

The supply chain of fertilizer in South Vietnam – a case study

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Executive summary

What we present in this case study is the supply chain ground truth in most industries. It is a counter example to the much hyped press and academic literature including the business school case studies. This case study presents the supply chain map and analysis of a common fertilizer product and brings to focus the improvements that need to be made to make these networks efficient and effective. There will not be any mention of ERP, WMS, TMS, Trade matrix or even the Internet in this case study. The reason is simple: these concepts have not been well accepted by this industry because the supply chain managers and decision makers are not clear of the value these packages bring to their bottom line. Another important issue is the sophistication of the automation and communication infrastructure at the country level, company level and supply chain network level. In most countries the IT and the automation infrastructure is primitive. The connectivity between companies and the functions within companies could be lacking. We have one such case of a old economy industry producing a cost sensitive product with customers located in a developing economy. Our message here is clear and simple, substantial improvements could be obtained through understanding the process flow and improving the logistics i.e. material flow across companies. The packaged applications solutions can come later.

We analyze the supply chain of urea fertilizer into South Vietnam. The analysis is limited to the part of the supply chain that starts at the port of the fertilizer factory and ends with the farmer. The study includes a thorough description of the supply chain, with description of issues such as demand forecasting, trading, suppliers, shipping, warehousing, local sales, inland water transportation, and local distribution network. Based on this description the analysis has special emphasis on logistics costs, lead-times and value adding activities. From this analysis following problems were identified: Warehousing, forecasting errors, long lead-times, and sales through dealers.

The discussion also covers the need for an information system to coordinate the planning and execution of processes across all the members of the supply chain, and also outlines how the materials flows could be managed in practice. The analysis identifies a potential for a reduction of logistics cost of 50 percent, which equals about 10 percent of the selling price of this fertilizer.

1 Introduction

This paper analyses the supply chain of urea fertilizer into South Vietnam. In a time where the main focus within logistics is on technological innovation, this study, in contrast, is an example of a traditional supply chain where very little technology is being used. Such supply chains are found in several countries where the development of information technology still is at its infancy. The focus on technology-innovations often place these supply chains in the background, however, they still are a significant part of the logistics systems in South East Asia and many other parts of the world.

The paper is based on the final thesis of Mr Lundestad and Mr Stenberg at the Master of Science program in Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway. Professor Solem was the supervisor of this thesis. The study was conducted in Singapore and Vietnam in cooperation with the National University of Singapore (NUS) and a global fertilizer company. Professor N. Viswanadham was the local supervisor in Singapore. The study was conducted over a period of 7 months from October 1999 till April 2000.

2 Scope of the problem

This study is an analysis of the supply chain of the urea fertilizer that a specific fertilizer company sells in South Vietnam. The logistics system was analyzed with the idea in mind to redesign, or reengineer, the system if that is found to be necessary. The analysis was limited to the part of the supply chain that starts at the port of the fertilizer factory and ends with the farmer.

Urea is used for the production of rice. Vietnam is the world's third largest exporter of rice, with 85% of cultivated land devoted to rice growing [1]. Most of the rice production takes place in the Mekong and the Red River deltas.

Vietnam's transport infrastructure has not been able to respond to the expanding demand for transport services, and the roads, bridges and railways are poorly maintained. Therefore waterways play an important role in the Mekong delta, where the main rivers can accommodate 5,000 dwt seagoing vessels with draft up to 8 meters [2]. These rivers are linked to feeder canals that have been developed for the support of rice production and exports and fertilizer distribution. The transportation is mainly done on old barges which are mostly made of wood and are small in size with a capacity of 20 to 200 MT, but there are also some companies that offers transportation on larger (300-500 MT) tug towed steel barges.

The distribution to the Mekong Delta is mainly done through about 20 dealers in Ho Chi Minh City (HCMC) that works as intermediaries between the importers and the local wholesale networks. These dealers keep stocks and speculate in rise and fall in fertilizer prices. They also trade among each other, and a pile of fertilizer can occasionally change owner several times without moving from the warehouse. In the provinces of the Mekong Delta there are some big wholesalers that buy fertilizer from the

dealers in HCMC and transport it up the rivers and canals on barges. These wholesalers usually have a network of retail shops and smaller wholesalers. They may also have a retail outlet themselves where they sell directly to the farmers.

