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The Effect of Just-in-Time Implication on Firm Financial and Operating Performance: Evidence from Iran

Mahdi beshkooh[1*], Mohsen dehghan[2], Habibollah garousi[3]

[1] Department of Accounting , Qazvin Branch, Islamic azad university, Qazvin, iran.
[2]Department of Accounting, Kar university, Qazvin, iran
[3]Department of Accounting, Imam Khomeini International University, Qazvin, iran

ABSTRACT

The purpose of this paper is to study The effect of just-in-time implication**(** inventory maintenance, both total inventory (INV) and its discrete components (raw material (RMI), work-in-process (WIP), and finished goods (FGI))**)**, on financial and opeating performance in manufacturing companies.
Statistical analysis is applied to the financial information of TSE manufacturing firms over the 5-year period from 2006 to 2010.
The paper finds a significant negative correlation between inventory maintenance (total as well as the discrete components of inventory) and measures of financial and operating performance for firms in manufacturing industries. In other words the just in time system improves the financial and operating performance.
This paper is the first to systematically analyze the effects of just-in-time implication for a large sample of firms across all manufacturing industries. The paper adds to prior literature by discussing and testing the relationship between both INV and the discrete types of inventory (RMI, WIP, and FGI) , profitability and efficiency of operations, both at the financial and at the operating performance levels. The results obtained support the operations management literature's claim that a managerial focus on inventory maintenance results in value creation for manufacturing firms.
KEYWORDS: Financial performance, operating performance, Inventory, Process efficiency

1. INTRODUCTION

The dominant theme of the operations management literature over the past century has been to improve operational performance. This can be achieved by reducing the lead time from raw materials to finished goods (faster cycle times), reducing the amount of waste in the process (managing the input and output quality), and by reducing the quantity of physical units held by the firm (working with suppliers and customers). Numerous techniques have been proposed to achieve this goal, including: business process reengineering, total quality management, supply chain integration, just-in-time (JIT), lean thinking, agile manufacturing, and activity-based management. The inherent logic of these techniques is self evident and widely accepted. The majority of success stories in operations management stem from small sample research in the automotive, machinery, and job-shop (assembly) industries. These studies document increased market share, higher profitability and greater product quality for firms that have employed the above techniques to improve their operations.

This paper aims to extend the evidence on the effects of improving inventory maintenance with a large sample study, an examination of total as well as the discrete components of inventory, in addition to an examination both across all manufacturing firms and within manufacturing industries.

We analyze the relationship between raw materials (RMI), work-in-process (WIP),
finished goods (FGI), and total inventory (INV) performance (inventory maintenance)
to the profitability of operating activities (financial performance) of US manufacturing firms in the 2006-2010 period. For the purpose of this study we use inventory levels scaled by sales as a measure of inventory maintenance. We find that improving a firm's inventory maintenance (lowering the inventory to sales ratio) yields better financial performance measured both at the gross profit and at the operating profit levels. Decomposing INV into its component parts (RMI, WIP, and FGI) reveals that the correlation is driven by all three discrete inventory types. The size of the correlation, however, varies significantly across inventory types and across financial performance measures. These results are consistent with and extend those of prior research, in particular that of Chen et al. (2005) and Shah and Shin (2007).

We further analyze the changes in inventory maintenance and financial performance over time (from 2006 through 2010) and find a decrease in INV levels scaled by sales (increase in inventory

***Corresponding Author:** Mahdi Beshkooh, Department of Accounting, Qazvin Branch, Islamic Azad University, Qazvin, Iran. beshkooh@qiau.ac.ir

maintenance), consistent with Rajagopalan and Malhotra (2001) and Chen et al. (2005). However, the decomposition of INV into its component parts reveals that the main component of the decrease in INV is the reduction of the WIP inventory. This suggests that manufacturing firms' efforts to improve their production inventory maintenance is focused on WIP inventory. The change in financial performance measures was mixed over the 2006-2010 sample period. Regardless of the trend in either inventory maintenance or financial performance measures, the correlation between inventory maintenance and financial performance remains present across all inventory types and financial performance measures.

