LOGISTICS TOOLS AND TECHNIQUES AND THEIR IMPACT ON MANAGING AGRO-FOOD CHAINS

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Abstract: the choice for and the use of a logistic tool or technique has a huge impact on the way goods and products are managed in the supply chain. This is true for all supply chains but due to specific aspects in the Agro-food chain, this is especially true for these chains. As a relative new aspect of business studies, logistics still lacks a model to link and match the various developed models with each other. This paper wants to build a model which enables the supply chain participants to understand the potentials and limitations of the various logistic tools or techniques especially within the framework of the Agro-food chain.

Keywords: planning, control, logistic tools and techniques

I. Introduction

Logistics is a young branch of business studies and is still trying to find its proper place amongst the other well established branches of micro economics. Perhaps the best way to prove this point is that till recently in an organization, logistics mainly dealt with two specific aspects: planning and control. It was not till the early eighties, as it was discovered, that the added value of logistics is to be found in linking the various needs of consumers with the possibilities as they were found within the logistic chain. Viewing this chain as one living organism with its own aspects, problems, possibilities and requirements opened the way to search for the keys to use all potentials within this chain.

The development of logistic theory has gone through certain phases in order to reach its present state. Every phase of this development focused on particular aspects only and wanted tools and techniques to cope with these specific problems. These tools are still used, but little has been done to compare these tools and techniques with each other and to consider negative side effects or other trade offs.

This paper suggests a model which could help logisticians and non-logisticians to visualize all aspects of these tools and techniques and to visualize the potentials and non potentials for Supply Chain Management. First the development of logistic theory is presented, secondly the various tools and techniques, as given in logistic theory, are researched for their functioning and core aspects. These aspects are placed in a larger frame work for easy comparing. The tools and techniques studied are limited to some of the most used and generally recognized in logistics as given in literature (Christoffer, Van Goor and Coyle): SIC; MRP, CRP, JIT, OPT, QRM, Lean, Six-Sigma and POLCA. There are more logistic tools available, but these will serve as temporary targets for this research. In a later stage other tools can be treated and compared in a similar way. Till now this is a desk research which will be tested in a field test for potential use by logistic professionals in the area round Arnhem en Nijmegen in 2008.

II. The development of logistics

The figure below shows the various phases in the development of logistics as a science (Weijers 2003).

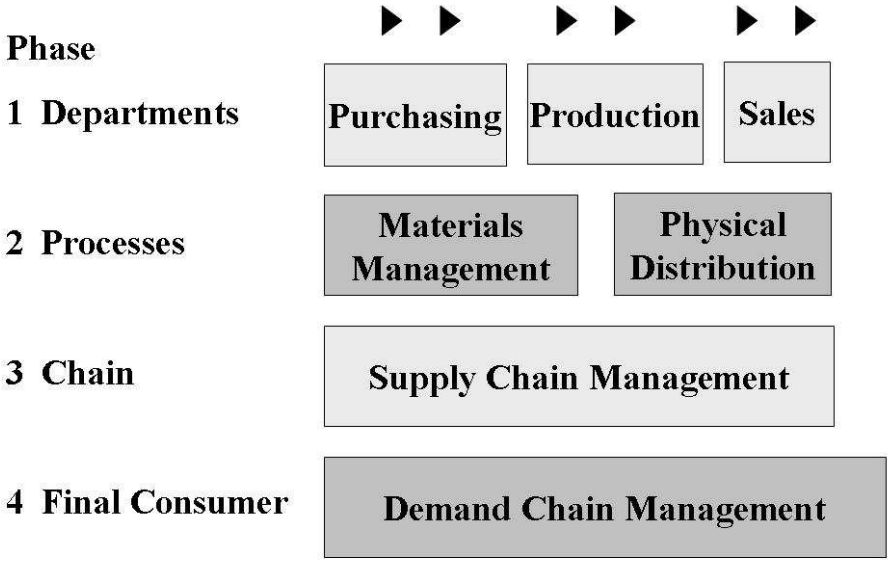

Figure 1 phases in the development of logistics

At the start, logistics was mainly concerned with the aspects connected with a specific department within an organization, like Purchasing, Production or Sales. The goal was to search for effectiveness within this particular department. This meant that hardly any thought was spend upon the possible side effects for other departments. So it could be that purchasing simply ordered huge quantities of a particular component in order to achieve volume discounts, but by doing so created huge stocks which were expensive to maintain and caused problems in the warehouses.

The second phase around the sixties, concentrated itself around the production itself on one side and the marketing/distribution aspects on the other side. Integration between departments within an organization became necessary in order to achieve an overall efficiency and also the aspects concerning effectiveness became hot topics. This approach was still based on

concentrating on separate departments, companies or perhaps improving the link between two aspects next to each other in the chain.

In the eighties this combination of effectiveness and efficiency, as played out so well by the upcoming Japanese industry, found its supreme theoretical framework of the third phase: Supply Chain Management. In this case all parts of the whole logistic chain should work as one team and benefits and problems should be shared amongst the partners with this chain. This phase saw the role of logistics as pivotal. It created a self-awareness which logistics had lacked before and created a foundation for a new generation of logistic managers who were not afraid to step in to the limelight. From now on logistics knew that it had added value for an organization and that it could make or break a products success and a company's profitability. A useful concept in this case is Order Decoupling Point (Hoekstra and Romme) which helps company to decide where to create a stock point from which customers will be served. This stock point decouples the production chain in two separate parts. Before this stock point efficiency will be the key aspect run on push aspects and after the stock point effectiveness is more important and demand pulls the products towards the customer.

