Inventory Management in Malaysian Construction Firms: Impact on Performance

Salawati Sahari, Michael Tinggi and Norlina Kadri

Abstract

Managers act rationally in managing their inventory efficiently if they are convinced that the practice enhances firm performance. However, extant research in operations management has revealed divergent insights into the inventory-performance link. This study empirically examines the relationship between inventory management and firm performance and capital intensity on a sample of financial data for 82 construction firms in Malaysia for the period 2006–2010. By employing regression and correlation techniques, it was found that inventory management is positively correlated with firm performance. In addition, the results indicate that there is a positive relationship between inventory management and capital intensity.

Keywords: *capital intensity, construction firms, firm performance, inventory management, JIT.*

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1. Introduction

In traditional settings, inventories of raw materials, work-in-progress components and finished goods were kept as a buffer against the possibility of running out of needed items. However, large buffer inventories consume valuable resources and generate hidden costs. Consequently, many companies have changed their approach to production and inventory management. Since at least the early 1980s, inventory management leading to inventory reduction has become the primary target, as is often the case in just-in-time (JIT) systems, where raw materials and parts are purchased or produced just in time to be used at each stage of the production process. This approach to inventory management brings considerable cost savings from reduced inventory levels. As a result, inventories have been decreasing in many firms (Chen *et al.*, 2005), although evidence of improved firm performance is mixed (Fullerton *et al*., 2003; Cannon, 2008; Kolias *et al.*, 2011).

Nevertheless, most of the studies focus on American firms in the manufacturing sector because of the many revolutions in inventory policies in 1970s and 1980s. Chen *et al*. (2005) observed that the extent of emphasis on inventories among American firms reaches to the financial markets, where there were rules that would reward firms that cut inventories and punish those that did not do so. This is because, during the 1970s, Japanese manufacturing companies made substantial market share gains in the U.S. markets in a range of industries, including most notably the automobile industry.

However, for construction firms, the importance of proper management of materials is highlighted by the fact that they account for substantial portions of project cost and time. Expert estimates and historical data analysis indicate that materials account for 50–60% of project cost and control 80% of its schedule (Ibn-Homaid, 2002). Major projects are characterized by many items of different nature, overlapping construction and degree of changes. These features have

exposed and attenuated shortcomings of the traditional clerically-oriented price-focused approach to managing project materials. For instance, non-availability of items when needed on site is identified as the major and most common and frequent cause of delays in projects. The situation is succinctly put in the form of a question reported to have been repeatedly asked by leaders in the industry: "How do we achieve effective materials management?"

Since performance measurement remains a surprisingly unsettled area in contemporary management (Ghalayini *et al.*, 1997) inventory improvement effect on performance merits empirical examination. According to Chen *et al*. (2005), firms with abnormally high inventories have abnormally poor stock returns. On the other hand, firms with abnormally low inventories have ordinary stock returns. In addition, firms with slightly lower than average inventories perform best over time. Their study (Chen *et al*., 2005) uses Tobin's q as a measurement for performance and number of days in inventory as a measurement for inventory management.

In this study, we follow a similar hypothesis as Chen *et al.* (2005) in order to test the inventory-performance link using construction firms listed in Bursa Malaysia for the period 2006–2010. Additionally, we will also measure the relationship between inventory management and capital intensity as emphasized by Kolias *et al*. (2011), which found that there is a positive correlation between inventory turnover and capital intensity as a result of the nature of investments.

The remainder of this paper is organized as follows. In the next section is a review of the relevant literature, where the relationship between inventory management with performance and capital intensity are discussed. This is follow by the methodology where hypotheses are introduced and this paper concludes with a discussion of the results.

2. Literature Review

2.1. Inventory Management and Performance

As mentioned earlier, inventory management leads to inventory reduction, as is often the case in JIT, where raw materials and parts are purchased or produced just in time to be used at each stage of the production process. Several studies have found that this JIT inventory management has a positive impact on firm performance. A study by Fullerton *et al*. (2003) provides empirical support that firms that implement higher degrees of JIT manufacturing practices should outperform competitors who do not; it was also found that a positive relationship exists between firm profitability and the degree to which waste-reducing production practices, such as reduced set-up times, preventive maintenance programs and uniform workloads are implemented. These findings indicate that enterprises employing JIT manufacturing techniques are consistently more profitable than their counterparts.

