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Supply Chain Management as the Company Engine in Automotive Manufacturing

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Abstract: The objective of this paper is to define how to create a supply chain management (SCM) organizational structure with roles and responsibilities in a multinational company with a big part of the supply chain inside of the company. SCM means having under control the complete supply chain to decide the global optimal instead of summing up the optimal of each node independently. We propose, based on the systems thinking concept, how to develop an organizational structure where the SCM acts as the engine of the organization. There must be a strategy to create this structure starting from the bottom to the top of an organization. An illustration example is given in a first tier supplier of an automotive supply chain.

Keywords: Supply chain management, supply chain organization, systems thinking, lean manufacturing, automotive.

1. INTRODUCTION

According to APICS Dictionary supply chain management (SCM) is the "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally". This paper introduces how to utilize the concept of systems thinking in order to create a multinational organization of SCM from the bottom (for instance, the logistics department) to the top (the president) of an organization. We are based on the works by Ackoff (1987), co-pioneer of the operations research (OR) school; Senge (1990), who belongs to the system dynamics school; and Jackson (2000, 2001, 2003, 2009 and 2010), who is a referent in the development of applied systems thinking; among others.

SCM is a discipline well studied in many scientific works (see for instance, Burt et al. 2003) but it is very difficult to find a complete SCM organization with roles and responsibilities on a company that holds part of his supply chain inside. At the same time and due to the globalization we can find out successful companies such as IKEA (Dahlvig, 2012), Zara (Martínez, 2012) and Toyota that apply fully SCM concepts together with lean manufacturing concepts (Womack et al. 2007). Here, it is important to highlight that Ford was the first one to do vertical supply integration when needed cost control and reduction (Ford, 1988).

With this philosophy we understand that the breakthrough is systems thinking: the sum of each optimal node is less than the total nodes optimal. As mentioned by Senge (1990), living systems have integrity. Their character depends on the whole. The same is true for SCM, to understand the most challenging managerial issues requires seeing the whole system that generates the issues. Dividing an elephant in half does not produce two small elephants. Then, if we look for optimal just making compete each node with each other without seeing the whole then we will not get the best.

The vision from the company must be to add value to the society (not to become rich as soon as possible) and respecting environment, health and the future for next generations. The margin is low and any improvement in costs is translated directly to the selling price.

It is usual that SCM and lean manufacturing is started from the top management to bring changes. We refer readers to Sandberg (2007) for an exhaustive study on the role of top management in SCM practices. It is pointed that top management is not directly involved in the company's distinctive logistics capabilities. The proposal here is to show how to change an organization from the bottom to the top and which must be the exact role and responsibilities of a supply chain organization.

The objective of our proposal is to provide the organizational change in which the SCM is the engine of an organization. We explain why there is not a SCM organization as frequently as other departments such as purchasing, manufacturing, quality, finance, sales or marketing, among others. if it is really thought as a key function for success. Also, we define the right SCM department with the right roles and how to achieve this organization starting from the bottom by overcoming the interest conflicts between departments, production sites goals or personal goals even

when all belong to the same company operating in the same supply chain. Moreover, to draw what must be organized by function, by customer, by product or by region, among others.

The main contribution of this paper is to use the systems thinking to convince to the organization about the necessity and the benefit of having the SCM department. We want to sell to the complete organization that working on general company standard processes for supply, logistics, finance, quality, purchasing and manufacturing, that solves the trade off between departments or production sites is the best solution. It will also put the SCM organization as the referee that sets the rules but has no direct responsibility on any operations. Another main contribution is to understand that continuous improvement based on the comparison by best business practices is not the best solution. The goal is to define the standard and then to compare with the reality to write down the complete continuous improvement gap. Targets for improvements cannot come from the top to the bottom without looking at the full standard operation.

