

# Evaluation of the application of JIT method in Greek SMEs

Maria Kouti, Panos Fitsilis

Project Management Dept., Technological Education Institute of Larissa,  
41110 Larissa, Greece.

**Abstract.** *JIT is a well known method for the implementation of lean strategy in manufacturing. The main objective of JIT method is achieving excellence through continuing elimination of waste and consistent improvement in productivity. Even though the application of the method in large manufacturing companies is successful and there many studies in the literature reporting benefits achieved and problems faced, there is not sufficient evidence from the application of JIT method in SMEs of an underdeveloped region. In this study we present the finding of a questionnaire that focused on identifying the effectiveness, benefits and problems from the application of JIT method in SMEs in the region of Thessaly.*

## 1 Introduction

“Just-in-time (JIT) is the name commonly used to describe a manufacturing system where necessary parts to complete finished products are produced or delivered at the assembly site as needed (Wafa and Yasin, 1998). JIT is defined as an approach to achieving excellence in a manufacturing company based on continuing elimination of waste and consistent improvement in productivity. A key point in understanding JIT is the continuous monitoring of production processes with the goal of eliminating all forms of waste” (Wafa and Yasin, 1998). Quality is emphasized heavily in JIT. The main goal is to have no defects or in other words “get it right the first time”. Quality is shown when stocks are decreased. JIT requires that quality already be in the products and not be inspected (Aghazadeh, 2004).

JIT, as a concept, has been in the business environment for more than 50 years in one form or another and many success stories have been reported (Aghasadeh, 2003). Even though, the application of JIT strategy was successful and well documented in large manufacturing companies there is little evidence on the application of JIT strategy in Small and Medium Size Enterprises (SMEs), which is the case of the Greek enterprises. The majority of Greek enterprises are small enterprises and they are being characterised with the existence of webs of horizontal and vertical relationships between themselves. Further, Greek economy exhibits a not balanced structure where small enterprises, such as food, drink, tobacco, textiles, clothing and footwear are the majority of the enterprises in comparison with medium or large size enterprises (Anagnostaki and Louri, 1995)

In Thessaly region and especially in Larissa prefecture, the largest sector is agriculture. In the manufacturing sector, the most important enterprises are those of foods, drinks, textile, clothing, timber, furniture and metallurgy.

The overall aim of this research therefore was to undertake an exploratory investigation to gain insights and draw conclusions on the applicability of JIT method in SME operating in underdeveloped areas such as Thessaly region. To achieve this, the following research questions have been studied:

- Do SMEs in the region of Larissa use the JIT method for their production?
- Is the method used effectively? It is essential to investigate how managers apprehend the method in the company especially the effectiveness

in those areas: quality improvements, time-based responses, employee flexibility, firm profitability and inventory reductions.

- What are the benefits that companies have achieved from JIT use? Despite the factor of how managers find the method, another factor that should be explored are the benefits that companies have gained. So as to understand those benefits it is useful to compare how the production was structured before and after the application of JIT method..
- What are the problems from introducing JIT method? The last question is focusing on the problem areas that companies have faced. During the introduction of the method companies find solutions to the problems from a scientific point of view, but it would also help others from avoiding it and gaining precious time.

In the remaining of the paper and in section 2 we present the findings of similar researches from the application of JIT method. These studies were the basis for structuring our research in order to ensure the validity of the questions of the research and the comparability of the research results. In section 3 the research design is presented and the questionnaire is analyzed. In section 4 we present the research results in a summary form. Finally, in the last section we present the conclusions and implications to be considered in future works.

## **2 Background**

Literature on JIT strategy is extensive. The main objective in this section is to identify the major JIT strategies from improving productivity along with their implementation issues that would be applicable to SMEs.

AbdulNour et al. (1998) identified several problems in implementing JIT in SMEs. Among them, they emphasize on the influence of factors such as inadequate material and human resources, high labor turnover, lack of influence over suppliers, etc. In order to overcome those obstacles, the authors proposed a project management approach for JIT implementation. As a result of this approach, productivity and quality went up, and lead-time went down from six to less than two months.