3 Theoretical perspective

Today the focus is not only on the logistic processes within an organization, but more on the whole supply chain of a product. Making a thorough description of the supply chain is the first step towards understanding the opportunities that exists for improvements. Together with describing the supply chain one must also choose what to measure.

3.1 Total supply chain costs

In a total cost analysis all costs are considered as a whole, not individually. Total costs include all the supply chain costs, including material, transport, inventory, and facility costs. These costs are usually dependent on one another. Using expensive air transportation instead of cheap sea transportation could for example give overall cost savings, if the cost savings from reduced inventories more than offset the difference. Companies may focus on minimizing functional costs such as transportation, when they instead should recognize that the goal should be to reduce the total logistics costs.

3.2 Time

Lead-time management is an important part of logistics. Lead-time, in this context, is the clock time spent by the supply chain to convert the raw materials into the final products and to place them into the hands of the distributor or customer [3]. The challenge is to reduce supply chain lead-time, since for every day that a product spends in the supply chain it incurs an inventory holding cost. A problem for many companies is the inaccuracy of forecasts. The response to this is usually to increase the safety stock, but lately the focal point has become lead-time reduction. Clearly the forecasts would be more accurate if one only needed to predict the nearest future.

3.3 Value-added

To be able to identify reengineering opportunities, it is useful to visualize how much time is spent in the chain on value-adding activities and non-value-adding activities. According to Martin Christopher [4] value-adding time "is time spent doing something which creates a benefit for which the customer is prepared to pay. (...) On the other hand, non-value-adding time is spent on an activity whose elimination would lead to no reduction of benefit to the customer." He suggests doing a rough-cut graph highlighting visually how much time is consumed in both non-value-adding and value-adding activities. These graphs will then give the first indications to which activities that could be improved or even eliminated.

4 Description of the supply chain of fertilizer in South Vietnam

This chapter gives a thorough description of the supply chain.

Figure 1 illustrates the stages the fertilizer goes through from the factories all the way to the farmers.