In the middle nineties, logistics saw its chance to step out of its normal role of being the very last phase in the organization to be considered and take on a role of its own. Japanese companies had paved the way by proving that well organized supply chains were better equipped to deal with the faster changing product life cycles as the old fashioned western approach. If the customer is king, why not let him decide exactly what, when and where a product will be made and delivered. This demands a stress on aspects like flexibility previously unknown to business but not unknown to logistics.

III. Logistic tools

In order to cope with the various problems facing decisions within logistics, tools have been developed to help make decisions. The first (Coyle) were the Statistic Inventory Control (SIC) tools to calculate reorder points (ROP) or decide when to place a new order. These tools were simple and did not consider anything but maintaining a preset level of stock. These tools were static and dependent upon long known traditional demand patterns.

With the rise of mass production and with the know-how build up in World War II in the USA for war production, Manufacturing Requirement Planning (MRP1) became popular (Orlicky) aided by the introduction of computers. These computers made complicated calculations of Bill of Materials (BOM), the depletion of stocks over time phased horizon possible. Logistics suddenly could tell what the consequences for Sales or Production were, if certain parts were not ready in time. Also a change in sales could be calculated as far as components need was concerned and whether this required action from the part of Production, Logistics, Sales or Purchasing.

The introduction of the computer must have changed the life and position of logisticians completely. No longer someone who was only asked when everyone else had decided what should be done, the information gathered and controlled by the Logistics department made it a growing power within the company. With the decrease of costs per byte and the increase in computer process speed, more and more data was put into the system. This meant that also more and more information was expected to be derived from the system to be used for decision-making on levels previously unaware of the potentials within logistics.

From MRP1 more tools were derived as it proved to be good, but not 100% helpful. MRP1 was only concerned with maintaining stock levels on all aspects of the BOM over a time phase. It did not thing twice about how much capacity was needed for making it within this time phase. For the calculation of the needed amount of men and machines, Capacity Requirement Planning (CRP) was invented and combined with MRP1 gave rise to MRP2 or Manufacturing Resource Planning.

All these tools were push type techniques. They relied upon the fact that one link in the chain knew when to start and when it should finish its part of the task in order to hand it over to the next link. The question whether this next link did need it, was not an issue. Plan was plan, and so they should have been ready. This attitude changed in the late seventies as the Japanese understood that the customer should be the goal of all action within a chain. You only should do something when asked by the customer. The customer "pulled" the demand through the chain and as the customer could easily change his demand, this was not simple to translate in anything like a production plan. Kanban was introduced, so demand signals could be transferred from one link to another.

The best known pull system is undoubtedly Just in Time (JIT). The name JIT is perhaps the worst term ever used within logistics as it caused many people to err on stressing the time factor instead of the core: retaining a level of zero stock. In fact if **just in time** should have been the key, MRP and even SIC would just serve the term just as well as they also ensure a replenishment of stock just before actual usage. Some purist even suggested renaming it Just on Time as that would perhaps better describe it as the fact that it should be within a certain time aspect. The Americans have found the best solution for this problem by renaming it zero inventory. This is exactly what should be the main focused of all aspects connected with JIT: attaining stockless production and distribution (Hall 1983). But zero inventory is not easily achieved. For instance it relies upon a quick response of all links concerned and this is build on a base of available capacity as is shown in figure 2.

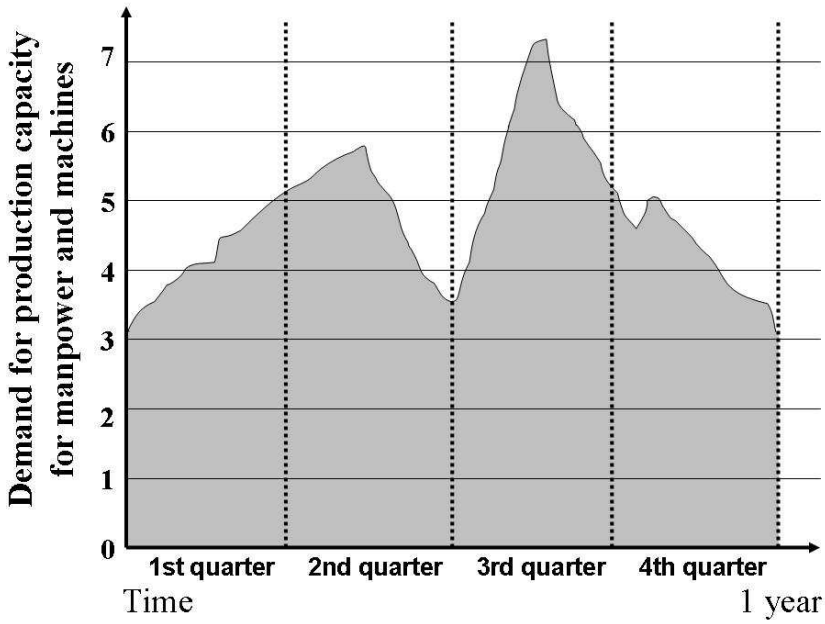

Figure 2 example of capacity demanded with JIT

Seldom, demand for products is equally spread over a time period. In order to avoid having stocks of products in order to cope with these differences, more capacity needs to be made available as is needed on an average during say a year. One could say that instead of having stocks of products, a company has to have a reserve (or stocks) of capacity ready for immediate use if requested. It seems that whatever approach a company chooses, push or pull, benefits always are accompanied by disadvantages.