The rest of the paper is organized as follows. Section 2 presents a literature review related to systems thinking and SCM and highlights the relevant IKEA's and Zara's supply chain strategies. Section 3 describes our proposal for establishing the SCM department as the engine of a multinational company. Section 4 applies our proposal in a first tier supplier of an automotive supply chain. Section 5 presents the conclusions and identifies the further research.

2. LITERATURE REVIEW

Mingers and White (2010) present a review of the contribution of systems thinking to the practice of OR. They consider the main systems theories and methodologies: the systems approach, complexity theory, cybernetics, system dynamics, soft OR and problem structuring methods, critical systems and multimethodology. Also, they review the main domains of application: strategy, information systems, organisations, production and operations, ecology and agriculture, and medicine and health. Their overall conclusion is that while systems may not be well established institutionally, in terms of academic departments, it is incredibly healthy in terms of the quantity and variety of its applications. With respect to SCM, systems dynamics and soft systems methodologies are the main basis for performance analysing.

Moon and Kim (2005) explore how individual systems thinking ability impacts on the supply chain. The authors use a range of different research methods including surveys, tests, and systems dynamics based simulations. The results show that individual systems thinking ability greatly influences the practice of SCM. The authors suggest that the rationality of managers in the decision-making process is good for the supply chain. To improve the supply chain efficiency with a more realistic solution, inventory and production managers have to make decisions with the systems' thinking ability and the consistency. Lingyun et al. (2006) present a research topic of supply chain dynamic performance analysis and prove that system thinking combined with balanced scorecard is a good method for identifying key factors and casual relations among key factors.

Agami et al. (2012) propose a framework for measuring, managing and improving supply chain performance. It integrates systems thinking, strategic planning, optimization, balanced scorecards, supply chain operations reference model, and theory of constraints thinking processes into a cohesive performance measurement system. This approach considers the SC as a whole rather than just considering individual entities. In this sense, in Liu et al. (2012), where is developed a performance management system using a soft systems methodology for a hi-tec Chinese company, it is presented as a novelty as the initial performance plans are established for the staff from top to bottom and then bottom to top iteratively. Other systems thinking applications can be found in project management (Kapsali, 2011), service supply chains (Maull et al. 2012), supply chain design (Bashiri et al. 2010), conflict resolution (Li et al. 2012) and logistics (Lindskog, 2012).

Related to SCM organization in the field of modelling and control, Li (2010) designs an automatic modelling method of virtual organization structure based on event logs from SCM system, which is a kind of business process management system. Mustapha et al. (2010) present an organizational oriented methodological framework, which permits modelling and agent-based simulation of supply chain organizational aspects. It allows observables of different level of detail while reproducing the supply chain behaviour according to desired observables. Giannocaro (2011) investigates through a NK simulation model, where N represents the number of supply chain operational decisions and K the number of inter-dependencies among the decisions, the relation between supply chain forms of governance (market, quasi-market, bottom-up network, top-down network, bottom-up network with leader firm, top-down network with leader firm, centralized network and hierarchy) and supply chain integration problems (internal, inter-organizational, full internal and SCM). In this sense, Vickery et al. (2010) demonstrate that simply investing in supply chain information technologies without integrating them into matching supply chain organisational initiatives does not provide significant benefits.

On the other hand, Baraldi (2008) analyzes the experience of IKEA in dealing with its industrial network and discusses the structural components and dynamic interactions of a network strategy, concretely, a strategy that considers and uses the external network for a company's goals. A pivotal role in this network is played by "IKEA of Sweden," that not only manages IKEA's product range, but also supervises and develops long-term marketing, logistics, and purchasing strategies. In fact, whereas most IKEA units are rather specialized (for example, local purchasing for IKEA's 40 Trading Offices), IKEA of Sweden has both an overall responsibility and a coordinating role in the development, purchase, distribution, and marketing of each single product. Relationships between suppliers is one of the most emphasizing issues of the IKEA's supply chain strategy (Elg et al. 2012; Hultman et al. 2012).