This study expands our knowledge of the relationship between firm level inventory and financial performance, which – as noted by Shah and Shin (2007) – "is not straight forward in the literature". First, prior research examining this relationship has been limited to small sample studies concentrated in a few manufacturing industries. By contrast, our paper uses a large sample of firms across all manufacturing industries.

Second, due to the differential impact inventory maintenance might have on and operating costs, we measure financial performance at both the gross and operating profit levels. Third, we incorporate the possibility raised by prior research that the sources, costs and benefits of inventory improvements could be very different (Balakrishnan et al., 1996; Lieberman et al., 1999; Lieberman and Demeester, 1999) by analyzing the inventory maintenance of the discrete components of inventory (RMI, WIP, and FGI), and their correlation with financial performance. To our knowledge, this is the first study to empirically test these relationships.

In addition to our main contributions noted above, we also analyze the cross-sectional and longitudinal correlations between inventory maintenance and financial performance, use a large sample of manufacturing firms and firm-level data over a longer time period[1], and offer an explanation for why better inventory maintenance should lead to better financial performance and increased firm valuation.

We proceed by presenting the relevant literature on the relationship between inventory maintenance and financial performance, as well as the related research on how operational methodologies have affected manufacturing firms since their introduction in the early 1980s. This discussion is followed by a description of the research questions, sample description, and applied methodologies. We conclude with a presentation of our key findings with their managerial implications.

2. LITERATURE REVIEW

About half a century ago, Forrester's (1961) non-linear simulations on information and delivery delays in internal operations and supply chains helped academics and managers understand how information distortion and order batching lead to ever longer lead times and inventory build-up. Scale and cost-centric manufacturing dominated operations management until the 1970s when the quality movement turned the focus to continuous improvement and errorless operations.

JIT, and its emphasis on reducing waste, inventory reduction, and operational flexibility through a pull system, appeared in the early 1980s. Goldratt and Cox (1984) and Suri (1998) argued for a relentless reduction of bottlenecks and lead time.

These approaches (that is, theory of constraints and quick response manufacturing) were based on flow and lead-time reduction and presented cases from job shops and machine assembly companies to support their claims. Other scholars and practitioners conveyed similar messages under different labels such as time-based competition (Stalk, 1988) and lean manufacturing (Womack et al., 1990). Lead time reduction is often described in the operations management literature as arising from initiatives such as JIT/lean production or agility (Naylor et al., 1999; Bartezzaghi et al., 1995) rather than from identifying and reducing congestion at bottlenecks, reducing lot sizes, and moving to a product layout from a functional one. Koufteros et al. (1998) claim time-based manufacturing is related to shop-floor employee involvement, setup time reduction, cellular manufacturing, quality improvement efforts, preventive maintenance, dependable suppliers, and pull production, but do not relate these constructs to the principles that drive lead time. According to Schmenner (2001), companies that focus on flow with an emphasis on operational speed and variability reduction outperform companies emphasizing other goals. This conclusion is consistent with the principles of operations management, based on queuing theory, which demonstrates the relationships between lot sizes, cycle times, bottlenecks, lead times, and process variability (Hopp and Spearman, 2001; Schmenner and Swink, 1998).

Recent research on the relationship between a managerial focus on improving operations and performance has been concentrated primarily on JIT. Virtually all of this research has been carried out at the plant level, is case oriented with a small sample size, or is a narrow industry specific survey. The overwhelming majority of studies show the positive effect of JIT implementation on earnings and financial performance through the increase in productivity and inventory efficiency (Neil and O'Hara, 1987; Huson and Nanda, 1995; Lawrence and Hottenstein, 1995; Boyer, 1996; Fullerton et al., 2003; Nahm et al., 2003; Christensen et al., 2005). Other studies like Callen et al. (2000) and Fullerton and McWatters (2001) provide support that JIT implementation improves firm performance through lower inventory levels, reduced quality costs, and greater customer responsiveness with higher profits. With only two exceptions (Balakrishnan et al., 1996; Sakakibara et al., 1997), these studies all contend that strategies aimed at increasing inventory maintenance (primarily through reduced inventory levels) are positively related to increases in value added defined as an increase in market share, sales, and profitability.

