Inventory Management in Turbulent Times with the Right Sourcing Strategy

Aradhana Gandhi[1] and Pratima Sheorey[2]

[1] *Symbiosis Centre for Management and Human Resource Development, Symbiosis International University, Symbiosis Infotech Campus, Plot No. 15, Rajiv Gandhi Infotech Park, MIDC, Hinjewadi, Pune – 411057, India. E-mail: aradhana_gandhi@scmhrd.edu*
[2] *Symbiosis Centre for Management and Human Resource Development, Symbiosis International University, Symbiosis Infotech Campus, Plot No. 15, Rajiv Gandhi Infotech Park, MIDC, Hinjewadi, Pune – 411057, India. E-mail: director@scmhrd.edu*

Abstract: Purpose:Many factors make inventory management a difficult task especially in the case of raw materials that are imported. This study aims to optimize inventory and effectively manage currency through strategic sourcing alignment.

Design/methodology/approach: This research is based on inventory data analysis of a construction equipment manufacturing company. It involves evaluation of free trade agreement, competitor's data analysis with the help of questionnaire design and administration, currency mapping, logistics data collection and analysis of lead times.

Findings: Many construction equipment manufacturing companies havehigher dependency on imports for procurement of their raw materials. The sourcing lead time in certain countries is high, which have been greatly impacting the total inventory as well as the inventory carrying cost. Currency volatility and commodity price movement have been one of the factors that have affected inventory and the bottom line. Based on these findings, a strategic framework was developed to provide guidelines for better inventory management and thereby improvement in the bottom line of the firm.

Research limitations/implications: Competitor analysis could not be explored in detail due to limitation in data accessibility, although this could have given more insight into the inventory monitoring and control mechanism. Further research is required to develop traditional inventory management techniques such as Milk run, vendor managed inventory and KANBAN. Benchmarking with other types of industry sectors needs to be explored to understand best practices.

Practical implications: This strategic framework can form the basis for decision making and can be integrated in Enterprise Resource Planning systems through empirical formulas for effective implementation.

Originality/value: The traditional focus of industry players has been on controlling inventory; however, in this study, an attempt was made to establish a link between currency movements and commodity inflation, which will help to improve the bottom line by better inventory management.

Keywords: Inventory management, Lead time, Cross-currency, Inventory carrying cost, Sourcing strategies.

1. INTRODUCTION

India's earthmoving and construction equipment (ECE) industry has enjoyed strong growth over the last seven years as a result of rapid economic development in the country. During 2006-2010, the industry grew at a compound annual growth rate of approximately 18% amounting to USD 3.3 billion. The Indian ECE industry has the potential to grow six to seven times—from total revenues of US$3.3 billion in 2010 to US$22.7 billion in 2020 with multiple benefits to the economy (IECIAL Report). The equipment sales volume is expected to increase from over 60,000 units in 2010 to 330,000 in 2020[1]. Because the industry is growing, there are many multinational companies that have established their presence in India. The dominant players in India in this industry are JCB, Terex, TATA Hitachi, L&T Komatsu, Hyundai, Caterpillar, Lui Gong, CNH, Dynapac and Witzgen.

Although the overall growth projected in the ECE industry is excellent, it is highly dependent on the Gross Domestic Product (GDP) growth of the country and government focus and spending on infrastructural projects. There are huge opportunities for this industry in the future, and there are huge challenges as well. The main challenge is the fragmentation of this industry; the other issue is technology up-gradation and infusion of new technology[2]. The author also projected that in the 12th Five-year plan, a trillion dollars (*i.e.* 52 lakh crores) has been committed to infrastructure.

Most of the products manufactured by these companies entail technological transfers from other countries, and hence, many of the critical parts used in the manufacturing process are imported from various countries worldwide. These imported parts have a high lead time, which greatly affects the inventory cost. Commodity inflation and currency fluctuations also affect the cost of inventory and the bottom line of the company.

The aim of this study was to establish an understanding of the linkage between inventory, commodity inflation and currency movement to form an effective sourcing strategy to improve the performance of an ECE company in India. To establish this, the research objectives were to

- Identify the present inventory level in the company and compare it with that of similar companies.
- Understand the impact of inventory on business.
- Identify and analyse factors that affect inventory cost.
- Understand commodity inflation.
- Analyse present currencies spent and formulate strategies to minimize the impact of currency fluctuation.
- Establish the linkage between inventory, commodity price movement and currency movement for formulating effective sourcing strategies to improve the bottom line.

This paper is organized as follows: Section 2 provides the literature review, Section 3 outlines the research methodology, Section 4 gives the data analysis and findings and finally Section 5 presents the conclusion and recommendations for future research.

2. LITERATURE REVIEW

In the manufacturing sector, raw material cost constitutes a large portion of the variable cost, and hence, it is vital to have right sourcing strategies in place. There are many factors that influence sourcing strategies; however, we will limit the discussion to three critical factors, namely, Inventory, Commodity inflation and Currency movement.

2.1. Inventory

Maintaining excess inventory provides some security against fluctuations in the level of customer demand, but at the same time, it also reduces the ability of a supply chain to respond to changes depending on the nature of that demand. Thus, excess inventory may act as a buffer against one risk, whereas it may increase another type of risk. The author[3] states that high speed to launch new products in the market, leads to potential obsolescence of existing inventory. There has been some concern about the true costs of inventory and whether companies do in fact recognize these fully. Another author [4] highlights various inventory costs such as those related to storage, obsolescence, damage, deterioration, shrinkage, insurance and management and cost of capital. With an incorrect assessment of inventory costs, there is the danger that companies may make inaccurate supply chain trade-offs in this respect and, therefore, may have fragile and vulnerable strategies for inventory management[5].