According to Li (2009), Zara spent more than three decades in perfecting its supply chain strategy by combining "focused factory" with "throughput management", what is called leagile, what means lean thinking in conjunction with agile ideas. In the efficient supply chain of Zara, the chain coexists with brand (Zhang, 2008). The four parts of the whole process of the Zara supply chain -product organization and design, purchase and production, product distribution, sales and feedback- work together around the brand and target customers, and all the efforts are for purpose of pursuing high efficiency and fast speed of supply chain. Romano (2009) compares the Zara's and Benetton's supply chains to understand the differences between time performance. Caro et al. (2010) presents how Zara use operations research models to determine each inventory shipment it sends from its two central warehouses to its 1,500 stores worldwide.

With respect to the literature reviewed, this paper can be positioned near to the works by Giannoccaro (2011), Agami et al. (2012) and Liu et al. (2012) but from an organizational point of view of the SCM department into the company rather than from a SCM performance measurement approach. Contrarily to the work by Giannoccaro (2011), this paper does not try to change the integration level of supply chain between different companies or belonging to the same business group. It is looked for a SCM reference group in all the operative calculations. Thus, that SCM defines the calculus model for the whole supply chain and every participant has to follow these procedures to be able to interact in the chain. Because of it, the SCM should be out and over operations to be able for establishing the standards. Also, we try to get the best of two well-known supply chain strategies, such as Zara's and IKEA's supply chain strategies for exporting it to our approach. Thus, our proposal provides an understanding of how SCM functions can be the engine of a multiglobal company by using an organizational strategy from the bottom to the top management, what is different from the existent literature.

3. PROPOSAL

The first step to achieve the change from the bottom to the top management is to believe that we can get it. Ackoff (1987) adds that in the art of problem solving we should identify controllable and uncontrollable variables. The reason is that sometime uncontrollable variables can be transformed into controllable. In our problem, that means we have not the right power to set the SCM organization but we can get it just by convincing them on the shared vision and team learning because standardization is always good for the firm.

We must build up a shared vision (Senge, 1990). We can be stronger and have better jobs if we work together as a unique company belonging to the same supply chain than if we just compete each other hiding information and looking at our own objectives. This is the most powerful force that we can have in the objective. As an example, Roman general Marcus Crassus asked who from all slaves was Spartacus to forgive the live to the others. The first one that answers "I am Spartacus" was himself and later all other slaves answer the same. They shared fully the vision that living as a slave was not better than to die for being free.

Another very important topic is team learning (Senge, 1990). It happens when the shared vision becomes an extension of their personal visions. Departments or production sites performance depend both on individual excellence and on how well they work together. Shared vision and team learning will be the basis for the right use of financial reporting key performance indicators (KPI's). Normally it can be found SCM functions split around different departments and at different levels in the hierarchy of an organization. In a local factory organization chart, it can be easily established a materials and logistics department. It may be also in an upper level with a SCM team in operations (Fig. 1). As an example, there are plants linked to an operations central team and a group vice president that holds business units plus operational units. This structure can be used by region, customer, product or as a whole. Each plant must belong to a unique Vice President (Fig. 2).

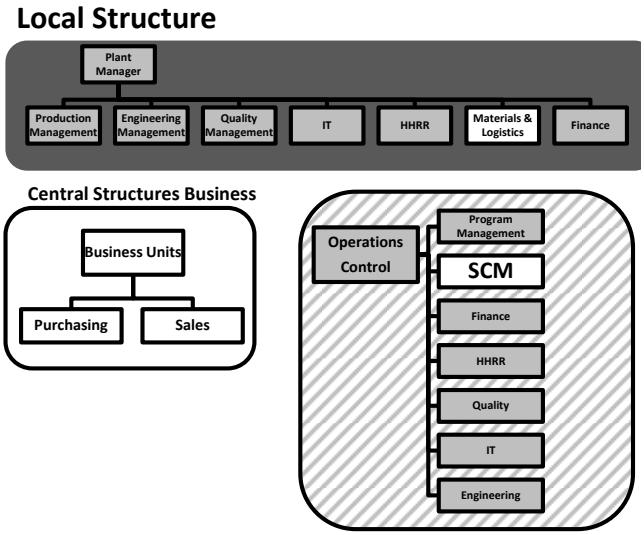


Fig. 1. Org charts to build up a global company.