The lead time related research has focused principally on the automotive, machinery, and computer assembly operations. By contrast, supply chain research extends to all industries. The underlying emphasis in supply chain management is on information transparency, reliable lead times, and the clever positioning of various value-adding operations in long logistical chains. Hendricks and Singhal (2003) document that supply chain "glitch" announcements are associated with negative abnormal stock returns, observing that the impact is greater for smaller firms.

To date, the direct relationship between inventory maintenance and financial performance has been investigated only to a very limited extent. Claycomb et al. (1999) provide a model of the causal relationship between inventory and financial performance.

Gaur et al. (2005) and Roumiantsev and Netessine (2007) both document a negative correlation between inventory maintenance and financial performance in the retail industry whose value proposition relates to efficient product availability. By contrast, the value proposition of the manufacturing industry is based primarily on value adding operations, product innovation and efficient order fulfillment. Chen et al. (2005) analyze the link between INV and long-term stock returns of manufacturing firms. They find that while firms with abnormally high inventory levels have poor long-term stock returns, firms with slightly lower than average inventory outperform firms with extremely low INV. Shah and Shin (2007) use aggregate sector data to show a link between inventory and profitability for the wholesale, retail, and manufacturing sectors.

However, none of the above studies analyze the relationship between inventory performance and financial performance of manufacturing industries at the firm level, nor do they analyze the relationship between different financial performance measures with inventory maintenance. No study to date has examined the relationship between the inventory maintenance of the discrete components of inventory with financial performance. Our paper attempts to fill this gap. The use of different measures of financial performance allows the analysis of both the level of profit above production costs (gross profit) as well as after operating expenses (operating profit). Including the performance of the discrete inventory components allows a test for any differential impacts on the costs of production and operating expenses (Palepu et al., 2007, pp. 199-207, for an overview of financial performance measures).

Our paper is the first to look at the discrete components of inventory (RMI, WIP, and FGI) and their correlation with financial performance and we do this both at the firm level as well as for firms within specific industries. We build on prior research suggesting that sources of reduction, costs of reduction and benefits arising from the reduction in RMI, WIP, and FGI are very different. Hopp and Spearman (2001) indicate that RMI is determined by discounts, economies of scale, quality problems, changes in demand and supply, and obsolescence. WIP is determined by queuing, processing, waiting for batch, moving, and waiting to match. Finally, FGI is determined by customer responsiveness, batch production, forecast errors, production variability, and seasonality. For a description of differences between discrete inventory components (Krajewski and Ritzman, 2005; Heizer and Render, 2006). Lieberman et al. (1999) empirically analyze the sources of change in inventory of RMI, WIP, and FGI in the automotive industry. They find that all three discrete types of inventory depend on managerial actions, but in different ways. While formal methods to reduce inventory (like JIT) reduce WIP and FGI, they have no impact on the RMI. They also find that maintaining communication with suppliers and customers leads to reductions in RMI and FGI, with no impact on WIP inventory. The costs and benefits associated with the change may differ between inventory types since the sources of these changes are different. As Balakrishnan et al. (1996, p. 195) argue, "reducing WIP inventory requires less coordination with a firm's suppliers or customers than is required to reduce RMI or FGI and thus imposes fewer implementation costs". Balakrishnan et al. (1996) further argue that unlike reductions in RMI, reducing the WIP inventory does not require stability of the supply chain and that WIP holds the highest potential for improvement by reducing production lead time, reducing conversion costs and increasing manufacturing flexibility. Several studies show that implementation of JIT has a differential impact on discrete inventory types, with the reduction of WIP inventory present in all studies, but results for RMI and FGI remain mixed (Barton et al., 1988; Norris et al., 1994). Lieberman and Demeester (1999) suggest that a reduction in inventory (primarily WIP) increases productivity.