The potential disadvantages of holding inventory are widely recognized, and several inventory-reducing strategies have been put forward. These include the following:

1. a reduction in production lead times, for example, by means of shorter set-up times and smaller manufacturing runs[6];

2. the use of production postponement, which enables the inventory of common components to be held rather than a multitude of finished goods lines[7];

3. the visibility of end consumer demand to all supply chain participants, to reduce excess inventories caused by demand amplification up the supply chain[4];

4. total cycle time compression, in both information and material flow lead times[8];

5. the centralization of inventory, which implies that the level of safety stocks can be reduced by centralizing inventory in a single distribution centre rather than holding inventory in several national distribution centres[9];

6. the virtual warehousing concept, whereby all inventory across many locations is regarded as one common inventory pool[10]. This may be associated with the transshipment of goods between warehouses at the same echelon level in the supply chain[11].

7. Cross-docking goods to speed up the flow of goods through the supply chain[12].

2.2. Commodity Inflation

In today's dynamic environment, commodity price movement plays a very important role specifically in the high material content manufacturing industry. Price movements in commodities push up or down the material cost. In the manufacturing industry, the bill of material (BOM) cost constitutes the major proportion

of the price. Hence, commodity price movement alters the price of end products, and sometimes, manufacturers may not be able to compensate for the inflation by offering a higher price to the end consumer[13].

With net margins being typically less than 10% and cost of goods sold swallowing up to 70-80% of revenues, original equipment manufacturers do not have much capacity to absorb raw-material commodity price fluctuations. In this industry, purchased goods tend to be large, heavy components with significant raw material content; the cost of the raw materials without any value-add included can be as high as 20% for finished goods. Given this high cost percentage and the volatility of raw material prices in recent years, heavy equipment companies need to have a plan to mitigate the cost risks associated with supplies.

Firms that master raw material management can improve earning margins by 2-5 percentage points, increase security of supply and improve supply chain operations, among other things[14]. For companies that preemptively manage these risks, effective raw material management can lead to a competitive advantage.

2.3. Currency Movement

The currency of one country tends to get stronger or weaker against that of another country on a daily basis. The impact that this scenario would have on corporations (particularly large multinationals) is a little more complex because these businesses often conduct transactions in many different currencies and tend to obtain their raw materials from a wide variety of sources. Sourcing raw material from overseas exposes companies to currency risk, and they would likely see their margins take a hit as a result of currency fluctuations[15].

A depreciated currency is not necessarily a disadvantage for a developing country like India. Although inflation will hurt the country by making oil import expensive and liquidity squeeze will hurt corporate, depreciated currency is certain to boost exports and create employment opportunities and most importantly make its current account sustainable[16]. Companies that have substantial open foreign currency exposure face maximum difficulties during a currency crisis.

Some of the key factors underlying extreme currency movements are current account deficit, high government debt/fiscal deficit, commodity price shock, financial contagion and adoption of a new exchange rate system[17]. Table I summarizes India's risk factors for a currency crash and also highlights factors that need to be monitored to gauge currency movement.

Most economies follow a floating currency regime. However, adoption of a new exchange rate system or a managed currency appreciation / depreciation has been a common reason for a sudden sharp currency movement amongst the cases studied[18]. In several countries such as Argentina, Chile, Russia, Mexico, Ukraine and Malaysia, a system of currency board or currency peg was started, and this temporarily leads to inflation control and prosperity. However, the fiscal policy continued to be loose and current account turned negative in most cases, which eventually created pressure. The country thus had to give up on the peg, which allowed currency to float more freely and led to a sharp depreciation.

In a few other cases, we have seen managed devaluation of the currency to improve the trade situation, as implemented by China in 1984 and 1994 and the USA in 1985 under the Plaza accord. China devalued the USD (US dollar) and the CNY (Chinese Yuan) peg from 1.98 to 8.40 during 1983-1994 with the objective of promoting exports. The report[19]showed that the CNY had been nearly 40% undervalued as compared to the USD.

Table 1: Factors Affecting Currency in India

Factors (in 2013)	India-specific scenario	Risk weightage for currency crash	Remarks
High current account deficit	5.0%+ of GDP	Very high	Current account deficit, high oil import.
High external debt	Yes (68%)	Medium	Government debt to GDP ratio is high. External liability is steadily growing, including short-term foreign debt.
Fiscal deficit	5.0% + of GDP	High	There is pressure from rating agencies and foreign investors to improve fiscal deficit.
Commodity dependency	Substantial oil import	Low	Oil shock from geopolitical conflict will likely affect India adversely.
Financial contagion	High dependence on capital flow and strong correlation with global risk appetite	High	A significant portion of foreign institutional investments in India is of a short-term nature (*i.e.* as trade credit, portfolio investment).
Political instability	Regional parties becoming stronger, which leads to fragmented coalition	Medium	Political inaction and instability are possibly the most important parameters for currency fluctuation, because economic performance is highly dependent on policy.
High inflation	6.62%	High	High inflation naturallycauses currency to depreciate.
Forex reserve	USD 295 bn.	Low	Sufficient forex reserve based on the Guidotti-Greenspan rule.
Banking system	Strong	Low	Strong banks and banking regulations. Stable policies with no USD funding for real estate companies.