IV. Opportunities for logistics

All tools try to get the highest degree of effectiveness (result driven) by using the minimum of means (efficiency), taking into account a given situation as a fact. Efficiency and effectiveness are two of the main performance indicators and are highly appreciated especially within Logistics where performing according to promise (or order or request) is easily done when no restraints are placed upon the available resources. Reality is of course something completely different. Both aspects should be used best and this creates a conflict which is perhaps the traditional playfield of Logistics anyway.

The battle between efficiency and effectiveness always was something which was pushed upon the plate of Logistics in a negative manner. Sales, Production or even the sister department of Purchasing, simply created a task which side effects like storage, (internal) distribution and administration had to be solved by Logistics.

This put Logistics into a position not unlike the one held by Cinderella. Just like her, the other departments were allowed to attend the balls and she had to clean up while her egoistic siblings enjoyed themselves and bathed in the limelight at the court balls. If we take customers to be kings (or at least handsome princes) this allegory becomes a picture very recognizable for Logistics. Stepsister Sales taking the glory of making deals which generated turnover which made managers eyes glow with the anticipation of profits, which meant that there was a positive difference between these sales and the connected costs. Costs which consist of the expected costs connected with the actual production and distribution itself and the extra costs derived from the extra service as given by Sales in order to obtain this particular sale. So often Sales added aspects like 24 hour delivery for the same price, but forgot to calculate what this would mean for the increase in the overall costs especially those within the field of Logistics. If there were problems, it was Logistics which failed and not one of the other sister departments.

V. Modern tools

With the change in speed with which markets change these days, the need to respond prompt and inexpensively to these changes is known to all within all modern organizations. It has become the key to survival of the fittest and this gives Cinderella her chance to dance at the ball with Prince Charming. Today’s logistic manager will not shrub the ashes from the hearth and wait what chance might bring, but he will instead try to direct the situation in such a way that his know-how will contribute in a positive manner towards the company’s profitability and future.

Recently, many new tools have quite been developed to help find an equilibrium between the need for effectiveness and efficiency. Most of them build upon older tools or try to

combine push with pull in order to mix the benefits of both systems. These new tools are in random order:

- Optimal Production Technology (OPT);
- Quick Response Management (QRM);
- LEAN
- SIX SIGMA
- POLCA

OPT searches for bottlenecks in the chain which hinder production. OPT seeks solutions in balanced capacity in the chain and could help a manager to understand why a particular aspects in the chain is more an obstacle as the other links (Goldratt 1984).

Time is the main aspect for QRM, which finds a prompt and right delivery on time more important as the costs which have to be accepted for achieving this goal. Sometime the word Agile is also used to describe this tool (Harding).

Lean could be seen as a logical continuation of the philosophy which underlies JIT. It states that all waste should be avoided and that a customer should not have to pay for the failures and problems within the chain. It concentrates on reducing aspects like unnecessary transport of products like first storing in an internal warehouse before putting it on the work floor instead of bringing it straight to the right spot. Other aspects are e.g. double administration, defects and unneeded stocks (Hall 1983). In figure 3 depicts the choice between Agile or Lean:

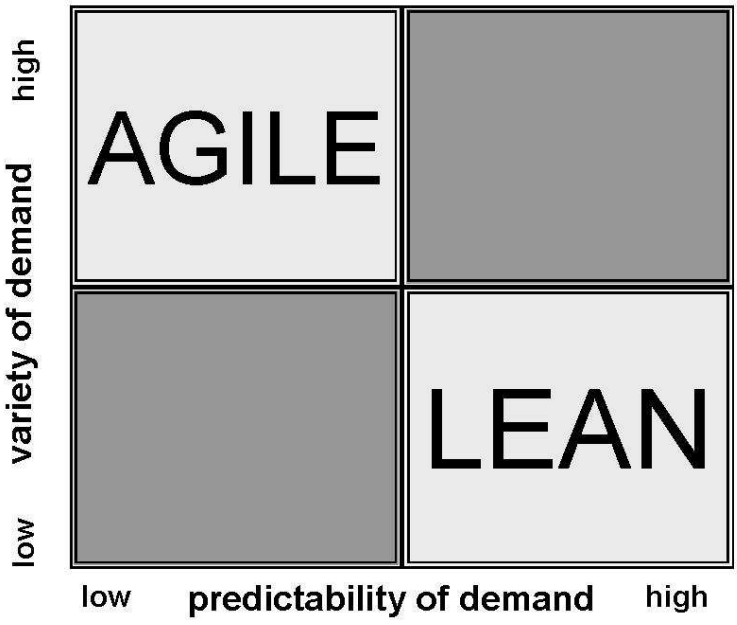

Figure 3 lean or agile

The higher the level of variety is, the better it is to rely upon Agile type systems, for more predictable production Lean could be better.