Overall, prior research suggests that the costs associated with improving inventory maintenance are different across RMI, WIP, and FGI. Prior research also suggests that RMI and FGI will depend on supply management and the relationship with customers and that their main impact on performance comes from carrying costs. By contrast, WIP inventory depends on changes in production speed while its impact on financial performance comes from manufacturing flexibility, increased production activity and lower costs of production. Recent research has begun to analyze the changes in the nature and level of inventory over time. Rajagopalan and Malhotra (2001) use aggregate industry data provided by the Census Bureau and find mixed results on the trends in INV and its components. By contrast, Chen et al. (2005) use firm-level RMI, WIP, and FGI data from the Compustat database and document a 16 per cent drop (from 96 to 81 days) in the average INV level (days of inventory) of all publicly-traded US manufacturing firms over the 20-year period from 1982 to 2000. Gaur et al. (2005) provide evidence of a reduction in inventory in the retail sector. Our results confirm the above findings and reveal that the improvement in INV over the 2006-2010 period comes primarily from improvements in WIP inventory maintenance and to a lesser extent RMI performance with no change in the FGI performance.

3. RESEARCH HYPOTHESES

The operations management literature indicates that financial and operating performance should be at least partially related to inventory maintenance. Following the literature review we set our hypotheses as:

H1a. A firm's inventory maintenance will be negatively correlated with the firm's financial performance.

H1b. A firm's inventory maintenance will be negatively correlated with the firm's operating performance.

H2a. The performance of all three discrete components of a firm's inventory (RMI, WIP, and FGI) will be negatively correlated with the firm's financial performance.

H2b. The performance of all three discrete components of a firm's inventory (RMI, WIP, and FGI) will be negatively correlated with the firm's operating performance.

Sample Selection and Methodology

The Tehran stock exchange database (TSE) from 2006 to 2010 is used to collect annual financial report data. We select 73 manufacturing company in TSE for this research.

Dependent variables

We use ebit and gps(gross profit scaled by sales) as proxies of financial performance and operating cycle(O.C), total assets turnover(T.A.T) and fixed assets turnover(F.A.T) as proxies for operating performance as below:

$\mathbf{EBITS}_{i,t} = EBIT_{i,t} / Sales_{i,t}$

$\mathbf{GPS}_{i,t} = (Sales_{i,t} - CGS_{i,t}) / Sales_{i,t}$

$\mathbf{O.C}_{i,t} = \{360 / (Sales_{i,t} / \text{a.v.g.accounts recievable}_{i,t})\} + \{360 / (CGS_{i,t} / \text{a.v.g.inventory}_{i,t})\}$

$\mathbf{T.A.T}_{i.t} = Sales_{i,t} / \text{a.v.g. total assets}_{i.t}$

$\mathbf{F.A.T}_{i.t} = Sales_{i,t} / \text{a.v.g. fixed assets}_{i.t}$

where EBIT is earnings before interests and taxes for firm i in year t, Sales are total sales for firm i in year t, and CGS is cost of goods sold for firm i in year t. A.v.g is the arithmetic average of accounts receivable and inventory levels at the beginning and the end of the year t . Using both gross profit (GP) and EBIT allows us to analyze the determinants of financial performance on two levels. The GP reflects the added value as a difference between sales and the cost of production, while EBIT proxies for the profitability of the business after deducting all operating expenses, not only the production costs.

Independent variables

Past literature provides us with several possible measures of inventory maintenance which include scaling inventory by cost of goods sold (Huson and Nanda, 1995), by combination of material costs and value added (Rajagopalan and Malhotra, 2001) and by sales (Chen et al., 2005).Using any of these measure yields qualitatively unchanged results. we scale inventory by sales:

$RMIS_{i,t} = \text{a.v.g} (RMI_{i,t-1} - RMI_{i,t}) / Sales_{i,t}$

$WIPS_{i,t} = \text{a.v.g} (WIP_{i,t-1} - WIP_{i,t}) / Sales_{i,t}$

$FGIS_{i,t} = a.v.g\ (\Delta FGI_{i,t-1} - FGI_{i,t}) / Sales_{i,t}$
$INVS_{i,t} = a.v.g\ (\Delta INV_{i,t-1} - INV_{i,t}) / Sales_{i,t}$

Where RMIS is the performance of RMI for firm j in year t,WIPS is the performance ofWIP inventory, FGIS is the performance of FGI, INVS is the performance of INV. Sales are total sales of firmj for year t. A.v.g is the arithmetic average of inventory levels at the beginning and the end of the year t. These inventory maintenance measures are used throughout the paper in all tables, results and discussions.

