relating to the controlling functions in the factory, it was not found to apply (100%) percentage that was the percentage to an applicate the (JIT) production; therefore, the percentage was (0%). The statement (6) of the checklist was Linked with the governance. The condition of this statement is made the governance the Key of the controlling work in the soft drinks factory, which was not found and not applied.

The explanation of statement (7) related to the stability of production operations

recorded (100%) because the operation manager depending on the production schedule which divided the production among the seasons of the year, which related to the pull of the product of soft drinks, an example the pull of soft drinks in summer season more than the author seasons, therefore, the depending on the scheduling, the statement (8) related to processes of the manufacturing functions, this statement reached (0%) the reason was there is no clear definition to all employees where work in the production line in the factory. But the statement (9) concentrates on the elimination of defects and risks record (0%) because the (JIT) production concentrates on Zero defects by using the (5s) approach, so this approach was not found in this factory. The statement (10) records (0%) because the production system applied large batches and stored them as a large Inventory to achieve all the contracts during the year's seasons. The statement (11) recorded (a 0%) percentage because the statement concentrates on the diversification of the worker's skills. This statement is divided into two sections, first the diversification of skills this point was not found because every worker specialist in Just a skill that he needed in his Job only, the second section concentrate on the multi-functional workers, this condition was not found because this approach was not applied in the factory. The statement (12) recorded (0%) that the controlling system in the factory did not connect with the communication system; therefore, the percentage (0%) was measured exactly the reality in the factory. On the other side, statement (13) recorded (0%) because the production system in the factory did not use cellular manufacturing. The same result in the statement (14), which related to designs and description for the complex process which was not available in this factory, finally the statement (15) this condition of full controlling was not applied for the movement of materials; therefore statement recorded (0%)>

Table (2) summarizes the results explained above and shows the final results of the practical side of this research to define the gap size in the factory as a result of the inability to apply (JIT) production.

Table (2). The checklist analyses

	statements	applied	Un applied	The percentage of application
1	Delegate responsibility to workers on the floor		*	0%
2	Ensure that Line employees are properly trained	*		100%
3	Information systems must give employees a holistic view of operations		*	0%
4	A flexible work face and flexible machines are both important to achieving JIT production		*	0%
5	Visual controls are important to managing JIT production	*		100%
6	Accountability abs governance are key		*	0%
7	stability in production operations in a requirement	*		100%
8	Adherence to defined processes across all manufacturing functions and processes		*	0%
9	Elimination of defects and risks		*	0%
10	Small manageable production lot sizes		*	0%
11	Worker skill diversification across multi-functional workers		*	0%
12	Controlling with time to increasing improve communication		*	0%
13	Cellular manufacturing		*	0%
14	Readily available designs and descriptions for complex process		*	0%
15	Full control of the movement of materials		*	0%
	Weights	1	0	
	Frequency	3	12	
	Weights * Duplicates	3	0	
	The weights mean		0.2	
	Percentage to match		20%	
	The size of the gap		80%	

It's noticed from table (2) that the statements which were applied at (100%) percentage were statements (2), (5), and (7). On the other side, the statements (1), (3), (4), (6), (8), (9), (10), (11), (12), (13), (14), (15), were not applied at (0%) percentage.

Figure (6) shows the percentage of applications as explained in the table (2).

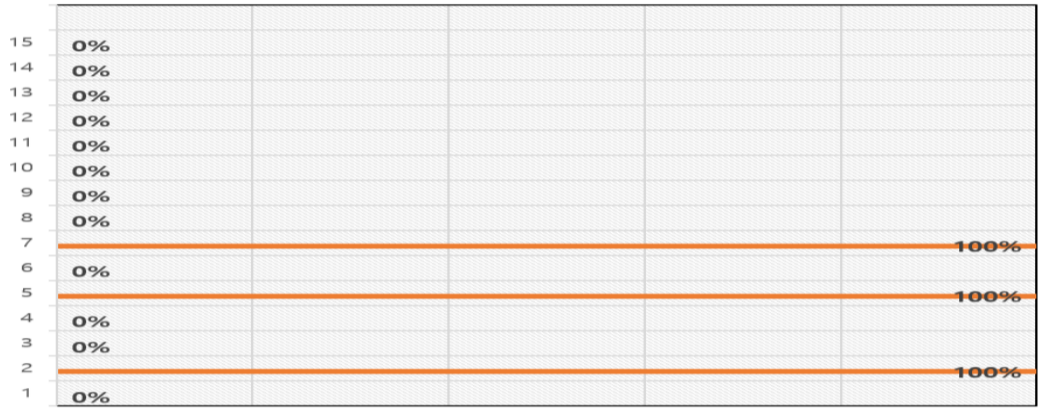

Figure (6). The percentage of checklist statements of the factory

As a result, figure (7) summarizes the percentage of application and the gap size depending on table (2).

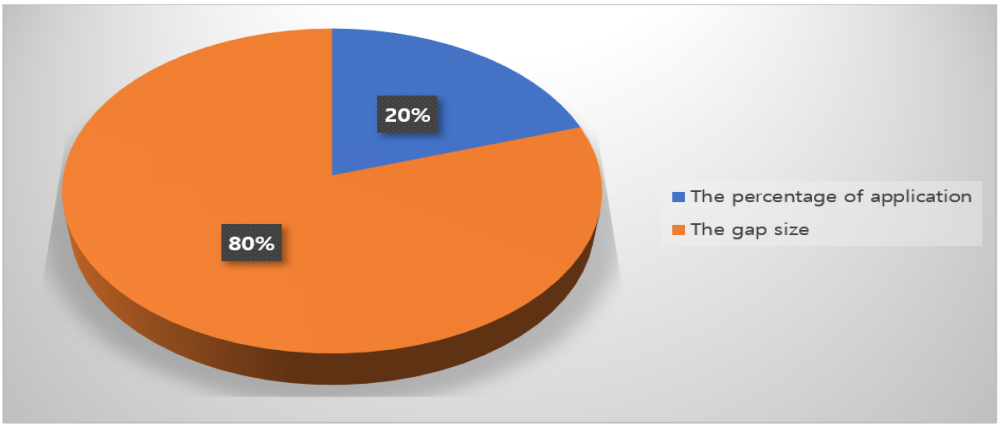

Figure (7). The percentage of application and the gap size

Figure (7) explained that the gap size was (80%) It is a large size, which is related to the inability of the factory to apply the (Just-in-Time) production. On the other hand, the statements which applied the conditions of (JIT) reached (20%), which prevents the application of this approach.

Conclusions and Recommendations

The company should use the (JIT) approach to reduce setup time and Waste. Just-in-Time approach attained the flow of goods from warehouse to shelves improves. The company should work with employees with multiple skills. The manufacturing company used the fishbone diagram to determine the root causes of the problem. The fishbone diagram helps the company to identify the areas for data collection. Baghdad Soft drinks company should try to attain the certificate (ISO 14001-2015) to save the environment around the factory. There must

be full scheduling to improve the production strategy of (IBSD) to attain a competitive advantage over the other companies in the same Industry. This company should adopt a new strategy for distribution of the products outside Iraqi boundaries by attaining competitive advantages. (IBSD) needs to renew another Line-production for new products added to Pepsi-products, seven-up, and means. (IBSD) should use (Kaizen) approach to attain Lower Inventories in its warehouses.

Acknowledgment

The author would like to thank Mustansiriyah university (www.uomustansiriyah.edu.iq) Baghdad-Iraq, for support in the present work.

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