Gunasekaran et al. (2000) studies how JIT can be used for improving performance in SMEs. In their study, an analysis was made of productivity and quality problems and the results obtained indicate that some manufacturing concepts and technologies typically associated with large companies such as JIT/Kanban, Hoshin and 5Ss can be applied to a small company. More specifically, they report that the application of JIT was an overwhelming success in the company of their case study.

The size of SMEs obviously is one important factor for the JIT implementation. The size of the company can affect the structure and its relationship to JIT implementation because size is a major determining factor of the structure. The wider the spans of control, the greater the number of hierarchical layers. Relationships between JIT and firm size have also been investigated. Small firms may differ from large firms in JIT implementation in four areas (Claycomb, Germain and Droge, 1999):

- (1) influence over suppliers
- (2) resources necessary for JIT operational changes
- (3) ability to run small scale tests of JIT implementation
- (4) knowledge of the JIT total system philosophy

Generally, larger firms may be better positioned to adopt a JIT strategy (Germain and Droge, 1995; Salaheldin , 2005).

Several factors could influence negatively or positively JIT implementation process. These factors have been addressed in detail by a number of similar researches.

According to Svensson (2001) study, JIT is the philosophy of quick response. In this study, JIT was examined from the theoretical framework, stating that is a philosophy where all goods are to arrive exactly when they are needed, that is, neither early nor late. It was also examined whether there has been any reduction in paperwork after the use of it.

Another factor that was examined is the level of flexibility of the production line.

Ramarapu, Mehra and Frolick, (1995) have studied the benefits of JIT implementation and how elimination of waste is achieved and simultaneously higher quality. These elements have been grouped into broader critical factors, the concept of quality at the source, or doing it right the first time.

Similar results were presented in Chong, White and Prybutok, (2001) research where they state that the longer the JIT system is in place more benefits are achieved, and the greater the extent of JIT implementation the greater the success achieved. Further, they state that employee satisfaction is increased and as a result the production output where human resources are involved, is maximised.

The issue of employees' willingness to accept JIT has been examined by Mehra and Inman, (1992) where it was proven that employee's showing flexibility is the adoption of JIT. Further, it was proven that employee's cooperation or unwillingness of workers to perform multi-tasks, is a critical success factor.

Employee training in the introduction of JIT was examined by Aghazadeh, (2004). It includes training of employees to improve their job skills in technical matters and problems solving, which means that multi-skilled workers are required. According to this research, Yasin, Wafa and Small, (2001), consider that training of management and employees is important, so as to make an organizational structure.

Yasin, Wafa and Small, (2001) studied how communication is affected by the introduction of JIT. Their study suggests that JIT improves communication internally (within the organization) and externally (between the organization and its customers and vendors). This factor also results in a closer relationship between buyer and supplier and a form of mutual dependency. In the same study, it is examined how JIT is increasing productivity and enhancing customer responsiveness. It is examined whether the quality initiatives are customer driven or not. Another research that is referred to customer focus is from Ahmad, Schroeder and Sinha (2003); JIT has the ability to respond to changes in customer needs. It is a philosophy that links the customer with the production system.

As it was mentioned before, the literature on the application of JIT is extensive. Numerous studies are examining implementation issues e.g. relationship with suppliers (Gupta and Kini, 1995), top management involvement (Wafa, Yasin and Swinehart, 1996), reduction of lead-time, decrease of throughput time (Crawford and Cox, 1991), improvement of quality, increase of productivity etc. (Cook, 1996)

In summary, it is clear that in order to realize benefits from JIT there are several prerequisites. Hence, organizations that are interested in successfully implementing JIT must be prepared to make certain modifications in their philosophy and operations in order to circumvent potential problems and to reap the potential benefits.

Further, the special characteristics of Thessaly region should be taken into account. The special characteristics of the Thessaly region are better expressed with a SWOT analysis. SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) could be used as a tool to understand those basic facts. It is important to know the opportunities and the strengths of the region since this would allow local SMEs, to capitalize the advantages present in the region. On the other hand, weakness or threats shouldn't be considered as flaws or as obstacles but they should be taken into account in the strategic planning of the SME. According to relevant researches, the strengths of the region are positive demand, existence of dynamic sectors that helped sustainable growth at least the last decade. On the other hand, Thessaly region weaknesses are lack of innovation, low penetration of new technologies, weak financial sector, etc. Also because of strong local

competition, companies don't cooperate with each other (www.keta.gr accessed at 08-28-2005) .