Six Sigma is a variation of Lean (Hearding) and relies strongly on quality improvements as often found in the service industry.

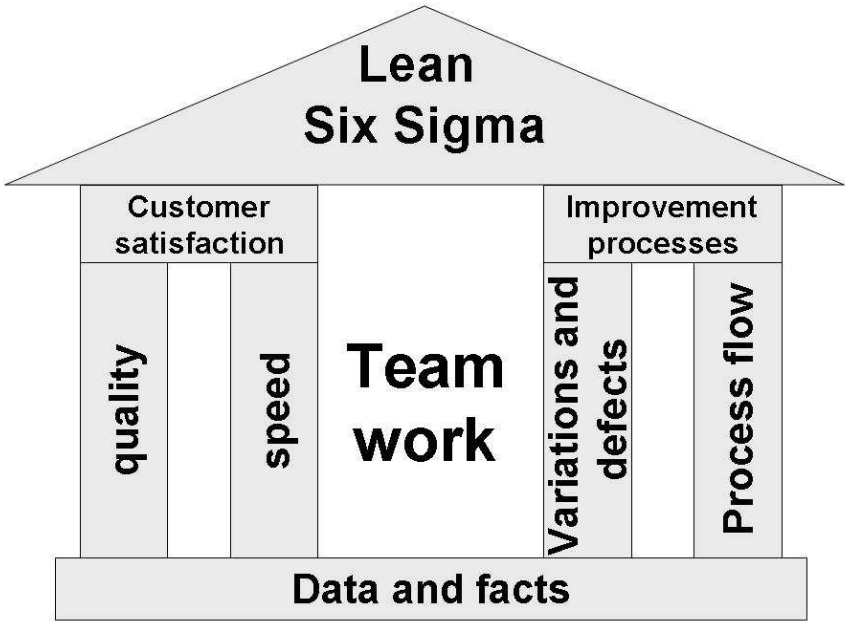

Figure 4 Lean Six Sigma

As depicted in figure 4 it is build upon 4 principles:

- Customer satisfaction: better service but faster;
- Improvement processes: search for the cause of problems. A mistake is everything which is unacceptable for a customer;
- Teamwork: learn to listen to each other;
- Data and facts: base everything on sound and clear data.

POLCA is an acronym for Paired-cell Overlapping Loops of Cards with Authorization (Suri) and tries to combine push systems to determine on higher planning level what could be done with pull systems to decide when in fact something has to be made.

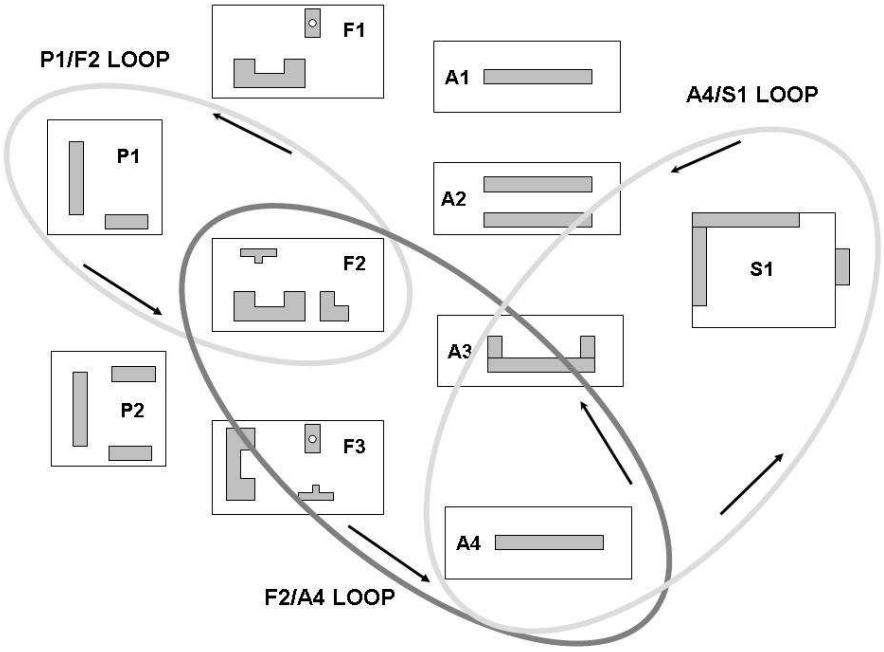

Figure 5 functioning of POLCA on the work floor

The process takes place on certain dedicated areas on the work floor (P1, P2 till S1) and will only start when the next link allows production to be made.

VI. Linking the tools

It seems that every system or tool available to logistics relies heavily on one or perhaps two aspects only. This implies that this will result in not being able to satisfy all aspects which logistics cherishes to accomplish, resulting in dissatisfied users and partners.

Looking at the various tools it must be possible to find a common denominator which could place a tool in connection with the others, so allowing a better understanding what can and can not be achieved by using a particular tool or technique. It would help understand both users (logistic as well as not logistic) and partners why certain aspect may be expected to be solved and why some are difficult to be achieved if a particular technique is applied for a certain situation.