3. RESEARCH METHODOLOGY

An ECE company was selected for this study to understand the various factors that impacted the cost of inventory. The inventory in this company was studied on a monthly basis. It was monitored in terms of the number of days, and it was calculated based on the present inventory value weighted by the number of machines to be produced in the following month. The Table 2 indicates the calculations for August 2013.

The inventory days for August is 30 as against the budgeted figure of 26 days. Import components are the major contributors of increased inventory, and account for 38% of the total BOM cost; however, they account for 80% of the inventory value. This clearly shows the impact of import parts on inventory.

The typical import lead time ranges from 30 to 75 days. Hence, any decrease in production adversely affects inventory. Also, the supplier's lead time for manufacturing ranges from 2 weeks to 16 weeks. Hence, these foreign suppliers need to be given a schedule in advance based on a 3- to 5-month forecast. However, the market dynamics changes every month, and subsequently results in a volume decrease or increase.

Table 2
Inventorycalculations for the month of August, 2013

Number of machines in monthly production plan	280			
Number of days/month	22			
Number produced/day	13			
Number of WIP machines @ 15%	42			

	Average machining cost in Lakhs	*Inventory days*	*Per day cost in Lakhs*	*Inventory in Lakhs*
Region I	3.454	2	45	90
Region II	3.862	2	50	100
Region III	3.025	5	39	197
Region IV	5.173	7	67	471
Imports	9.386	64	122	7809
Total machine cost	24.900	Total Inventory Value for Monthly Production (A)		8667
		WIP Value 15 % of Monthly Volume (B)		1046
Total Inventory value (A + B)				9713
Total Inventory days				30.0

With the above background, it is essential to understand the inventory standards followed across the construction industry. To analyse inventory-related issues in similar companies, a questionnaire was prepared (Annexure 1) and through a telephonic/personal discussion with materials executives, data were collected from four companies. The summary of a comparative analysis of the reference company in this research, which is company 1 with three other competitors, is presented in Table 3.

Table 3
Comparative Inventory Analysis

	Company 1	*Company 2*	*Company 3*	*Company 4*
Present market share (%)	16	35	19	24
Local content (%)Import content (%)	6238	6535	5545	8218
Inventory in days	28-30	24	35	18
Currency hedging	No	No	No	No
Major sourcing countries	Japan, Italy, China	Japan, Italy, Korea	Korea, Japan	UK, Japan, Germany

From Table 3, we can infer that companies that have high imports have a higher inventory. Also, none of the companies are involved in currency hedging. Companies 2 and 4 are market leaders, and hence, they have higher volumes. Higher volumes also lead to a lower inventory, because multiple lot sizes can be planned[20]. This may not be possible when volume is staggered in multiple products.

Company 1 has a total of 5075 BOM components. Because it is very difficult and time consuming to analyse each and every part, Pareto analysis was used for identifying the vital few. Pareto analysis was done based on inventory value. The inventory value was calculated based on the number of units and price of the parts. The non-moving and slow moving stocks of the inventory were not considered for analysis.

The pie chart in Figure 1 indicates the distribution of the total inventory of 110 crores. The domestic inventory accounts for 41% of the value, comprising 4601 parts, which is 91% of the total parts. The remaining 474 parts, which are imported, contribute to 59% of the inventory value. The contributions of Euro, GBP and JPY are 22%, 18% and 13%, respectively. Any movement in currency significantly impacts inventory value. For the purpose of illustration, if the currency appreciates by 5%, then the impact on inventory would be an approximately 3% change. It is therefore essential to monitor currency movement and have a close integration of inventory, currency movement and sourcing strategy.

Because it was difficult to analyse 5075 parts, we considered only the top 100 parts, which are 2% of the total parts and account for 69% of the total inventory value (*i.e.* INR 76 crores). This inventory value was accounted for by 39, that is, 11% of the suppliers out of 343 suppliers. We analysed some of the suppliers and sourcing strategies pertaining to those suppliers to maximize the bottom line. Focused effort on these suppliers and close integration of information together with the right sourcing strategy helps in optimizing inventory and improving the bottom line. We examined suppliers for information integration such as currency movement, raw material inflation, Comprehensive Economic Partnership Agreement (CEPA) and lead time analysis to establish the right sourcing strategy.

Figure 2 indicates that 29% of the inventory (*i.e.* 21.7 crores)is domestic. The rest of the inventory is mainly on account of imported parts from countries such as the UK, Japan, Italy, Germany, China and Korea. Hence, it is imperative to analyse import lead times for these countries.

The various factors relating to the cost of inventory are analysed one by one as follows:

3.1 Lead time Analysis

Because import contributes to a major portion of the inventory value, it is crucial to analyse import lead times for determining the total inventory cost. For this, data were collected for 726 consignments from
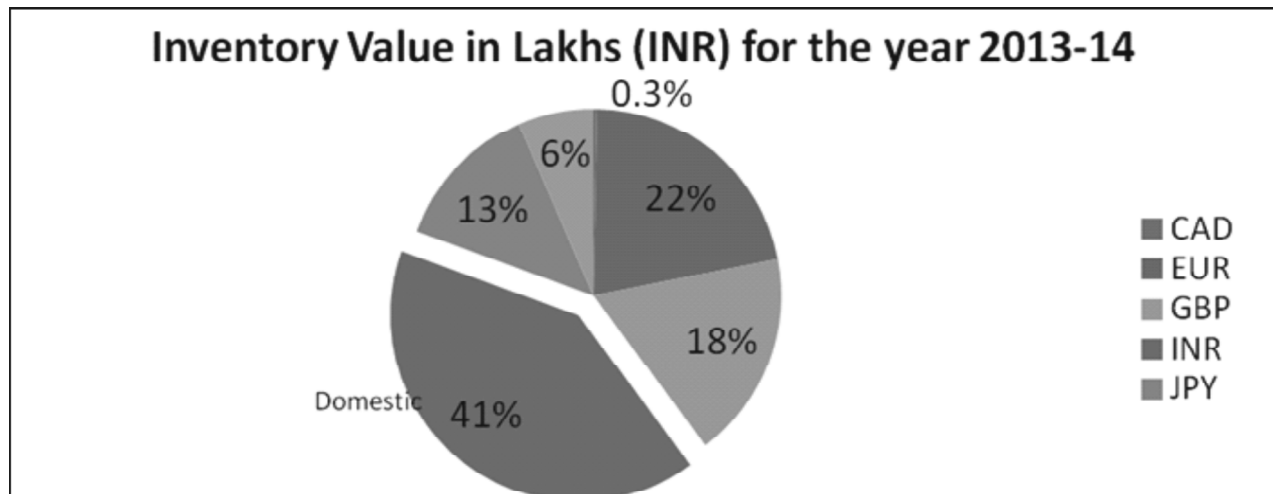

Figure 1: Inventory Value in Lakhs (Inr) for 2013-2014

Top 100 Parts Analysis

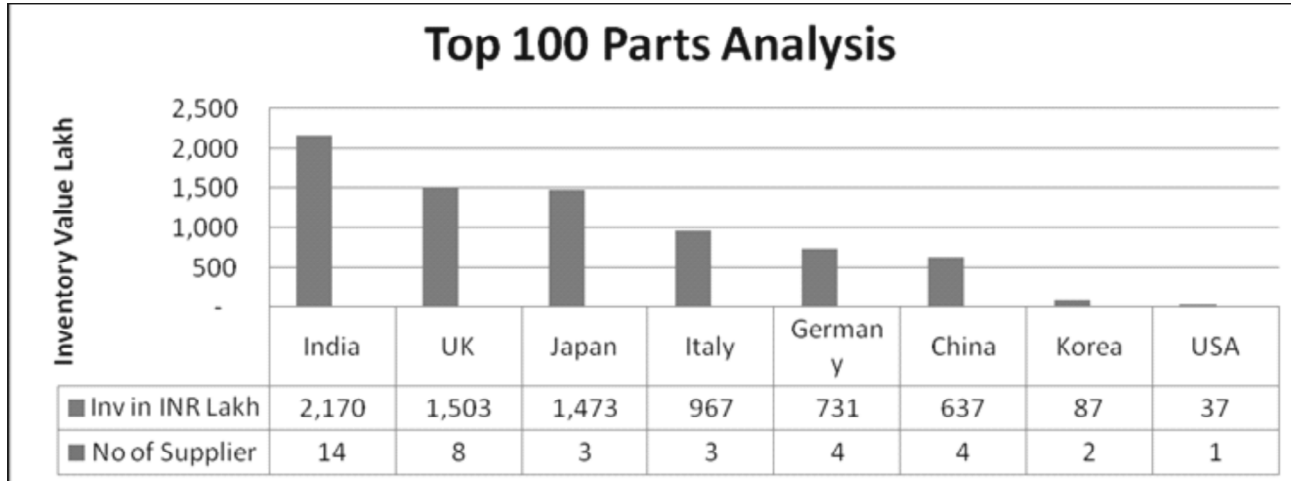| Inventory Value Lakh	India	UK	Japan	Italy	Germany	China	Korea	USA
■ Inv in INR Lakh	2,170	1,503	1,473	967	731	637	87	37
■ No of Supplier	14	8	3	3	4	4	2	1

Figure 2: Analysis of the Top 100 Parts

countries, namely, the UK, Germany, Japan, the USA, Korea, Italy, Thailand and Philippines. These data were collected from DHL, the global logistic freight forwarder of company 1. In a typical import cycle, once a freight forwarding request is given by the planning team, the courier company coordinates with respective suppliers based on the delivery term. The various stages were defined to calculate the lead time to understand possible opportunities for improvement. Lead time was categorized into five major stages and was mapped for the top five countries in terms of inventory value contribution. The five stages are given below:

1. Transportation from the supplier pickup point from the country of origin to the nearest port; vessel connection time is based on vessel departure date. Vessel frequency is one to three weeks, depending on the trade between two countries.

2. Lead time of the ship from the port of lading to the port of discharge.

3. Custom clearance, which involves filing of the bill of entry and other documentation to move the container from the vessel to the port and from there to the loading point.

4. Custom duty payment, lead time.

5. Transportation from the Port to company 1.

This lead time mapping will help to identify the areas of opportunities.

3.2. Raw Material Inflation

The BOM cost accounts for the majority of cost in product pricing. For example, the BOM of a particular finished product may consist of 650 parts. The top 50 parts (8% of parts) contribute to 80% of the BOM cost. These high value parts include the engine, track parts, hydraulic parts, bearing, cabin and cylinders. Most of these high value parts contain steel in some form or the other. Hence, any change in steel prices impacts the part cost, inventory cost and bottom line of the company if such a price increase is not passed on to the customers.