Another study suggesting a positive relationship between inventory management and performance was Eroglu and Hofer (2011), which used the Empirical Leanness Indicator (ELI) as a measurement for inventory management. They argued that inventory leanness is the best inventory management tool. Lean production itself considers inventory as a form of waste that should be minimized and it has become synonymous with good inventory management. Their study on US manufacturing firms, covering the period of 2003–2008, found that leanness positively affects profit margins. According to Eroglu and Hofer (2011), firms that are leaner than the industry average generally see positive returns to leanness. They found that the effect of inventory leanness on firm performance is mostly positive and generally non-linear. Their study also implies that the effect of inventory leanness is concave, which is in line with inventory control theory that there is an optimal degree of inventory leanness beyond

which the marginal effect of leanness on financial performance becomes negative.

On the other hand, a study by Cannon (2008) introduced contradictory findings. That study focused on assessing the relationship between inventory performance and overall firm performance and it was argued that inventory performance should not be measured as a robust indicator of overall performance. In doing so, it tested the incorporation of firm's annual percentage change in inventory turnover as a measurement for inventory management towards return on assets (ROA) as a measurement of performance. The study (Cannon, 2008) indicated that when the effects of time were taken into account, turnover improvement on average had a slightly negative effect on ROA. Additionally, turnover improvement exhibited a prominent random effect, with result indicating that approximately 95% of the firm's turnover-improvement slopes would fall within a negative range. This was interpreted as evidence that substantial variability existed across firms with regard to turnover improvement and its performance effects, with some turnover improvement associated with increased ROA and other turnover improvement associated with decreased ROA. Moreover, Cannon (2008) also further explored the turnover-ROA dynamic by including capital intensity as potential source of variability. It was found that capital-intensive firms tended to be below average with regard to ROA and the variable's presence in the model did not significantly alter the relationship between turnover improvement and ROA over time. Hence, this lent additional weight to the conclusion not to support the hypothesis that improved inventory performance will be associated with improved overall firm performance.

Consistent with Cannon (2008), another study (Kolias *et al*., 2011) found that inventory turnover ratio (as a measurement of inventory management), is negatively correlated with gross margin. Kolias *et al*. (2011) is based on an econometric analysis conducted on a sample of financial data for Greek retail firms for the period of 2000–2005. They

found a negative relationship between gross margin and inventory turnover. This implies that retailers' trade off gross margin for inventory turns to achieve similar return on inventory investment since, if inventory turnover ratio is lower than targeted given the level of gross margin, then management should be alarmed with this inefficiency. Consequently, it was likely that the coefficient of gross margin differs between sectors.

2.2. Inventory Management and Capital Intensity

According to Cachon and Fisher (2000), the positive correlation between inventory turns and capital intensity results from the nature of the investment. Capital investment includes investment in warehouses, equipment, information technology (IT) and logistics management systems. These capital investments lead to better inventory allocation as well as to a more efficient implementation of customer orders, thereby increasing inventory turns. Additionally, a positive influence of IT on inventory performance is well supported at the firm level. For an instance, prior studies (Frohlich and Westbrook, 2002; Vickery *et al*., 2003) found that an increase in IT investment results in higher inventory returns and lower inventory holding costs.

Investments in IT have helped firms to cut back on the volume of inventory as a precaution against glitches in their supply chain or a hedge against unexpected increase in aggregate demand (Ferguson, 2001). In addition, IT investments may increase inventory turns due to improvement in the replenishment process. Clark and Hammond (1997) show that with the adoption of a continuous replenishment process by food retailers, their inventory turnover increased by up to 100%. However, automatic replenishment is not limited to the grocery industry: apparel retailers utilized automatic replenishing programs to improve inventory efficiency (King and Maddalena, 1998).

Another study (Kolias *et al.*, 2011) on the Greek retail sector found that inventory turnover was positively correlated with capital

intensity. The coefficient in their study for the supermarket sector is relatively higher than those for other sectors, indicating the importance of the investments in IT in that sector where supermarkets may experience improved product availability associated with the reduction of stock-outs and they can thereby carry less backup inventory leading to lower inventory levels. Hence, with lower inventory investment, inventory turnover may be higher.