Three aspects dominate all known and available techniques and tools as used in logistics (Pieters 2006). These are:

- Time: How long will a customer have to wait, or how long in advance will everything have to be ready, as far as planning or preparation are concerned?
- Stock: “To have inventory or not, that is the question?” could have been a main theme in many logistic perspective. From safety stock till money pit ranges the attitude towards this phenomenon. You could loose customers for not being able to supply directly from stock and go bankrupt for having invested too heavily in it.
- Capacity: If we would have all the means, we would not have any problems achieving all our set goals. Unfortunately means are limited and can only be set to use once for a certain action. Money, machines and manpower have to be considered with great care when employed.

Most techniques lean on one or two of these aspects and ignore the rest. What you loose while concentrating on one aspect, you will loose on not being able work with the others. This could be the main reason behind the fact that companies tend to change techniques rather rapidly instead of working well with one specific tool. Even a company like Dell which was pioneer for such a long time for direct marketing and delivery has decided in May 2007 to abandon this idea and it will set up sales through retail outlets.

Working with three aspects creates the idea “why not try to set these aspects against each other?”. This resulted in the model as shown below:

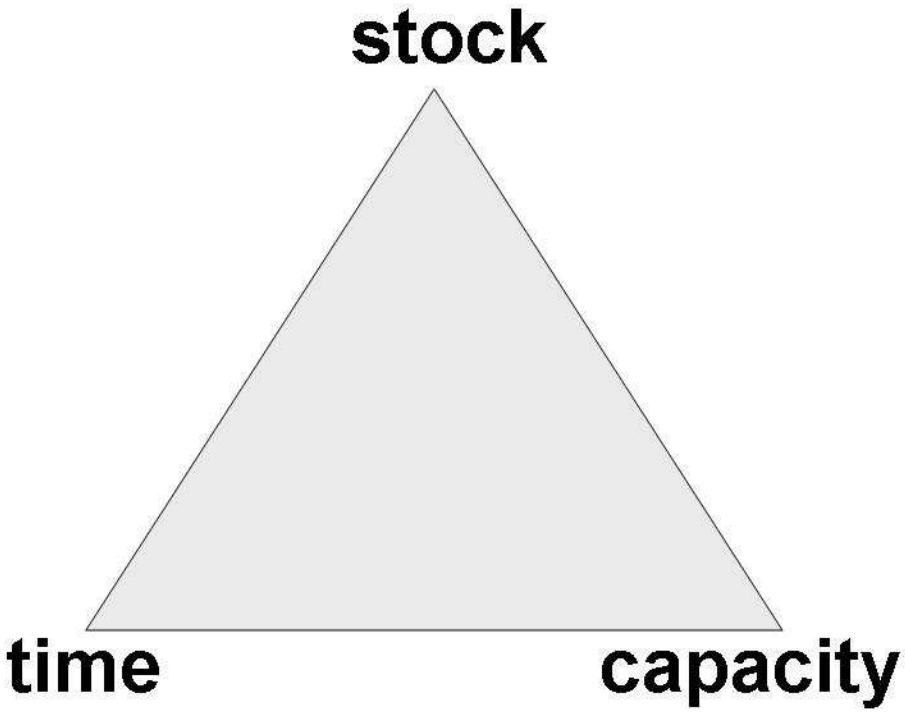

Figure 6 the three aspects

If a tool relies more on aspects like time, it should be place close to this and vice versa. It would be interesting if we could place the various tools in this triangle model. In table 1 is tried to connect the techniques to these three aspects and to specify whether an aspect is very important (+ + +), reasonable important (+ +) or somewhat important (+). (- - -) indicates that an aspect in absolutely not considered at all, hardly unimportant for (- -) and (-) for somewhat unimportant.

Professional logisticians found it easier to place a technique or tool in the triangle as to define its connection with the above mentioned aspects. After this exercise, a matrix was made connecting the techniques and tools with the aspects as the participants using the average position in the triangle. It seems that the triangle helps to understand the various logistic tools and techniques easier as trying to define a situation straightforwardly. In table 1 the results of this exercise are shown.

Table 1 logistic tools and techniques and the related aspects

Tool	**Stock**	**Time**	**Capacity**
CRP	- - -	- - -	+ + +
DRP2	+	+	+ +
JIT	+ + +	+	- -
LEAN	+ +	+	+
MRP1	+ +	+ +	- - -
MRP2	+	+	+ +
OPT	- -		+ + +
POLCA	+ +	+ +	+ +
QRM	- - -	+ + +	- - -
ROP	+ + +	+	- - -
SIC	+ + +	+	- - -
SIX SIGMA	+ +	+ +	+ +

Placed in the triangle these tools and techniques could find a place within the triangle as depicted in figure 7.