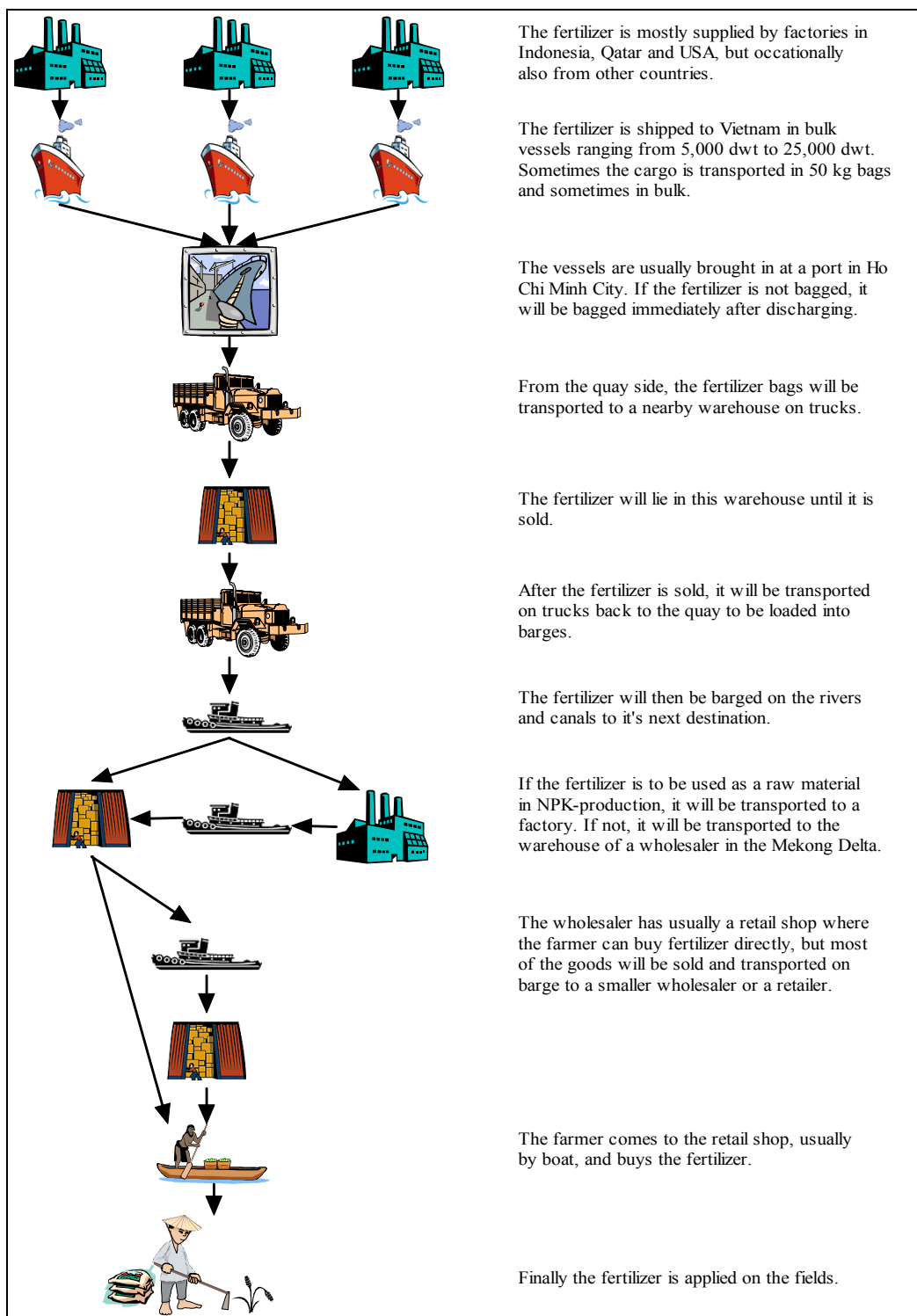


Figure 1 Illustrative flowchart for the physical flow of fertilizer to South Vietnam

5 Demand forecasting

Forecasts are made by estimating from experience how the demand for fertilizer fluctuates.

Months	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Crop season 1															
Crop season 2															
Crop season 3															
Timing for fertilizer application															
Timing for fertilizer importing															

Figure 2 Crop seasons, fertilizer application and fertilizer import in South Vietnam [5]

Figure 2 shows the cultivation schedule and fertilizer demand for rice in the Mekong Delta. The figure shows the three annual crop seasons winter-spring, summer-autumn and autumn-winter. The fertilizer is applied during the first two and a half months of the rice's growth cycle, while the import of fertilizer is done in the months before this.

Purchasing is done in a world commodity market. This market is very volatile, where prices on for example urea in Qatar ranged between 85 and 125 US\$ per MT in 1999.

The fertilizer sold by the fertilizer company in Vietnam in 1999 was mainly from suppliers in Indonesia, Qatar and USA. Typical vessel sizes, voyage times and freight rates from different load ports to Vietnam are shown in the table below:

Load port	Vessel size [dwt]	Voyage time	Freight rate [US\$/MT]
Bontang	5,000-10,000	4 days	10-12
Lhokseumawe	5,000-10,000	4 days	10-12
Mesaieed, Qatar	10,000-13,000	18 days	16-18

6 Methodology

The study was performed in the following way:

- Make a thorough description of the supply chain
- Based on this description, do an analysis of the supply chain
- Based on the findings in the analysis, make recommendations for improvements

The first challenge was to get as much information as possible about the processes and links in the supply chain. There was not one source for this information, but it had to be obtained from different places and different persons. Therefore interviews with 13 key persons involved in the supply chain operations in Singapore and Vietnam were carried out. Figures were gathered from the accounting departments of the fertilizer company. In addition to this, two trips were made to Vietnam to study the logistics operations in detail.