Control variable

We control our models for the size effect. Size is the natural log of total assets.

We derive a model similar to Shah and Shin (2007) to test for the relationship between our financial and operating performance and inventory maintenance measures. The following models (1 to 4) are estimated:

$EBITS_{i,t} = a + b1Size_{i,t} + b2invs_{i,t} + €$

$GP_{i,t} = a + b1invs_{i,t} + b2Size_{i,t} + €$ (1)

$O.C_{i,t} = a + b1invs_{i,t} + b2Size_{i,t} + €$ (2)

$T.A.T_{i,t} = a + b1invs_{i,t} + b2Size_{i,t} + €$ (3)

$F.A.T_{i,t} = a + b1invs_{i,t} + b2Size_{i,t} + €$ (4)

EBITS is operating profit scaled by sales, GPS is the gross profit scaled by sales. Size is the natural log of inflation adjusted total assets. INVS is the inventory maintenance measure. We further estimate regression models (5 to 8) that take into account all three-inventory types as follows:

$EBITS_{i,t} = a + b1RMIS_{i,t} + b2WIPS_{i,t} + b3FGIS_{i,t} + b4Size_{i,t} + €$

$GP_{i,t} = a + b1RMIS_{i,t} + b2WIPS_{i,t} + b3FGIS_{i,t} + b4Size_{i,t} + €$ (5)

$O.C_{i,t} = a + b1RMIS_{i,t} + b2WIPS_{i,t} + b3FGIS_{i,t} + b4Size_{i,t} + €$ (6)

$T.A.T_{i,t} = a + b1RMIS_{i,t} + b2WIPS_{i,t} + b3FGIS_{i,t} + b4Size_{i,t} + €$ (7)

$F.A.T_{i,t} = a + b1RMIS_{i,t} + b2WIPS_{i,t} + b3FGIS_{i,t} + b4Size_{i,t} + €$ (8)

We expect all inventory types (RMI, WIP, and FGI) maintenance measures to have negative and statistically significant coefficients. The less inventory a firm requires per unit of sales, the greater its financial and operating performance (all else equal). We also control for the size effect.

4. Empirical analysis and results

To test whether implication of just-in-time production (less inventory) correlated with better financial and operating performance, we create a sample of TSE manufacturing firms for 2006 to 2010 period. We exclude all firm-year observations without data available on RMI, WIP inventory, or FGI. We also exclude all firm-year observations with data unavailable on sales, cost of goods sold or total assets. Table I shows the descriptive statistics for our firm-year sample of all iran manufacturing firms, containing 305 observations.

Table 1. descriptive statistics

	EBIT	GPS	O_C	T.A.T	F.A.T	INVS	RMIS	WIPS	FGIS	SIZE
Mean	0.245	0.313	5.960	0.843	5.389	0.289	0.115	*0.030*	0.056	13.543
Median	*0.174*	*0.272*	*5.831*	*0.802*	*3.364*	*0.257*	*0.089*	0.013	*0.032*	*13.343*
Maximum	2.616	0.999	9.219	2.757	44.185	1.054	0.686	*0.266*	0.409	18.195
Minimum	*0.003*	*-0.324*	*2.842*	*0.018*	*0.033*	*0.036*	*0.000*	0.000	*0.000*	*10.896*
Std. Dev.	0.224	0.183	1.095	0.435	5.823	0.158	0.105	*0.044*	0.066	1.447
Observations	305	305	305	305	305	305	305	305	305	305

We present our regressions results in Table 2 and table 3. the results of inventory maintenance effect on firm performance are in table 2.

Financial performance

EBIT: As hypothesized, the coefficient associated with inventory maintenance variable for EBIT is negative and statistically significant.

GPS: the coefficient of inventory maintenance variable for GPS is negative and statistically significant. These results indicate that less inventory ameliorates firm's profitability.

So the H1a should be accepted.

operating performance

O.C: inventory coefficient is positive but statistically insignificant. So less inventory results in decreased operating cycle and ameliorates it.