Information was collected for steel price movement in Europe to understand the impact of increase in steel price on product price, inventory and bottom line. The Metal Bulletin research index was used to evaluate movement of raw material in the European market. Figure 3 indicates the movement of steel
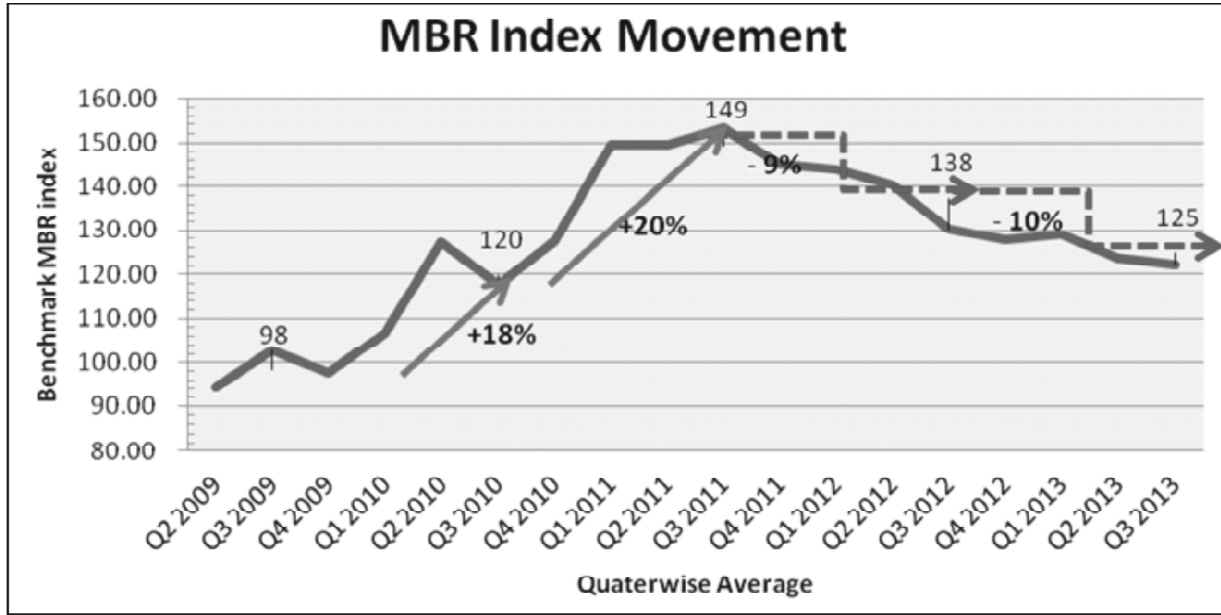
Figure 3: Steel Price Index

from 2009 to quarter III of 2013. The steel price index movement is plotted against the quarterly average price. The graph indicates that steel commodity had appreciated in 2009, 2010 and up to quarter III of 2011, after which there is a downward trend in the price movement of the commodity.

3.3. Currency Movement

To understand the impact of currency on price movement, the cost of major currencies were analysed. Data released by the Reserve Bank of India (RBI) on a daily basis were tracked from the RBI website. Currencies in which major imports were happening were selected for this study. The quarterly average of currencies such as the USD, Pound Sterling, Euro and Japanese Yen was plotted against Rupee per unit of Indian currency. Figure 4 indicates that all the currencies show an upward trend; thus, currency appreciation
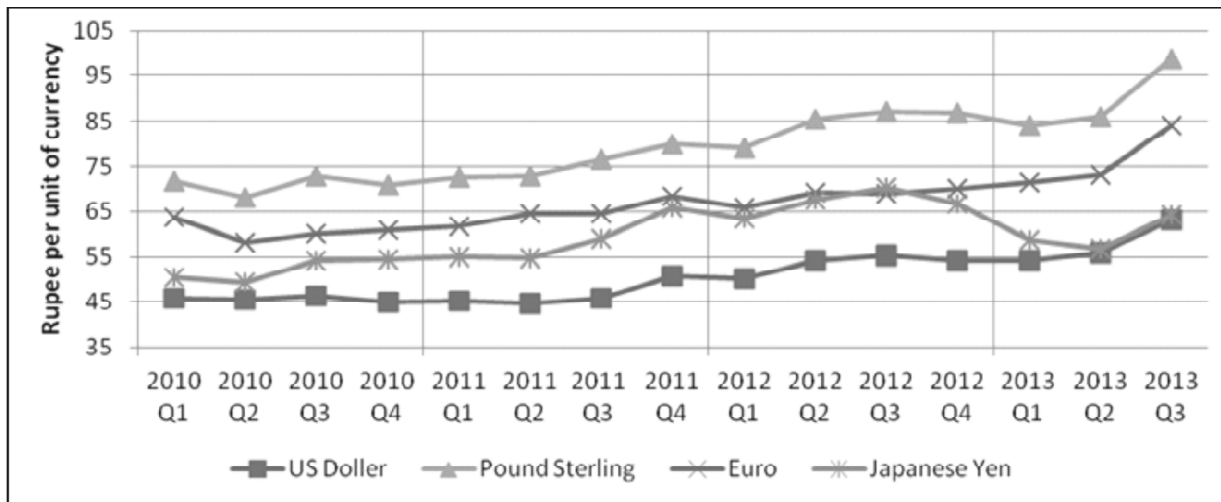

Figure 4: Currency Movement

was evident post quarter I of 2013. Such an upward trend could exist because of global factors and poor performance of India's GDP against expected performance coupled with a widening current account deficit. All the currencies show an upward trend movement except for the Japanese currency, which shows a depreciation trend, post quarter III of 2012.