7 Analysis of the supply chain

The following analysis illustrates where in the supply chain costs are added and time consumed. The logistics activities involved in supplying bagged urea from Indonesia to a wholesaler in the Can Tho Province is used as an example. There are three reasons why the analysis stops at the wholesaler level, and does not go all the way down to the final consumer. Firstly because economic figures were difficult to obtain for this part of the chain. Secondly because the interviews revealed that the price difference between wholesale and retail level is only a few US\$ per MT, and it hence can be assumed that not much can be gained here in terms of cost reductions. And thirdly because the part of the supply chain between the factory and the big wholesalers is where the fertilizer company easiest can initiate changes.

The figures used in this example are actual averages from 1999.

7.1 Logistics costs breakdown

Figure 3 shows a breakdown of the logistics costs involved in moving the urea from the factory in Indonesia. The figure illustrates how the different stages add costs as the product moves through the supply chain.

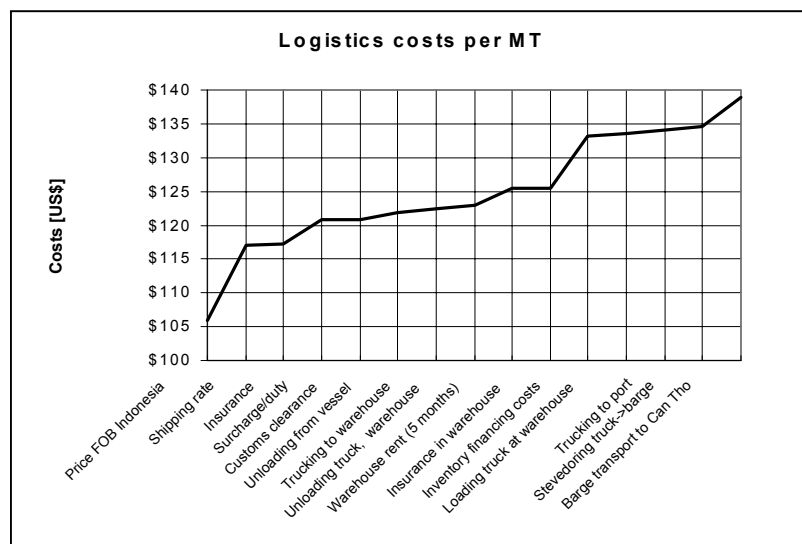


Figure 3 Logistics costs breakdown for 1 MT of bagged urea delivered free on board in Indonesia, until delivered on barge in the Can Tho Province in the Mekong Delta

figure 3 shows that the logistics operations add more than 30 percent extra costs, on top of the price paid for the fertilizer in Indonesia. The most significant cost factors are the voyage from Indonesia, the warehousing in HCMC and the barge transport to Can Tho.

7.2 Lead times

Figure 4 shows how time is consumed as the urea is moved from the factory in Indonesia. The chart shows how long time the different stages takes as the product moves through the supply chain.