T.A.T: the coefficient of inventory maintenance variable for total asset turnover is negative and statistically significant. This means that less inventory ameliorates firm's efficiency.
F.A.T: inventory coefficient is negative significant. This result indicate that less inventory results in increased fixed asset turnover, so ameliorates it.
The size coefficient is positive and significant across all regression models.
F-statistic indicates that all regressions line are significant and durbin-watson in all regressions shows that there is not autocorrelation. So the H1b should be accepted.

Table 2. OLS regression models for financial and operating performance with inventory

dependent Variable / Independent Variable		financial performance		operating performance		
		gps	ebit	o.c	t.a.t	f.a.t
invs	Coefficient	-0.199	-0.13	0.094	-0.53	-0.023
	sig.	*0.000*	*0.001*	*0.816*	*0.000*	*0.001*
size	Coefficient	0.015	0.019	0.04	0.06	0.843
	sig.	*0.0214*	*0.0226*	*0.000*	*0.000*	*0.000*
c	Coefficient	0.18	0.04	5.38	1.55	16.32
	sig.	*0.05*	*0.7*	*0.000*	*0.000*	*0.000*
Adjusted R-squared		0.04	0.02	0.03	0.09	0.09
F-statistic		9.39	4.73	3.57	15.3	6.34
Sig (F-statistic)		0.000	0.009	0.057	0.000	0.002
Durbin-Watson		1.59	1.94	1.62	2.02	1.67

We present our regressions results for inventory types (RMI, WIP, or FGI) in Table 3.

Table 3. OLS regression models for financial and operating performance with discrete types of inventory(rmi, wip and fgi)

dependent Variable / Independent Variable		financial performance		Operating performance		
		gps	ebit	o.c	t.a.t	f.a.t
fgis	Coefficient	-0.33	-0.63	1.79	-0.478	-0.56
	sig.	*0.02*	*0.000*	*0.07*	*0.02*	*0.07*
rmis	Coefficient	-0.2	0.07	1.82	-1.096	1.097
	sig.	*0.034*	*0.594*	*0.007*	*0.000*	*0.7*
wips	Coefficient	-0.92	-0.86	3.47	-0.283	-15.87
	sig.	*0.000*	*0.002*	*0.018*	*0.6*	*0.001*
size	Coefficient	0.014	0.021	0.016	0.05	0.807
	sig.	*0.03*	*0.01*	*0.002*	*0.000*	*0.000*
c	Coefficient	0.2	0.027	5.75	1.38	15.7
	sig.	*0.02*	*0.81*	*0.000*	*0.000*	*0.000*
Adjusted R-squared		0.11	0.067	0.028	0.1273	0.045
F-statistic		12.35	7.56337	3.19	12.09	4.43
sig(F-statistic)		0.000	0.000	0.014	0.000	0.001
Durbin-Watson		1.63	1.97	1.43	2.01	1.67

Financial performance
GPS: The regression estimates reveal that all inventory component maintenance is negatively related to GPS regardless of the inventory type (RMI, WIP, or FGI). That is, less inventory components ameliorates the gross profit. All coefficients are statistically significant.
EBIT: FGIS and WIPS are negatively and RMIS is positively associated with the EBIT. It means less finished goods and work in process inventory ameliorates the EBIT, but less raw materials exacerbate the EBIT. FGIS and WIPS coefficients are significant, but RMIS coefficient is insignificant. So H2a must be accepted.

operating performance
O.C: all inventory types (FGIS, WIPS and RMIS) are positively associated with the operating cycle(O.C). that is, less finished goods , work in process and raw materials inventory ameliorates the O.C. all coefficients are statistically significant.
T.A.T: all inventory types (FGIS, WIPS and RMIS) are negatively associated with the operating cycle(O.C). that is, less finished goods , work in process and raw materials inventory ameliorates the T.A.T. the coefficients of FGI and RMI are significant, but for WIP is insignificant.