3.4. Inventory Cost

To calculate inventory cost, all the factors related to inventory were evaluated. Cost of capital was taken as 15%. This is based on opportunity cost for a company if the same amount if invested elsewhere will get a minimum 15% return. Other costs such as storage space, insurance, material handling and labour were factored.

4. DATA ANALYSIS AND FINDINGS

4.1. Inventory Carrying Cost

The inventory carrying cost was calculated based on the relevant data collected from Company 1. Storage cost was calculated based on the market rate for storage in a warehouse or revenue that will be generated from rent if company 1 starts warehousing. Cost of obsolescence is based on actual obsolescence cost during 2012. There is no shelf life for such products and this is therefore not applicable. Cost of customers lost is the opportunity loss due to decreased responsiveness. With the above background, inventory cost is calculated as indicated below.

Inventory carrying cost calculations

(A) Fund cost – opportunity cost 15%

(B) Storage cost – Area occupied – 6 Lakh square feet

Storage cost if outsourced –INR 15/square foot. Therefore, total storage cost is 90 lakhs, Storage cost - 1% (includes raw material and finished goods storage)

(C) Cost of obsolescence – 0.7%

(D) Shelf life cost – Not applicable

(E) Handling cost – Fork lift cost and labour cost – 0.6%

(F) Opportunity lost due to decreased responsiveness – Customer Lost – 0.7%

Total Inventory carrying cost – approximately 18%

4.2. Inflation

The linkage between inventory costs and inflation was established. We have seen that only 8% parts contribute to 80% of the inventory cost. Figure 4 depicts that commodity inflation had increased by 18% in 2010 and 20% in 2011. This means that at the end of the year, inventory cost will be further increased by 18%, if the price of a machine is unchanged. For simplicity, we will consider that inflation increases by 1.5% every month (18% p.a.). In such a case, if inventory is increased by one month's stock, then additional impact

due to inventory carrying cost is 1.33% per month. However, stock buildup will be used in subsequent months, when prices will increase by 1.5% due to inflation. This will save 0.27% on a net basis even though inventory is increased.

In 2011, inflation was 20%, which means gain will be 0.34% (*i.e.* 1.67% - 1.33%), that is, 4% on an annual basis. This means we can use inventory as a hedging tool for inflation when prices are moving up. Benefit can be further maximized by getting discounts and transportation and logistics cost reduction on account of larger lot sizes. Saving on account of logistic optimization and discount is up to 1% of the price.

Post quarter III of 2012, it was observed that the trend was reversed, and that there was a decrease in raw material inflation rate. In such a case, a higher inventory reduces saving potential in subsequent months. Hence, when raw material inflation decreases, it is recommended to control inventory by reducing lot sizes. It is also important to integrate inflation agreements with suppliers in a planning cycle. For example, with a particular supplier, there is an inflation agreement, as per which prices for the next quarter are decided based on average raw material prices of previous quarters. In this case, if we monitor inflation trends, then it will help us to make inventory decisions more wisely.

4.3. Currency Movement

We have seen earlier that the rupee has depreciated at a constant rate over the years; however, in 2013, there was a 13%-17% depreciation of currency. Import content in the BOM is 38% and make up to 59% of the inventory. It is recommended to have a higher inventory as a currency hedge when currency is depreciating, as observed in the case of inflation. However, depreciated currency impacts the bottom line due to an increase in the price.

Table 4 depicts that all the relevant currencies had appreciated against the Rupee; however, the Japanese Yen had depreciated by 4% during 2013.

Table 4
Currency Movement

|	%age change yearly			
Foreign Currency	*2010*	*2011*	*2012*	*2013 - Q3*
USD	–2	11	7	17
Pound Sterling	–1	9	9	13
Euro	–4	11	6	20
Japanese Yen	7	16	5	–4
CNY	1	15	7	17

To understand the interdependence of currencies, regression analysis was done for currency rates from 2010 to quarter III of 2013 as depicted in Table 5. It is observed that correlation between all the currencies is very high, that is, >90% except for the Japanese currency, which ranges from 0.67 to 0.83. The prices in the case of one of the Japanese suppliers were in USDs till 2012. In 2012, the USD was appreciating, but at the same time the Yen was depreciating. The company insisted that the supplier swap

the currency from USD to JPY. This resulted in a saving of 4% as against a potential increase of 17%. The company saved a lot of money through such a sourcing strategy. Thus, there is a need to constantly track currency movement and look for opportunities for currency swap and use inventory as a hedging tool.

Table 5
Currency Correlation

	Correlation
USD, Pound	0.96
USD, Euro	0.90
USD, Yen	0.73
USD, CNY	0.98
Pound, Euro	0.93
Pound, Yen	0.83
Pound, Cny	0.97
Euro, Yen	0.67
Euro, CNY	0.94
Yen, CNY	0.75