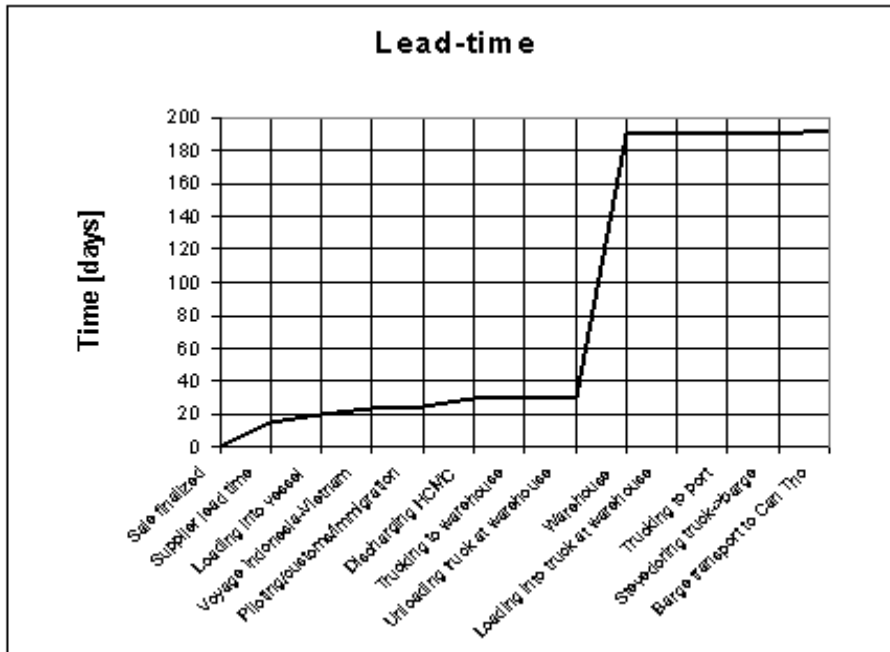


Figure 4 Lead-time for bagged urea delivered free on board in Indonesia, until delivered on barge in the Can Tho Province

One of the interesting things that figure 4 shows is that it takes more than 6 months from the fertilizer is bought in Indonesia till it reaches the first level of wholesalers in Can Tho. Most time is spent as supplier lead-time and on warehousing in HCMC.

7.3 Value added from operations

Understanding which activities are value-adding, and which are not, is important. A value adding activity is doing something that creates a benefit, which the customer is prepared to pay for. Figure 5 shows how the different logistics operations add value to the product. The fertilizer is for example worth more (for a customer in Vietnam) on the quay of HCMC than in a port in Indonesia, hence has the ship transport added value. To create this figure, we have roughly estimated what the price of fertilizer is on board a ship in Indonesia, delivered in the port of HCMC, delivered on a barge in HCMC and in Can Tho. Value perceived by the customer may be difficult to measure exactly in terms of money, we have therefore chosen to use the term utility instead. The purpose of figure 5 is not to give a perfect measurement of how much value each activity adds, but simply to illustrate which activities are value-adding and which are not.

figure 5 shows that the ship transport from Indonesia to Vietnam, the unloading from the vessel, and the barge transport to Can Tho add value to the fertilizer, while the activities connected to the warehousing are non-value-adding. In fact the transport of the fertilizer to the warehouse decreases the value, since the fertilizer is worth more on the quayside than inside the warehouse.

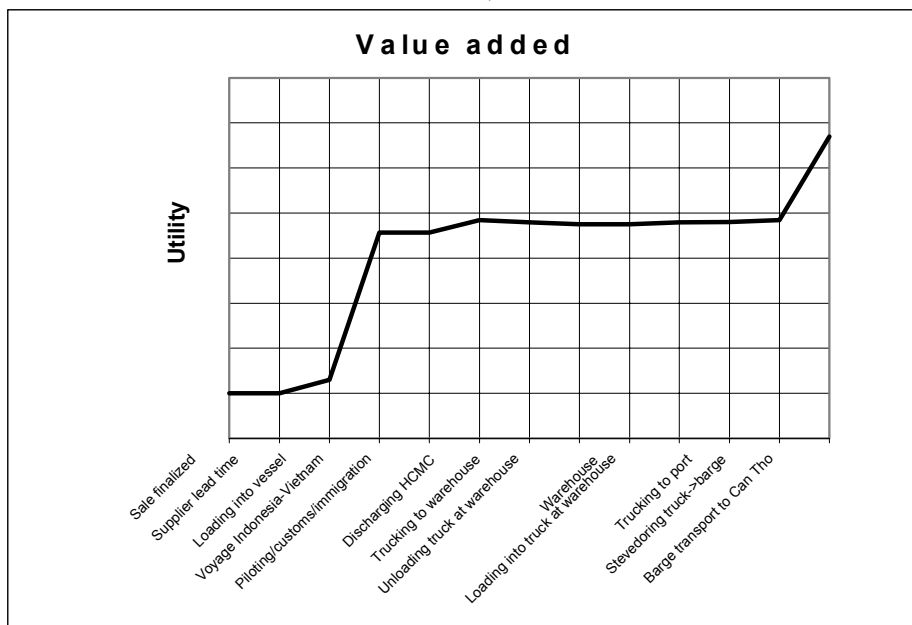


Figure 5 Value added from different logistics operations for bagged urea delivered free on board in Indonesia, until delivered on barge in the Can Tho Province