F.A.T: WIPS and FGIS are negatively and RMIS is positively associated with the fixed asset turnover(F.A.T). that is, less work in process and finished goods inventory ameliorates the F.A.T, but less raw materials inventory exacerbate the F.A.T. FGIS and WIPS coefficients are statistically significant, but RMIS coefficient is insignificant.
The size coefficient is positive and significant across all regression models.
F-statistic indicates that all regressions line are significant and durbin-watson in all regressions shows that there is not autocorrelation. So the H2b is accepted for all variables.

CONCLUSION

We analyze the relationship between inventory performance, both INV and its discrete components (RMI, WIP, and FGI), and financial as well as operating performance using a large sample study of TSE manufacturing firms over the 5-year period from 2006 to 2010. Our results show a strong correlation between inventory maintenance and firm performance across manufacturing industries. maintenance of total as well as all three discrete components of inventory is negatively associated with

financial performance. That is less inventory, result in better financial performance. Inventory maintenance also has positive effect on operating performance. However, the strength of the correlation differs between inventory types. FGI and WIPS maintenance has the strongest correlation with financial and operating performance. But RMIS has weak correlation with financial and operating performance. Our results support the operations management literature's claim that a managerial focus on operations performance – in particular increases in inventory maintenance – correlates with significant value creation.

REFERENCES

1 . Alan W. Mackelprang , Anand Nair(2010) Relationship between just-in-time manufacturing practices and performance:A meta-analytic investigation, Journal of Operations Management ,28 (2010) ,283–302
2 . Ashton, J.E., Cook Jr., F.X.(1989). Time to reform job shop manufacturing. Harvard Business Review 67 (3), 106–111.
3 . Balakrishnan, R., Linsmeier, T.J. and Venkatachalam, M. (1996), "Financial benefits from JIT adoption: effects of customer concentration and cost structure", The Accounting Review,Vol. 71 No. 2, pp. 183-205.
4. Boyer, K. (1996), "An assessment of managerial commitment to lean production", International Journal of Operations & Production Management, Vol. 16 No. 9, pp. 48-59.
5 . Barton, F.M., Agarwal, S.P. and Rockwell, L.M. (1988), "Meeting the challenge of Japanese management concepts", Management Accounting, Vol. 74, pp. 49-52.
6 . Bartezzaghi, E., Spina, G. and Verganti, R. (1995), "Lead-time models of business processes", International Journal of Operations & Production Management, Vol. 14 No. 5, pp. 5-20
7 . Booth, J.(1987). Beavers—changing to low inventory manufacturing. International Journal of Production Research 26 (3), 397–413.
8 . Callen, J.L., Fader, C. and Krinsky, I. (2000), "Just-in-time: a cross-sectional plant analysis",International Journal of Production Economics, Vol. 63 No. 3, pp. 277-301.
9 . Chen, H., Frank, M.Z. and Wu, O.Q. (2005), "What actually happened to the inventories of American companies between 1981 and 2000?", Management Science, Vol. 51 No. 7, pp. 1015-31
10 . Christensen, W.J., Germain, R. and Birou, L. (2005), "Build-to-order and just-in-time as predictors of applied supply chain knowledge and market performance", Journal of Operations Management, Vol. 23 No. 5, pp. 470-81
11 . Dean Jr., J.W., Snell, S.A.(1996). The strategic use of integrated manufacturing: an empirical examination. Strategic Management Journal 17, 459–480.
12 . Fullerton, R.R.,McWatters, C.S. and Fawson,C. (2003),"An examination of the relationships between JITand financial performance", Journal of Operations Management,Vol. 21No. 4, pp. 383-404.
13 . Goldratt, E.M. and Cox, J. (1984), The Goal, North River Press, New York, NY.
14 . Heizer, J. and Render, B. (2006), Operations Management, 8th ed., Prentice-Hall, Chicago, IL.
15 . Heiko, L. (1989) A simple framework for understanding JIT. Production and Inventory Management, 30 (4), 61–63
16 . Hopp, W.J. and Spearman, M.L. (2001), Factory Physics, 2nd ed., McGraw-Hill, New York, NY.

17 . Hosseini t. et al.(2001) determining the effective factors on jit with dynamic condition. Modarres technical and engeneering journal,no. 18

18 . Im, J.(1989) Lessons from Japanese production management. Production and Inventory Management 30 (3), 25–29.