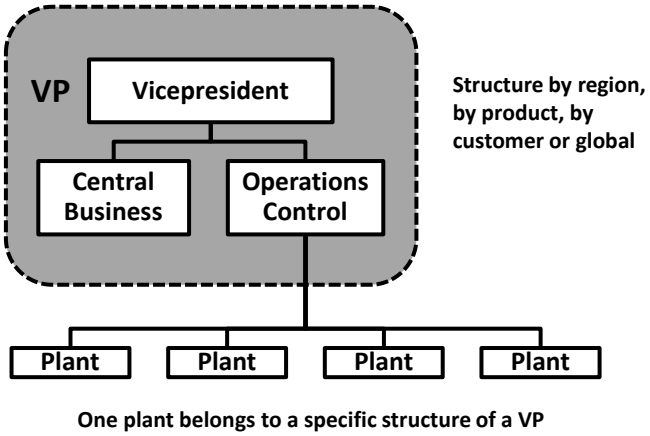


Fig. 2. Global company structure unit.

What is always found is a central group that cares of inventory and freight costs. Therefore, we need to draw the path or methodology to collect all SCM functions into a corporate team that looks for the complete company profit. It will become the latest referee on the company. We will split this strategy into two phases: operational phase 0 and

strategic phase 1. This is needed to address the time of the team creation at the phase 1 in the corporate level (Fig. 3). Both phases must be supported by financial KPI's defined together between SCM and finance department.

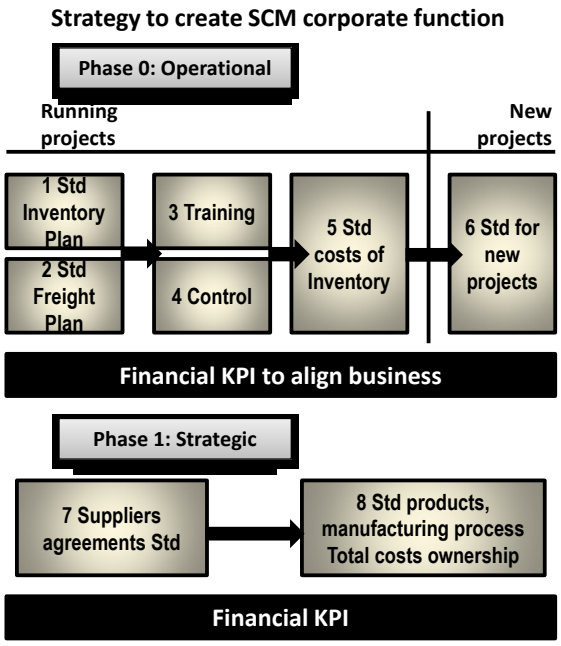


Fig. 3. Strategic phases for the creation of the SCM organization.

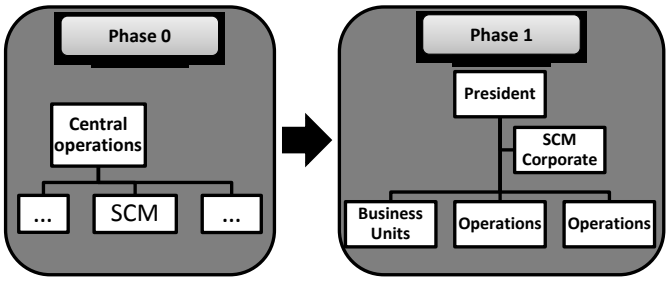
Phase 0 - Step 1. The first step is to standardize the inventory plan together with the second step that is to standardize the freight in plan. The inventory is the first point to start because inventory levels higher than needed are hiding other problems in the company and this is against the lean material flow.