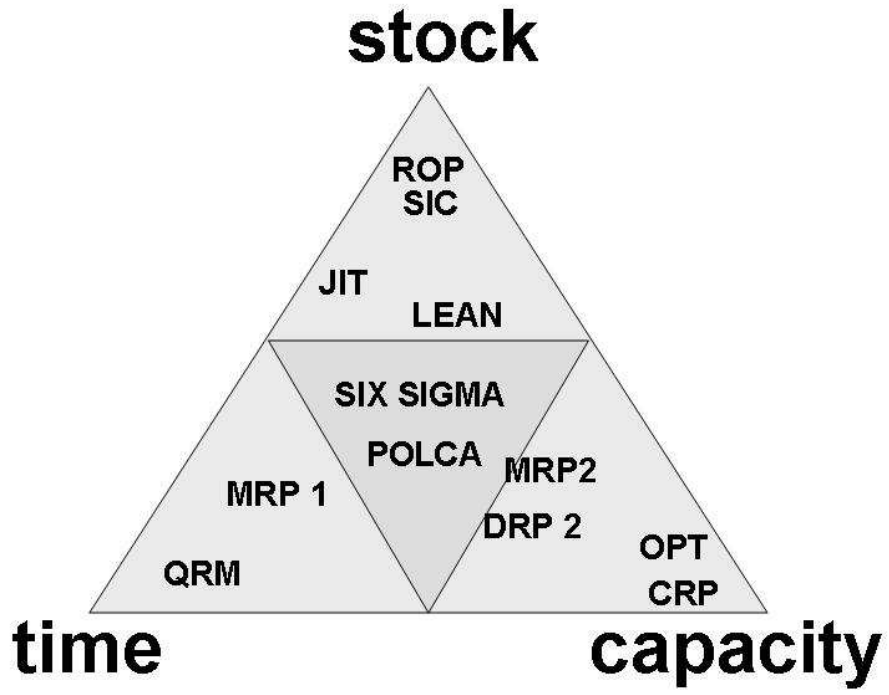

Figure 7 placing tools and techniques within the triangle

VII. Logistic aspects for Agro-food products

Agro-food products encounter the same three aspects as shown in the triangle as all other products. But they have specifics which makes that certain aspects have to be taken more into considerations within production and distribution of these products. In this part some products are considered (sugar beets, cigarettes, beer, cheese, ice cream and bananas) and analyzed on the specific logistic needs due to specific market requirements or product features.

Sugar beets

Sugar beets grown for the European sugar beet industry are harvested between September till the end of December. Harvested sugar beets have to be processed as soon as possible to prevent the loss of sugar content. This means that the refineries for the European sugar beet industry are working round the clock during harvest time, but are underutilized for the remaining period. This implies for the industry that they have more capacity as the average need. At the same time, after processing the sugar beets, they have a huge inventory of sugar and sugar products which have to be stored, as demand for sugar is more evenly distributed. So even if for instance the industry demands a Just-in-time delivery of sugar, it never will be able to fulfill the main idea of lowering stocks within the whole value chain.

Cigarettes

The cigarette industry knows an evenly distributed demand for its products. This allows the industry to operate machines very efficiently and use its capacity to the full. The main ingredient is harvested unevenly and is not always of the same quality. The customer demands

on time delivery of a product of a constant taste and quality. In order to be able to fulfill this demand, some cigarettes producers have created a stock of raw materials which could serve production for more as 8 months.

Beer

As agricultural products have to be put on the market or processed as soon as possible after harvest or reaching slaughter age, and shell life is limited, and special storage expensive, producing for stock is hardly an option in this branch. Perhaps the only exceptions are products which are sold on a seasonable basis like food which is mainly consumed during special feast like Thanksgivings, Christmas or Saint Nicolas (chocolates and sweets) or New Year's Eve (Champagne). Production starts long before the peak in sales is reached and is stored for fast delivery on demand. These festive days are known well in advance and demand can be estimated on basis of sales in the past. For product sales related to weather conditions this will be more difficult as the past is no guarantee for the future. Summer will come for sure, but not in the same way, at the same time or in a similar condition as previous years. Often the beer and soft drink industry is confronted with temperatures which in an instance will increase, or decrease, sales. For the soft drinks industry it simply means that they have to have, next to a production capacity, an accessible stock of empty bottles to fill with syrup, fruit concentrate, gas and water. For the beer brewers an extra problem is the time it takes to brew beer. Lager for instance will take from 8 to 12 weeks to mature after being brewed. So even if all the necessary ingredients are available to the brewer, he still will have to start to brew long before he knows what the actual weather will be when the product is ready to be sold. At the same time he has to have an extra supply of package material like barrels, cans and bottles. For the Dutch market which relies mainly on returnable bottles, this causes extra problems as demand for bottles rises rapidly and they either should be returned to the factory faster or an extra stock of bottles is needed. The Grolsch brewery has even an extra problem as their special bottle and its components are often used for decoration in student homes and the purchase price for such a bottle (around two euros) is in no way connected to the deposit of 10 or 15 eurocents. This bottle has become a marketing tool for Grolsch, but also a nightmare for its logistic department.

Cheese

Cheese making has a long tradition in the Netherlands, but the old idea of transforming perishable milk into more sustainable products like cheese by a farmer's wife has now developed into a mass industry in which just a few employees operate expensive machines and equipment in order to produce tons of cheese. These machines are expensive and demand for cheese is relatively stable, so emphasis is laid upon using the capacity to the limits. If availability of milk in the Netherlands is declining, milk will be bought from other countries and transported to the factory. This transport is expensive, but so is not utilizing the equipment. As fresh milk has a limited storage time, stocking is not a viable option.