3. Methodology

The aim of this study is to investigate the relationship between inventory management with performance and capital intensity. This study, therefore, hypothesizes that there is a positive relationship between inventory management and firm performance and, also, with capital intensity.

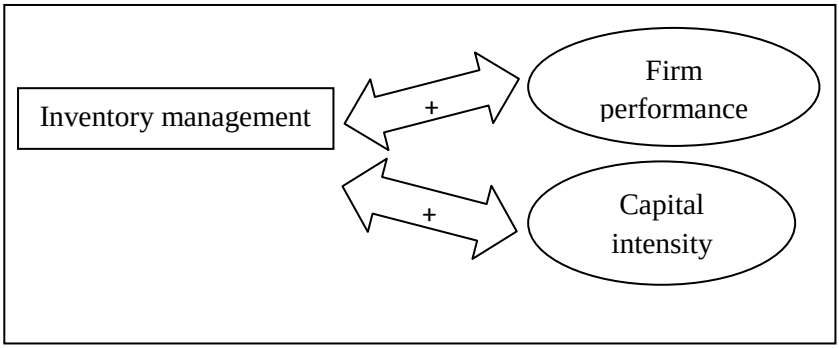

Figure 1: Theoretical Framework

3.1. Measures

There are various different inventory ratios that may be considered and the appropriate measure depends on the purpose. Inventory management in this study was measured by using inventory days. A similar measurement method was used by Chen *et al.* (2005), in which

from an operations management point of view, the authors are most interested in how long inventory is held. Moreover, it is important to have productive inputs available when needed. However, as stressed by the advocates of JIT, holding inventory takes up space and can permit slack attitudes to become pervasive with damaging effects overall.

Inventory days (ID) measures how many days on average it takes for the inventory to turn over. In year *t*, the formula used to calculate inventory days for a firm *i* would be

$$ID_{it} = \frac{\text{Inventory}_{it} \times 365 \text{ days}}{\text{Cost of goods sold}_{it}}$$

Hence, the lower the number of ID, the better the inventory management and this may cause better firm performance.

As for the independent variable capital intensity, this study uses a similar measurement to Kolias *et al.* (2011), which defined capital intensity (CI) as the ratio of net fixed assets (NFA) to the sum of inventories (I) and net fixed assets (NFA) at year *t* as follows:

$$CI_{it} = \frac{NFA_{it}}{NFA_{it} + I_{it}}$$

Firm performance is measured by financial performance using ROA, which is calculated as a firm's reported net income divided by net value of its total assets. According to Cannon (2008), ROA is a strictly accounting-based measure and he used the same measurement to study inventory improvement and financial performance among US manufacturing firms.

3.3. Sample, Data and Study Period

The sample frame for this study was obtained from the Datastream database, which consists of financial statements of listed firms in BursaMalaysia. The sample consists of construction firms which had data available for the study period of 2006–2010. Some firms with missing data were discarded; thus a balanced panel set of 420 firm-year observations were obtained, with observations of 82 firms over the 2006–2010 period.

4. Results and Findings

4.1. Descriptive Statistics

Table 1 (below) provides basic descriptive statistics for the three variables utilized in the study, namely inventory days (ID), return on assets (ROA) and capital intensity (CI). ID, as a measurement of how many days it takes for the inventory to turn over; is on average 242 days, with a maximum of 11,769 days and a minimum of 1 day. It should be noted that the sample firms were construction firms where the inventory to be held includes raw materials, work in progress and finished goods. Hence, the number of days the inventory being held varies with the type and the number of projects held by the firms.

	ID	ROA	CI
Average	241.917	3.074	0.662
Std Deviation	773.342	14.064	0.204
Minimum	1	-121.370	0.047
Maximum	11,769	146.310	0.998

Table 1: Descriptive Statistics; source: Original Research

As for ROA, which measures firm profitability, the average is 3.07%, with a minimum of loss 121% and maximum return of 146%. Another variable, CI, as a measurement of the ability of a firm to use its fixed

assets effectively is on average 66.2%, with a minimum of 4.7% and a maximum of 99.8%.