Phase 0 - Step 2. The second step, which may be also done together with the first step, is the freight in planning because there is a direct relationship between inventory targets and transport frequencies and costs. SCM managers must be prepared to solve the trade off between inventory and transport costs in a standard way (system thinking). It is a very important point to use data coming from live ERP (Enterprise Resource Planning) systems.

Phase 0 - Step 3 and Step 4. After the standards are created, we need to train to the logistics and finance community, implement the standards and control the figures. These are steps 3 and 4. In all steps we need the agreement from the production plants. That means targets are not imposed. They are agreed.

Phase 0 - Step 5. Fifth step is related to the cost of inventory standardization for planning and controlling. Financial reporting should reflect all topics for the cost of inventory. That means capital costs, handling costs, floor space costs, insurance costs, cost of poor quality, obsolescence costs or packaging investments costs, among others. This is of a huge value for purchasing sourcing decisions. Thus, purchasing should be trained on the standard.

Phase 0 - Step 6. The step 6 is defined to include inventory and freight plans and the cost of inventory in new projects. That means to create the quotation to get new businesses. The difference here is that the data source is not ERP systems. Nevertheless, we need to capture the complete item life cycle. Start up costs are of equal importance than operational costs for running projects. If we do not plan properly this item life cycle we will not be able to have costs under control. In order to move to next phase 1, we need that the SCM team does not belong any more to a central operations team on a specific region, customer or product unit. We need that their work is developed as corporate for all units as a one company vision. This idea must be shown to top management before going to the next step in phase 1.



Phase 1 SCM must belong to corporate in order to set global rules from a company point of view

Fig. 4. SCM organization at a convenient place.

Phase 1 - Step 7. The step seven is to create global supplier standard agreements for all regions, products and customers by acting as a unique company.

Phase 1 - Step 8. The step eight is focused on standardization for products and manufacturing processes. from a lean manufacturing and supply cost point of view. At the same time, a complete global total cost of ownership must be created as a horizontal subject across the whole company. If needed, the company vision should be changed accordingly for lean philosophy. Then, SCM will report to CEO (chief executive officer) directly as a strategic global department that sets the operational rules for others.

4. APPLICATION IN AN AUTOMOTIVE FIRST TIER SUPPLIER

As an illustrative example, we provide the case of a global automotive first tier supplier that controls a big part of its supply chain. It delivers products to all OEMs (original equipment manufacturers), regions and product segments. The plants are connected as a supply network towards final customers OEMs (Fig.5). The issue is how to organize the company by customer, region, product or components, among others. And which place and role will play the SCM.

From our point of view the most important is to have a SCM global organization (corporate) that drives the business for standards point of view and for setting KPI's. Purchasing, logistics, manufacturing, information systems just follow the standard rules or simulation decision tools in order to avoid conflicts with each other or personnel interests over company

interests. The split by region, customer or product should be decided following practical organizational rules.

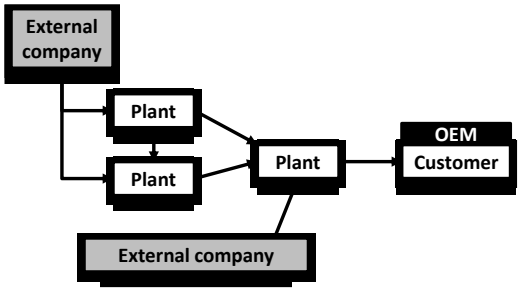


Fig. 5. Supply network of an automotive first tier supplier.

From a practical perspective, we show the systemic relationships between different decisions that in the past where seen as independent. For instance, we demonstrate that inventory plan and freight plan are connected and that we cannot accept two independent figures anymore. But this must be shared, understood and assumed as a rule for all parties involved.