### 3 Research approach

To analyze the implementation of JIT philosophy by Thessalian manufacturing firms, the researchers developed close-ended questionnaire with ordered choices. In the questionnaire, participants were asked to evaluate the influence of various factors using a scale for 1 to 5, where 1 indicated negative influence and 5 very positive influence.

The companies that were included in sample for the research were selected from the list of the Association of Thessalian Industries. According to those data in the area of Larissa, where the research was conducted there are 200 manufacturing industries; from which only 60 of them use the method of JIT. After, an initial screening a sample of 30 companies was selected. Finally, a limited number of interviews was done in order to elaborate replies on questionnaire and to discuss qualitative factors that affected the introduction of JIT.

One of the main selection criteria was company size. Further, companies were selected according to sector of activity. The selected companies were classified as follows:

Sector of activity	Number
Construction materials	11
Furniture, timber	5
Metallurgy	3
Food	4
Chemical, plastic	3
Various	4

Finally, according to the number of employed personnel, companies were classified as follows:

	Very small (<10)	Small (<50)	Medium (<250)
Number of companies in the selected sample	22	7	1

In order to have better results the questions were structured around a number of fundamental questions. More specifically the main research objectives were:

- to study how the product quality is affected from the introduction of JIT.
- to analyze how the introduction of JIT influenced the effectiveness of production.
- to explore the relationship between human modification efforts that should be undertaken prior and after JIT implementation and JIT success.
- to study how the information flows are changing in the triangle between the organization, the suppliers and the customers.

Further, other issues examined by the questionnaire were:

- reasons for deciding to enter the procedure
- preparation method used and time needed
- role and contribution of consultants
- content and intensity of training for executive members and personnel
- degree of personnel participation and involvement
- difficulties experienced during preparation and implementation of the system
- benefits emerging from JIT
- future plans of Greek companies

In order to ensure the comparability of the results, the authors attempted to base the questionnaire on similar researches and this was partially accomplished.

#### **4 Research results**

The study attempted to answer five questions and through them understand the use of JIT in the enterprises. The first question was if Thessalian companies are using the JIT method and it was proved that JIT is widely used in the area of Larissa.

The second question was about whether managers find the method effective. The percentage of 64% supporting the effectiveness makes obvious the answer to the question. Managers found the method effective being based on the fact that the characteristics of JIT are that customer service is improved, operations are faster, more responsive, and reduce costs dramatically. In order to have the best results workers were involved and trained, and suppliers' cooperation was established. Their overall experience with JIT was satisfactory to the extent that they would recommend it to others. Two main principles that JIT relies on are the elimination of waste and the complete utilization of capabilities of people. The goals are like the advantages, the main goal is to eliminate cost. Costs should decrease through reductions in total costs of material acquisition and storage, reductions in repair and warranty costs, and reductions in inventory audit time. JIT strategies therefore aim to improve financial efficiency by increasing revenues and decreasing costs (Claycomb, Germain and Droge, 1999). From the research it came up that nearly all manufacturers were successful in achieving tangible financial improvement.

The third question that had to be answered was how the effectiveness of the method can be explained. Various studies have shown that JIT helped companies so as to improve their performance. One such study was by, Inman and Mehra (1993) (referenced in Ahmad, Mehra and Pletcher, 2004), which surveyed 114 manufacturing JIT firms. It came up from their survey that there is correlation "between the level of JIT implementation and the level of financial success". Comparatively the research that was made at Larissa, gave the result that each company that use JIT was totally satisfied having a percentage about 64%, particularly about helping in the production line, the quality of the product and the delivery. On the other hand, the answer in the question about the operation costs of the company is not specific, because there are many factors that could influence the outcome of the financial results, e.g. regulation, technological innovation, politics, etc. as it is mentioned in Ahmad, Mehra and Pletcher, 2004.