We will now evaluate sourcing opportunities from a low cost country like China in conjunction with the USD. Sourcing from China is seen as a cost effective strategy. China has pegged the Chinese Yuan against the USD for a considerable period of time to sustain export competitiveness. However, due to international pressure, currency has been moved from the fixed exchange regime to the floating currency regime. We can observe from Figure 5 that post July 2010 the Chinese currency had started appreciating against the USD.
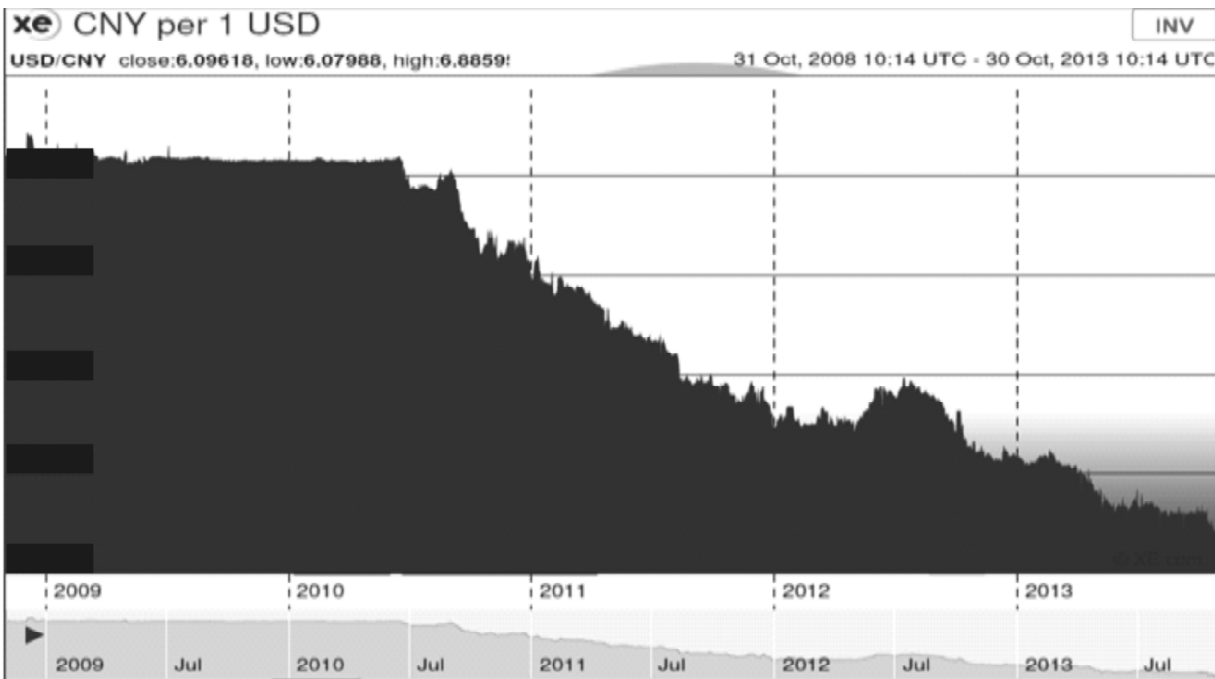
Figure 5: Chinese Cny Per Usd

In 2013, the CNY had appreciated by 3% against the USD, whereas the Rupee had depreciated by 17% against the USD. Trade between India and China takes place in USDs because no trading happens involving CNY and INR. From the example given below, we can anticipate future prospects of sourcing from China.

Suppose that in 2012 an Indian original equipment manufacturer bought parts worth USD 100 from China. Assuming that the price remained the same in 2013, what would have been the price impact with currency change in 2013? In 2012, USD 100 was equivalent to INR 5415 (*i.e.* 54.15 x 100). In 2013, it had become 17% costlier because the currency moved to 63.209. For China, profit margins had reduced by 3% because the CNY had appreciated by 3%. This implies that the gap had widened by nearly 20%. In such a case, import from China will become nonviable. Hence, a local sourcing strategy has to be adopted to avoid price escalation.

4.4. CEPA

As per the CEPA agreement, there is a duty reduction year on year between India and Korea. The duty gets reduced with effect from the 1st of January. This information needs to be integrated with the planning team so that shipments are planned carefully at the end of the year to maximize the benefit of duty reduction. This means that inventory at the end of the year should be kept as low as possible and that the same can be rebuilt in January in the subsequent year. Thus, BOM cost in the following year will be lower by 1.5%. In contrast, if the duty is increasing under CEPA agreement, then inventory needs to be increased to minimize the loss due to the increase in duty.

4.5. Lead Time

Figure 6 indicates that the total average lead time from the Japanese supplier to company 1 is 34 days. This chain involves road transport at each end, and also includes Full ContainerLoad (FCL) or Less Container Load (LCL) sea freight container movements to India. The pipeline map is drawn in Figure 6. It is evident that sea transport takes 19 days; whereas lead times other than sea transport requires 15 days. Contribution of inventory from Japan is 14 crores, which is 13% of the total imported inventory. There is scope for reducing the lead time by processing the duty payment one day in advance by providing advance documentation. This will help inventory reduction by 3 days' time. This can be applied across all the shipments coming from other countries as well.

Figure 6: Lead Time from Japan to Company 1

Figure 7: Lead Time from UK to Company 1

Figure 7 indicates that the total average lead time from the UK supplier to company 1 is 47 days, which is about 20% of the total import contribution. The deliveries can be planned in such a way that inland transport and vessel booking time can be optimized to 6-7 days, instead of 13 days.

From the experience of Japan and the UK, it can be inferred that there is a lot of scope for improvement in terms of reduction in the lead time to get imported components from foreign suppliers. This reduction can happen if conscious effort is taken to reduce not only inland transport and vessel booking time but also the duty payment cycle. The overall import accounts for 59% of the inventory value and reduces supply chain lead time by 4-5 days. This eventually leads to an inventory reduction of 3 days (5 days * 59%). Another important sourcing strategy would be to localize major parts in India to improve inventory and avoid currency risk. Thus, integration of sourcing strategy, inventory and integration of information will help in optimizing inventory and improving the bottom line for an organization.