The important thing is to export from current MRP (material requirement planning) systems: item master data, supplier data, packing and demand information. It is not desired data if this does not come from the system because then this data cannot be checked and improved the data quality in their systems. The next step is to enrich this data with routing information, car model information. Some basic rules are applied for safety stocks calculations, in-transit inventory calculations, work in process target and target inventory. Now, it can be made inventory and freight calculations from a systemic point of view.

Ship or delivery patterns have not been used to calculate inventory values daily. If inventory values are calculated daily to determine exactly how much there will be at month end date, the plants will receive all material at Monday, for instance. This is not lean. It is desired to purchase every day the same amount of inventory. Therefore, having targets over averages will set a lean plan. There were some deviations from the standard regarding who is responsible to fulfil trucks, how packaging quantities affect targets, how target is affected when production days are bigger or less that receiving days, what is the impact of producing just a few days during the whole month for the standard inventory calculation. The customer demand variation effect is very difficult to include, therefore, we prefer to keep the standard and explain afterwards deviations due to this topic.

Inventory levels at each node relationship cannot be set independently. They are part of a system and visibility and agreements based on facts must be addressed. General rules or simulation models must substitute simple decisions in the past.

A practical implementation of the steps of our proposal for running the Phase 0 or new projects need to be focused on each individual production site. This can grow to the next Phase 0 strategy when we introduce powerful techniques for whole supply chain optimization (Fig. 6).

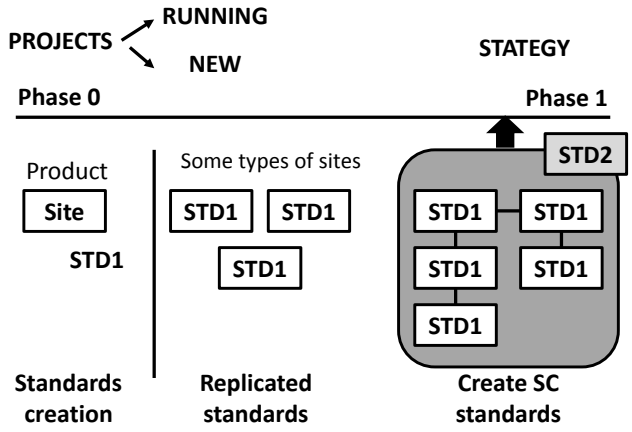


Fig. 6. Standards and phases.

5. CONCLUSIONS

Today, the biggest problem to have a SCM organization is that this role is split around different people and is not organized. Furthermore, a company that is on stock exchange market must deliver regular profits to owners. That topic could drive the company towards short term profits and long term losses, this behaviour grows better before it grows worst (Senge, 1990). The only way to focus in long term and implement SCM philosophy when this does not come from the top management is to start with the standardization of the logistics process with the support of the central finance department.

In this paper, we have discussed the organization and management in the company with a SCM philosophy. We have proposed 8 steps for a SCM global organization. The main novelty of our approach in front of alternative approaches is that we claim that a SCM philosophy should be acquired into a company from the bottom to the top of the organization. Then, an example from an automobile supply chain is provided. An evaluation and comparison of our proposal with alternative approaches is a forthcoming work. At present, the application example is still not implemented to 100 % for what it is not possible to evaluate neither comparing. The organization is still in the Phase 0, therefore, SCM is inside operations and not over it as desired in the Phase 1 and is, precisely, the strategy from how comes there what has been proposed in this paper. Further research is also oriented to demonstrate that SCM can have a better strategic role in the company and even change the vision of the company. The solution is not to leave each production site to compete alone each other as animals in Darwin theories. The best strategy is to think as a whole company as Ford did at the beginning. Like in an orchestra all departments must be aligned to play an understandable and nice melody with the help of SCM.

6. ACKNOWLEDGMENTS

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