The fourth question was about the benefits that companies have achieved. The study has shown that JIT has the ability to make improvements in those factors: relationships with employees, customer service, and quality of the finished products, but in order to achieve these, workers had to be trained and a better cooperation with suppliers was build. Their overall experience with JIT was satisfactory to the extent that they would recommend it to others. JIT philosophy has the prospective to give the company great benefits which can be translated into a strategic competitive advantage. The success with JIT can be achieved if JIT is approached as a strategic philosophy rather than a quick fix of business problems (Wafa and Yasin, 1998). According to Fullerton and McWatters, (2001) adopting JIT practices, all companies have experienced considerable benefits in all of the measured areas: quality improvements, time-based responses, employee flexibility, firm profitability, and inventory reductions.

Some significant benefits of JIT reported by participants included:

- reduction in defects, errors or breakdowns at a percentage of 25%
- improved customer service at 30%
- improved incoming and outgoing quality standards at 55%
- paperwork reduction at 57%,

similar effects have come up from a study of Yasin and Wafa, (1996). Despite the benefits that JIT can offer to each company, it is a demand-

pull system. It leads the company to produce a product only when it is needed and only in the quantities demanded by customers. It should be acknowledged, however, that the scope of JIT is broader than the way it has been operationalized here. It also raises issues of purchasing decisions and the procurement of frequent deliveries from nearby suppliers (Hoque, 2000).

The main findings related with this key question are presented in the following table:

<b>Benefit</b>	<b>Mean (scale 1-5)</b>
Profitability improvement (operating cost decreased)	3,62
Improvement in production line	4,14
Product quality improvement	4,18
Reduction in defects	4,37
Reduction in process time	3,59
Product availability has increased	4,02
Better communication between the organisation and its customers	3,92
Paper work reduction	4,22
Reduction in customer complaints	4,25

Factors such as product quality improvement, the reductions of the product defects and the elimination of waste are main quality attributes that can be translated as direct quality improvements.

Finally, the fifth question was the effects or problems of JIT. The identified problems from the introduction of JIT strategy in the Thessalian companies are mainly related with the small size of the companies. It was made clear that a lot of emphasis has to be put on human resource management. More specifically it was proven that most of companies do not have formal training programmes neither for the management nor for workers. Further, the available expertise on JIT implementation is limited and therefore the most commonly used approach is the exploratory JIT implementation. On the other hand employee motivation and willingness to participate for JIT implementation is quite high, indicating that employees are aware of JIT strategy advantages.

## **5 Conclusions**

This research is an attempt to document and analyse the use of JIT method in the region of Larissa, the benefits that companies have realised and the problems phased during and after the implementation of the method. Moreover, some relevant literature advocating was presented that JIT does work. Even unsuccessful JIT firms reported benefits that have derived from JIT. The survey was made by questionnaires in a wide range of Larissa manufacturing companies. Around 93 per cent of all respondents to this study reported it is considered to be successful. A very significant managerial result of the current study is that the Thessalian companies can use JIT as a strategic philosophy, rather than as a temporary solution for operations obstacles.

Of course there is a limitation to the implementation of this study, since the data were gathered through the perceptions of the managers and all the benefits and failures were measured only from the interviews and from their point of view. Even though, some argue that just perceptions do not reflect how is the actual performance of the company, they believe that it is better to measure the companies success by the judgments of the stakeholders as they care more about the financial performance.

JIT practices become more and more relevant and in-depth study of specific industries and companies would result in a more detailed analysis of

benefits and limitations. Further detailed studies of JIT failures would provide information on the pitfalls of JIT and the needed conditions for its success. These case studies would help to uncover the motivation to implement JIT and come up with the fact that JIT's substantial benefits merits its consideration as part of organizational strategy to enhance long-run performance and competitiveness.