Ice cream

Ice cream has a seasonable demand, but can be stored for a long time. The process is simple and the equipment not too expensive. The company can choose to produce on demand and have an overcapacity or to maximize the utilization of the production capacity and store the unsold ice-cream. The first allows variations to enter the market and to respond to a change in

weather and customers taste, the latter allows for lower production costs and for mass production.

Bananas

Bananas will be shipped green to the final destination in special ships and stored on location. When the market demands a shipment, the product will be allowed to mature and supplied to the retailers or industry.

If these products are confronted with the aspects of stock, time and capacity, we could place them in a matrix as shown in table 2 below:

Table 2 the discussed products and the related aspects

Item	**Stock**	**Time**	**Capacity**
Bananas	+ + +	- - -	- - -
Cigarettes	+ +	- - -	+ +
Gouda Cheese	- -	- - -	+ + +
Grolsch	+	+ +	+ / -
Ice cream	+ +	+ +	+ +
Sugar Beets	- - -	+ + +	- -

Based upon this information, the discussed products are placed in the triangle as shown in figure 8:

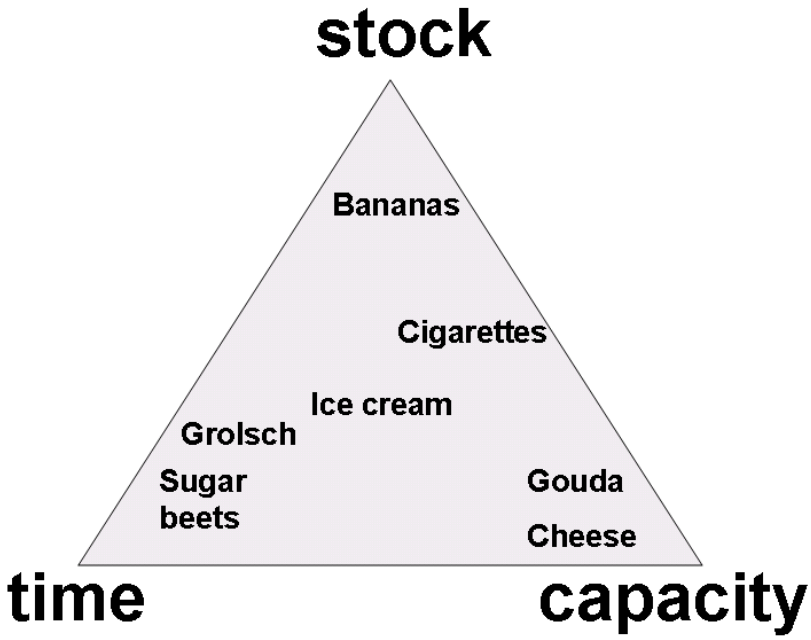

Figure 8 placing the discussed products within the triangle

If figure 8 is combined with figure 7 we find that for these products some tools and techniques seem to be in this given situation more appropriate as others as given in table 3 after which the various suggested tools and techniques are discussed for their appropriateness.

Table 3 Products with appropriate tools and techniques

Product	**Suggested tools and techniques**
Bananas	ROP or SIC
Cigarettes	Six Sigma or Lean
Gouda Cheese	OPT or CRP
Grolsch	MRP1
Ice cream	Six Sigma or POLCA
Sugar Beets	QRM/Agile

So for instance, according to the model, bananas would be best served by techniques as ROP or SIC. In this way the stock of bananas will be controlled in a simple and effective way. And for cheese, a well balanced and optimized production capacity should drive planning and control. OPT, which allows a balance in the production capacity throughout the chain and CRP, which plans capacity use, are better suited for this situation than all other tools and techniques.

The products above are ranges of individual products. For individual products we could expect a change in position. For instance, if we would take ice creams we could discern the following three product variations:

[1] Seasonal ice creams for special occasions or for beach weather;
[2] Fashionable ice creams, to satisfied the hype of the day and
[3] Standard ice creams for everyday consumption.

We could place these individual products in the model and would find that all variations would ask for a different logistic tool or technique. Seasonal ice cream could be produced way in advance and shipped from stock, fashionable ice cream needs to be produced and delivered fast before either the hype is past or a competitor enters the market and standard ice cream requires low costs to compete with competitors and would benefit from good utilization of equipment. Figure 9 shows the place of these three products in the model:

Figure 9 placing the ice cream variations within the triangle

And for the appropriate tools and techniques in these three situations:

Table 4 Ice cream products with appropriate tools and techniques

Product	**Tools and techniques**
Seasonal ice	ROP or SIC
Fashionable ice creams,	QRM/Agile
Standard ice creams	OPT or CRP

So if a company would like to cover all niche markets within a product range, it could find itself confronted with conflicting tools and techniques. In this particular case the company could decide to plan and control the production of each particular type of ice cream in a completely different way. This would suit the various types, but might cause confusion inside the company itself. Running different tools simultaneously is therefore perhaps not the best solution, but trying to get a tool which might partially suit these types will generate a suboptimum.