7.4 Value added versus time consumed

The difference between value-adding time and non-value-adding time is important to understanding of how logistical processes can be improved. figure 6 visualizes how much time is spent on both value-adding and non-value-adding activities.

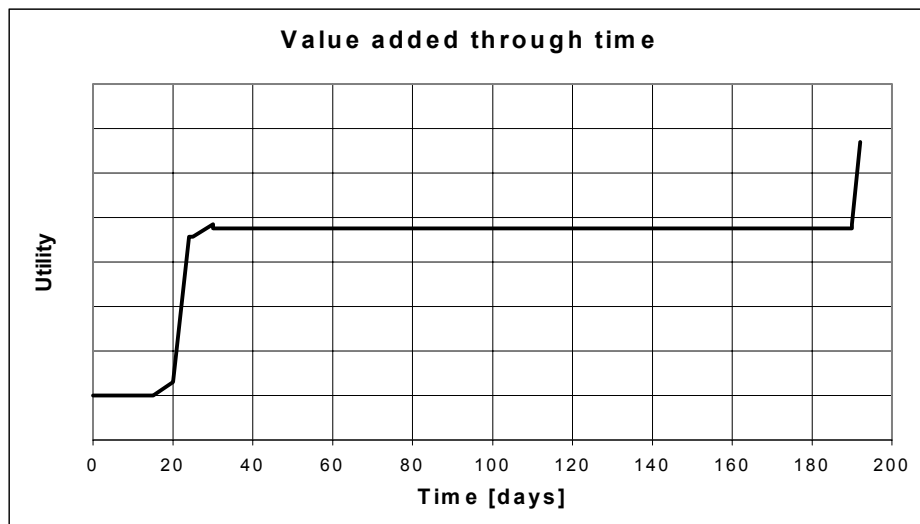


Figure 6 Value added and time spent for bagged urea delivered free on board in Indonesia, until delivered on barge in the Can Tho Province

Figure 6 shows that the total process time was about 190 days, and yet value was only being added for less than 6 per cent of that time. It seems that a lot of time and money is lost in this supply chain. Especially the time spent and the cost added for warehousing in HCMC, seems to be something to look closer into.

7.5 Warehousing

The warehousing-levels were analyzed and are illustrated in figure 7.

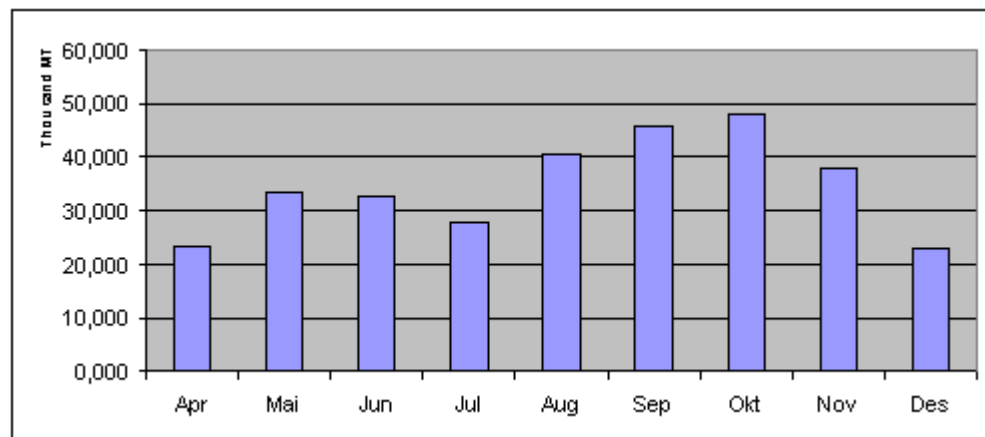


Figure 7 Inventory levels for Urea imported by the fertilizer company in 1999

As we can see from Figure 7, there were significant quantities of fertilizer in warehouses in 1999. It is however important to mention that some of the stock of fertilizer that is shown in this figure is already sold. In these cases a dealer has bought a certain quantity of fertilizer, but waits to take it out of the warehouse. The dealer then pays the inventory costs for this period.