4.2. The Impact of Inventory Management on Performance

A critical argument on behalf of effective inventory management is the claim that it will improve the financial position of a firm. If the claim is true, then the market should value the firms that have already reduced their inventories more highly than they value firms that have not reduced their inventories. Is this argument empirically valid? A common way to answer this type of question is to ask whether the factor of interest is associated with the financial performance of the firm measured by ROA. This is tested with a simple regression,

$$ROA = \alpha + \beta\ ID + \varepsilon \quad (1)$$

where:
ROA is return on asset as a measurement for financial performance
α is the regression constant
β is the beta coefficients
ID is inventory days as a measurement of inventory management
ε is error

The result from (1) is ROA = 0.092 – 0.092 ID, where R^2 = 0.092. The F statistics are 3.559, with the 0.060 significance level. This indicates that the impact of efficient inventory management towards financial performance among construction industries is not significant. This is consistent with prior studies (Chen *et al.*, 2005; Cannon, 2008) even though they used different measurement on the firm performance such as market-to-book ratio, Tobin's q as market performance, ROI (return on investment) and different measurements for inventory management.

4.3. Correlation Analysis

In order to examine the relationship between the two variables, a Spearman correlation coefficient was used to test both hypotheses. The Spearman correlation is used because, even though the data are numerical in nature, they are not normally distributed and there are several extreme scores which meet the criteria for non-parametric testing (Saunders *et al.*, 2009). In efficient inventory management, it would be expected that the number of inventory days will be lower where it will increase firm performance.

Table 2 (below) shows the result from the Spearman correlation coefficient matrix between ID, ROA and CI. The table indicates that there is a significant negative relationship between inventory days and return on assets (ρ = -0.277; significance at 0.05 level). This finding explains that the lower the number of days the inventory is held in a firm before its turnover, the better the performance of the firm. In other words, the better the inventory management, the better would be the firm performance. This finding supports the hypothesis of the study in that there is a positive relationship between inventory management and firm performance.

	ROA		CI	
	Correlation coefficient	Sig. (2-tailed)	Correlation coefficient	Sig. (2-tailed)
ID	-0.277**	0.00	-0.381**	0.00

Notes: ** Correlation is significant at the 0.05 level.

Table 2: Spearman Correlation Coefficients Matrix; source: Original Research

In addition, Table 2 also shows that inventory days are negatively correlated with capital intensity at a 0.05 level of significance. This means that construction firms with better capital intensity tend to have lower numbers of days holding their inventories. Kolias *et al*. (2011)

indicates that a firm with a higher coefficient for this relationship indicates the importance of investments in IT and other CI in the firm. In this case, the firm may experience improved product availability associated with the reduction of stock-outs while they can carry less backup inventory to stay in stock. Hence, inventory levels are lower and, with lower inventory investment, the number of days to hold the inventory is higher. This indicates that, with higher CI, the firm may improve its inventory management. Consequently, this justifies the hypothesis that there is a positive relationship between inventory management and CI.

5. Conclusion

This study attempted to investigate the relationship between inventory management, firm performance and capital intensity. Three measurements were used in this study, namely (1) ROA as a measurement for financial performance, (2) ID, number of days inventory was held as a measurement of inventory management and (3) CI, the capital intensity measured by dividing fixed assets by the total of fixed assets and inventory. Prior research (Fullerton *et al*., 2003; Cannon, 2008) concerned samples of manufacturing industries using different performance measurement variables such as market value and different measurement variables for inventory management, such as inventory turnover. However, inventory turnover used for manufacturing firms involved with JIT procedure is not much used in Malaysian construction firms. This study was conducted on a sample of financial data for 82 firms over the period of 2006–2010. By employing regression techniques, the impact of inventory management on performance was found to be insignificant in this study. However, the relationship between inventory management and financial performance of the firm was found to be significantly positive. This is consistent with prior studies (Fullerton *et al*., 2003; Eroglu and Hofer, 2011). As for the relationship between CI and inventory management, this study found that there is also a significant

positive relationship which is consistent with prior research by Kolias *et al*. (2011).

Acknowledgements

The authors would like to thank the Faculty of Economics and Business, UNIMAS for the financial and reviewer support provided.

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