5. CONCLUSIONS AND RECOMMENDATIONS

In times of economic uncertainty, anything that can provide a competitive edge could prove to be critical to a company's survival. An understanding of supply chains can make all the difference. Effective inventory management requires real-time integration of information from internal sources, suppliers, partners and customers, and an awareness of past trends and future expectations. This enables an organization to react quickly to sudden changes and therefore meet customer demands.

One of the great balancing acts for any business entails the optimal management of its inventory. Too much inventory means additional cost to the business, whereas too little can mean lost revenue and dissatisfied clients. Tailored inventory management integrated with information and agile sourcing strategies can give a competitive advantage. Most of the companies monitor inventory in isolation; however, inventory is always "not bad" and can be used as a hedging tool against inflation, currency appreciation and trade agreements[21].

In volatile markets, companies need to consider various initiatives to optimize the inventory cost by simultaneously ensuring the availability. The company cannot treat all stock keeping units alike. Efforts should be focused on key components and key suppliers, as we analysed that only 8% parts and 11% suppliers contribute to 80% of the total inventory cost. Once the important parts and suppliers are identified, the company needs to estimate the inventory cost to facilitate the decision-making process. Unless one knows the true cost and the breakup, one cannot make any efforts to reduce it further.

The company needs to maintain real-time data to formulate sourcing strategies, which can be both tactical and strategic in nature. Information such as alerts for the trade-off between inventory and inflation trend, inventory and currency movement should be integrated into the enterprise resource planning system so that quick action can be taken and substantial profits can be booked as and when an opportunity arises. Market intelligence can be integrated into the planning process by observing key factors and trends of commodity inflation in domestic and international markets to derive short-term and long-term sourcing strategies. Deliberate increase or decrease of inventory, whenever there is a change in import / export duties between two countries as seen in the CEPA agreement between India and Korea can again enhance the bottom line. Over a period of time, companies can aim for more and more localization by guiding and cajoling vendors to manufacture their products locally. This will thereby reduce the lead time for delivery and cost of importing. Indigenous production will also offer the possibility to tap the export market and thus earn significant revenues. The company should be equipped to source products from across the globe based on the least total cost of procurement. Companies also need to monitor currencies and mitigate risk through currency agreements or currency swaps.

NOTES AND REFERENCES

1. Report on Indian Construction Equipment Industry. (http://www.i-cema.in).

2. http://timesofindia.indiatimes.com/business/india-business/Infrastructure-is-key-to-Indias-growth/articleshow/18405574.cms, M F Farooqui, secretary - department of heavy industry, government of India said in the Times of India dated 8th Feb 2013.

3. Etienne, E. C. (2005), Supply chain responsiveness and the inventory illusion. In Supply Chain Forum: An International Journal (Vol. 6, No. 1, pp. 48-65). KEDGE Business School.

4. Christopher M. (2005), Logistics and Supply Chain Management, Prentice Hall, 4e.

5. Lee and Billington, (1992), Managing supply chain inventory: pitfalls and opportunity, MIT Sloan Management Review, April, http://sloanreview.mit.edu/article/managing-supply-chain-inventory-pitfalls-and-opportunities/

6. Harrison, A., and van Hoek, R. I. (2005), Logistics management and strategy. Pearson Education.

7. Van Hoek, R. I. (1998), "Measuring the unmeasurable"–measuring and improving performance in the supply chain. Supply Chain Management: An International Journal, 3(4), 187-192.

8. Mason-Jones, R., and Towill, D. R. (1999), Total cycle time compression and the agile supply chain. International Journal of Production Economics, 62(1), 61-73.

9. Sussams, J. (1986), Buffer stocks and the square root law. Focus on Physical Distribution and Logistics Management, 5(5), 8-10.

10. Landers, T. L., Cole, M. H., Walker, B., and Kirk, R. W. (2000), The virtual warehousing concept. Transportation Research Part E: Logistics and Transportation Review, 36(2), 115-126.

11. Herer, Y. T., Tzur, M., and Yücesan, E. (2002), Transshipments: An emerging inventory recourse to achieve supply chain leagility. International Journal of production economics, 80(3), 201-212.

12. Apte, U. M., and Viswanathan, S. (2000), Effective cross docking for improving distribution efficiencies. International Journal of Logistics, 3(3), 291-302.

13. Apte P.G. (2003), *International Financial Management*, Tata McGraw Hills, 2e.

14. https://www.atkearney.com/consumer-products-retail/global-retail-development-index/full-report/-/asset_publisher/oPFrGkbIkz0Q/content/2013-global-retail-development-index/10192, accessed on July 7, 2013

15. Harrison, A., and van Hoek, R. I. (2005), Logistics management and strategy. Pearson Education.

16. Jhamb L. C. (2010), Inventory Management, Everest Publishing House.

17. Horngen, Sundem and Stratton (2010), Introduction to Management Accounting, Prentice Hall, 13e.

18. Curtis Glenn, (June 19, 2013), The Impact Of Currency Conversions. http://www.investopedia.com/articles/basics/07/currencies.asp

19. https://piie.com/sites/default/files/publications/pb/pb10-26.pdf, accessed on 15th Dec, 2013.

20. Chopra, S. and Meindl, P., (2004), "Supply Chain Management: Strategy, Planning and Operation," Prentice Hall, edition 6

21. http://news.thomasnet.com/imt/2012/06/05/how-to-cope-with-unpredictable-raw-materials-costs , accessed on 31st Dec, 2013.