For the fertilizer company and the other parties involved in this supply chain it is of course important who is paying for this inventory, but in an integrated supply chain management perspective it is more important to find solutions that reduces the total costs of the supply chain network. We will therefore not separate between inventory owned by the fertilizer company and inventory owned by the dealers.

We calculated the inventory turnover to be 2.2 which means that the average bag of fertilizer stayed more than five months in warehouse.

8 Key findings

From the figures and charts shown above, some possible opportunities for improvement were identified.

8.1 Warehousing in HCMC

The activities concerned with warehousing in HCMC are very costly and time consuming, and at the same time are non-value-adding. The habit of storing the fertilizer in HCMC before transporting it to the Mekong Delta is an example of an activity whose elimination would lead to no reduction of benefit to the customer.

Even though the current design of the supply chain may require some warehouses that are used for consolidation and as distribution centers, it does not seem necessary to keep an average stock of five months sale.

8.2 Forecasting

The fertilizer market in Vietnam is quite volatile, with highly fluctuating demand and prices. Under such conditions it is important to have good forecasts. We have seen that the warehouse levels in HCMC are very high. This could be a symptom of forecast errors. The fact that the fertilizer company had more than 23,000 MT of urea on stock in April 1999 without selling anything that month implies that their forecasting methods could be improved.

8.3 Lead times

As we have seen, the supply chain has very long lead times. It is typical that forecast errors and warehouse levels rises as supply chain lead time increases. It seems unnecessary for example to have such high levels of inventory when a ship voyage Indonesia-Vietnam only takes 4 days. Two activities that consume a lot of time, but are not adding any value to the fertilizer, are the supplier lead-time and the warehousing in HCMC. These seem as good starting points for minimization that could lead to significant improvements.

8.4 Dealers in HCMC

The dealers in HCMC are not adding any value in the supply chain, but are just adding cost and consuming time. It seems as if improvements could be made from circumventing these.

8.5 Information sharing and forecasting

As we have seen, there is significant room for improvement in the forecasting. Through information sharing these problems can be reduced. Today the demand for fertilizer from the dealers in HCMC is directly derived from the demand for fertilizer from the wholesalers in the Mekong Delta, which in turn is derived from the ultimate demand from the farmers. Instead of forecasting the demand in HCMC using traditional methods, demand should be calculated based on the demand at the next step in the supply chain. With more accurate information about the demand smaller quantities could be shipped directly to the wholesalers when it is needed, and thereby eliminating the need for warehousing in HCMC.

In practice this could be done if the wholesalers in the Mekong Delta shared more information with the fertilizer company. With modern information technology, this is feasible at low cost. If the fertilizer company built alliances with the wholesalers in their distribution network, the wholesalers could periodically send figures showing their current inventory levels and expected sales for the next weeks. Summing up the numbers from all the wholesalers would give the total demand. These numbers could then be passed on to the other players in the chain, so that production, shipping, discharging, inland transportation, etc. could be planned better. Through cooperation and information sharing, the supply chain partners will be better able to respond rapidly to known demand and to do so with less inventory and more effective handling for the chain as a whole, and hence at a lower cost.

8.6 Materials flow

A future scenario for the supply of urea to South Vietnam could be as follows:

Figure 8 illustrates how the supply of urea fertilizer to South Vietnam should be done according to our findings.