VIII Further research

This model is build upon assumptions and is not yet tested in practice. Do all logisticians agree that time, capacity and stock determine the way a product is planned and controlled within the supply chain and production or do they consider others aspects to be important as well? Therefore the model will be shown to more professional logisticians and they will be asked whether these aspects are sufficient or what they would like to see as determining aspects for choosing logistic tools and techniques. If these aspects are correct, they will be asked to pin the various tools and techniques within the model. In this way the model could be validated and taken into the next stage, linking it with real products and markets.

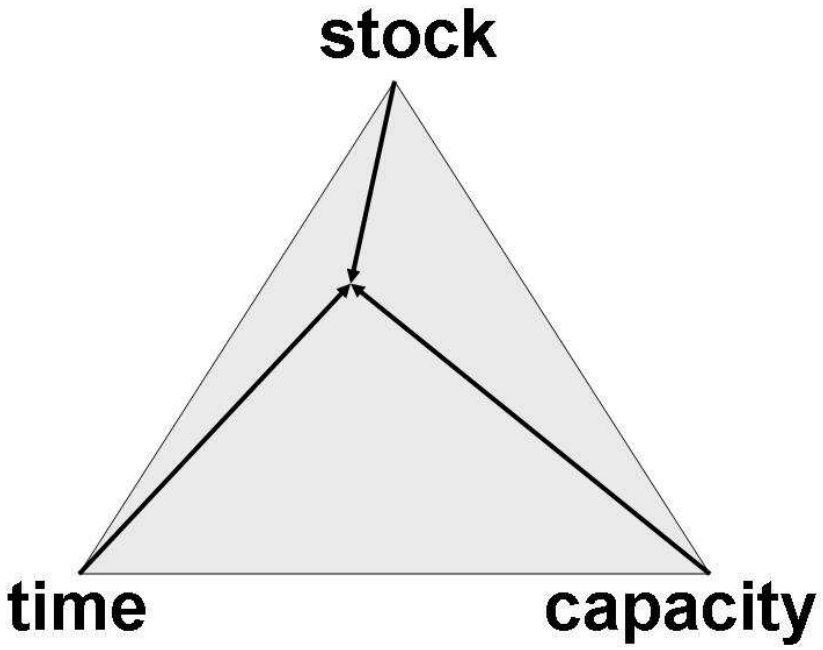

Figure 10 triangulation of a choice

An other aspect for further research is to investigate if stages of the life cycle of a product correspond to certain places within the model?

IX. Conclusions

The triangle model could be a good way to help logisticians to explain to others like marketers, purchasers or finance department why certain tools are more successful in solving certain aspects of a problem compared to other techniques. The model visualizes an often complicated discussion and could facilitate the search for the best technique for a certain problem.

Logistics in and outside the Agro-food chain will have to understand that it should concentrate on certain aspects only, if she is unable to satisfy all. It is not a shame and often impossible to try to please each and everyone all the time without understanding that this can not be achieved without the concept “at all costs”. Playing off the advantages of certain techniques and tools with the disadvantages of others is a hard game. This triangular model could be a tool to help understand why certain things can not be solved by using particular techniques and which techniques could be better equipped for solving them. This model could also be used visualize others, less imbedded in logistic theory, where problems may be expected and which systems could be beneficial for this particular company and product.

By making a triangulating, anyone, logicians and non-logicians, are able to check in the triangle what could be the expected outcome of a potential new product or a specific tool or technique and deduct their own conclusions. Used as a quick scan, new techniques could as be simply evaluated and compared with existing tools. This could allow a quicker response to solving certain logistic problems and save valuable time and discussions. The model should be tested amongst more logistic professionals and more product-market combinations to see if it fulfills its potentials.

REFERENCES

Aldridge, D. and A. Harrison, Implementing Agile Methods in Retail Supply Chains: a Scenario for the Future. International Journal of Agile Manufacturing. 3, 2, 37-44

Christoper, M., Logistics & Supply Chain Management: creating value-adding networks (3rd Edition) Financial Times Series 2005

Coyle, J.J., E.J. Bardi en J. Langley Jr.,The management of business logistics, 6th ed. 1996, West Publ Minneapolis/St. Paul, MN USA

Goldratt, E.M. and J.Cox, The Goal. 3rd Revised edition 2004. Gower Publishing Ltd. Aldershot UK.

Goor, A.R. van, M.J. Ploos van Amstel and W. Ploos van Amstel, European distribution and supply chain logistics Stenferd Kroese Groningen, 2003

Hall, R.W., Zero Inventories. 1983. Dow Jones-Irwin. Homewood Ill. USA

Harding, L,. QRM – an Enabler on the Road to Agility? Quick response manufacturing Part 1. IOM Control Magazine Vol 28 No 04 May 2002

Hoekstra, S. en J.H.J.M Romme (red), Op weg naar integrale logistieke structuren, 2de druk 1993, Kluwer, Deventer

Orlicky, J., Material requirement planning 1975, McGraw-Hill Inc., New York NY

Pieters, R., Logistiek in de praktijk 2006. MBES . Arnhem, the Netherlands

Suri, R., 2000. Quick Response Manufacturing: A Competitive Strategy for the 21st Century. files.meetup.com/502556/SuriPaperQRM.pdf assessed Decemver, 5th 2007

Weijers, S.J.C.M., De verbinding: linking processen and people. 2003. HAN University Press. Arnhem, the Netherlands