19 . Krajewski, L.J. and Ritzman, L.P. (2005), Operations Management, 7th ed., Prentice-Hall, Chicago, IL.

20 . Lieberman, M.B. and Demeester, L. (1999), "Inventory reduction and productivity growth: linkages in the Japanese automotive industry", Management Science, Vol. 45 No. 4, pp. 466-85.

21 . Lawrence, J.J. and Hottenstein, M.P. (1995), "The relationship between JIT manufacturing and performance in Mexican plants affiliated US companies", Journal of Operations
Management, Vol. 13 No. 1, pp. 3-18.

22. Lee, S.M., Ebrahimpour, M.(1984). Just-in-time production system: some requirements for implementation. International Journal of Operations and Production Management 4 (4), 3–15.

23. Martin-Vega, L., Pippin, M., Gerdon, E., Burcham, R.(1989) . Applying just-in-time in a wafer fab: a case study. IEEE Transactions on Semiconductor Manufacturing 2,16–22.

24. Manoochehri, G.H. (1985). Improving productivity with the just-in-time system.Journal of Systems Management 36 (1), 23–26.

25. Nahm, A.Y., Vonderembse, M.A. and Koufteros, X.A. (2003), "The impact of organizational structure on time-based manufacturing and plant performance", Journal of Operations Management, Vol. 21 No. 3, pp. 281-306.

26 . Neil, G. and O'Hara, J. (1987), "The introduction of JIT into a high technology electronics manufacturing environment", International Journal of Operations & Production Management, Vol. 7 No. 4, pp. 64-80.

27. Naylor, J.B., Naim, M.M. and Berry, D. (1999), "Leagility: integrating the lean and agile manufacturing paradigms in the total supply chain", International Journal of Production Economics, Vol. 62 Nos 1/2, pp. 107-18.

28. Norris, D.M., Swenson, R.D. and Chu, Y. (1994), "Just-in-time production systems: a survey of managers", Production & Inventory Management Journal, Vol. 35 No. 2, pp. 63-6.

29. Oliver, N., Davies, A.(1990) . Adopting Japanese-style manufacturing method: a tale of two UK factories. Journal of Management Studies 27 (5), 555–570

30. Parnaby, J. (1987) A systems approach to the implementation of JIT methodologies in Lucas Industries. International Journal of Production Research 26 (3), 483–492.

31. Roumiantsev, S. and Netessine, S. (2007), "What can be learned from classical inventory models:a cross-industry exploratory investigation", Manufacturing and Service Operations Management, Vol. 9 No. 4, pp. 409-29.

32. Sakakibara, S., Flynn, B.B., Schroeder, R.G. and Morris, W.T. (1997), "The impact of just in time manufacturing and its infrastructure on manufacturing performance", Management Science, Vol. 43 No. 9, pp. 1246-57.

33. Sepehri , m.m. jafari a.(2001) solution of the problem for jit preparing of the elements required for manufacturing systems though mathematic models and ant algorithm, modarres technical faculty journal, no. 38 .

34. Shah, R. and Shin, H. (2007), "Relationships among information technology, inventory, and profitability: an investigation of level invariance using sector level data", Journal of Operations Management, Vol. 25 No. 4, pp. 768-84.

35. Shah, R., Ward, P.T.(2003) Lean manufacturing: context, practice bundles, and performance. Journal of Operations Management 21, 129–149.

36. Stalk, G. Jr (1988), "Time – the next source of competition advantage", Harvard Business Review,Vol. 66 No. 4, pp. 41-51.

37. Suri, R. (1998), Quick Response Manufacturing, Productivity Press, Portland, OR.

38. Vedran Capkun, Ari-Pekka Hameri, Lawrence A. Weiss(2009) On the relationship between inventory and financial performance in manufacturing companies , International Journal of Operations &Production Management Vol. 29 No. 8, 2009 pp. 789-806

39. Womack, J.P., Jones, D.T. and Roos, D. (1990), The Machine that Changed the World, Rawson Associates, New York, NY.