#### References

- AbdulNour, G., Lambert, S. and Drolt, J. (1998), "Adaptation of JIT philosophy and Kanban technique to a small-sized manufacturing firm: a project management approach", *Computers & Industrial Engineering*, December, Vol. 35 No. 3-4, pp. 419-422.
- Aghasadeh, S., (2003). "JIT Inventory and Competition in the Global Environment: A Comparative Study of American and Japanese Values in Auto Industry". *Cross cultural management*. Vol. 10, No 4, pp. 29-42.
- Aghazadeh, S., (2004). "Does manufacturing need to make JIT delivery work?" *Management research news*. Vol. 27, No. 1, pp. 27-42.
- Ahmad, A., Mehra, S. and Pletcher, M., (2004). "The perceived impact of JIT implementation on firms; financial /growth performance". *Journal of manufacturing technology management*. Vol. 15, No. 2, pp. 118-130.
- Ahmad, S., Schroeder, R. and Sinha, K., (2003). "The role of infrastructure practices in the effectiveness of JIT practices: implications for plant competitiveness". *Journal of engineering and technology management*. Vol. 20, pp. 161-191.
- Anagnostaki, V. and Louri, H., (1995). "Manufacturing entry in Greece, 1982-1988: did sectoral policy work?" *Journal of economic studies*. Vol. 22, No. 6, pp. 60-68.
- Chong, H., White, R. and Prybutok, V., (2001). "Relationship among organizational support, JIT implementation, and performance". *Industrial management & data systems*. Vol. 100, No. 6, pp. 273-280.
- Claycomb, C., Germain, R. and Droge, C., (1999). "Total system JIT outcomes: inventory, organization and financial effects". *International journal of physical distribution & logistics information management*. Vol. 29, No. 10, pp. 612-630.
- Cook, R.L. (1996), "Applying JIT principles to continuous process manufacturing supply chain", *Production and Inventory Management Journal*, Vol. 37 No. 1, pp. 12-17.
- Crawford, K.M. and Cox, J.F. (1991), "Addressing manufacturing problems through the implementation of just-in-time", *Production and Inventory Management Journal*, Vol. 32 No. 1, pp. 33-36.
- Fullerton, R. and McWatters, C., (2001). "The production performance benefits from JIT implementation". *Journal of Operations Management*. Vol. 19 pp 81-96.
- Germain, R. and Droge, C., (1995). "Just-in-time and context: predictors of electronic data interchange technology adoption". *International journal of physical distribution & logistics management*. Vol. 25, No. 1, pp. 18-33.
- Gunasekaran, A., Forker, L. and Kobu, B. (2000), "Improving operations performance in a small company: a case study", *International Journal of Operations & Production Management*, Vol. 20 No. 3, pp. 316-335.
- Gupta, O. and Kini, R., (1995). "Is price-quantity discount dead in a just-in-time environment?" *International journal of operations & production management*. Vol. 15, No. 9, pp. 261-270.
- Hoque, Z., (2000). "Just-in-time production, automation, cost allocation practices and importance of cost information: an empirical investigation in new Zealand-based manufacturing organizations". *British accounting review*. Vol. 32, pp. 133-159.
- Mehra, S. and Inman, A., (2000). "JIT implementation within a service industry: a case study". pp. 53-61.

- Ramarapu, N., Mehra, S. and Frolick, M., (1995). "A comparative analysis and review of JIT "implementation" research". *International journal of operations & production management*. Vol. 15, No. 1, pp. 38-49.
- Salaheldin S. I. (2005), JIT implementation in Egyptian manufacturing firms: some empirical evidence, *International Journal of Operations & Production Management*, Vol. 25 No. 4, pp. 354-370.
- Svensson, G., (2001). "Just-in-time: the reincarnation of past theory and practice". *Management Decision*. Vol. 39, No. 10, pp, 866-879.
- Wafa, A. and Yasin, M., (1998). "A conceptual framework for effective implementation of JIT: an empirical investigation". *International journal of operations & production management*. Vol. 18, No. 11, pp. 1111-1124.
- Wafa, M., Yasin, M. and Swinehart, K., (1996). "The impact of supplier proximity on JIT success: an informational perspective". *International journal of physical distribution & logistics management*. Vol. 26, No. 4, pp. 23-34.
- Yasin, M. and Wafa, M., (1996). "An empirical examination of factors influencing JIT success". *International journal of operations & production management*. Vol. 16, No. 1, pp. 19-26.
- Yasin, M., Wafa, M. and Small, M., (2001). "Just-in-time implementation in the public sector". *International journal of operations & production management*. Vol. 21, No. 9, pp. 1195-1204.
- Yasin, M., Wafa, M. and Small, M., (2004). "Benchmarking JIT. An analysis of JIT implementations in the manufacturing service and public sectors". *Benchmarking: an international journal*. Vol. 11, No. 1, pp. 74-92.