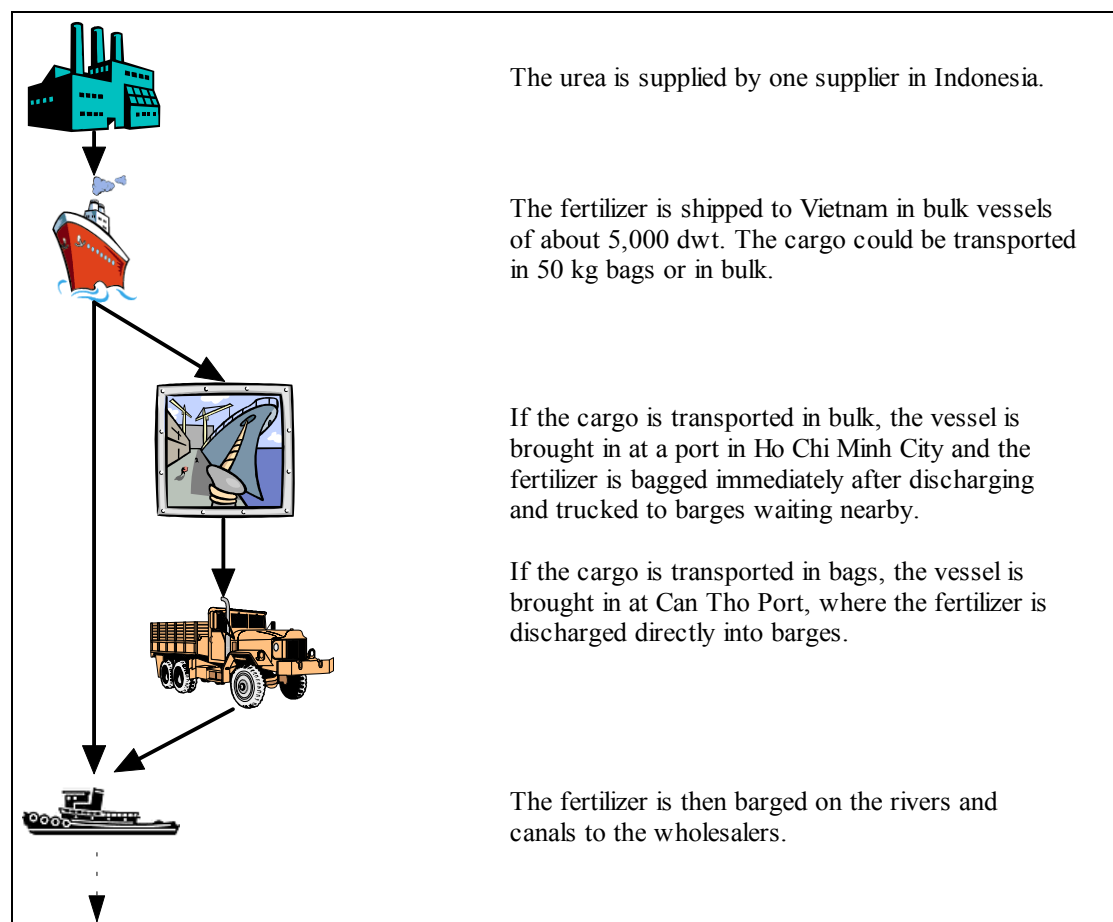


Figure 8 Illustration of how supply of urea to South Vietnam could be organized

Our calculations have shown that there is a potential for saving US\$ 15.68 per MT for urea fertilizer bagged in Indonesia. This equals a reduction of logistics costs of 52 percent. In addition to this come whatever additional costs and commissions the dealers in HCMC add to the final price.

Conclusions:

In this paper, we have considered an old economy industry supply chain in a developing country environment and conducted analysis of total relevant cost and lead-time. This analysis has lead to suggestions for improving the effectiveness and efficiency of the chain. Food supply chains in general, the related chains such as the fertilizer chain exist for a long time and they are not yet touched by the recent e-business concepts, methodologies, and technologies except perhaps in the retail sector. Attention is needed to improve the back-end and logistics of the farm sector.

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