Supply chain strategies beyond the peak

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Abstract
When customer demand becomes increasingly volatile and product life cycle shortens, a capability to dynamically adjust the supply chain during the product life cycle becomes more urgent. The study's purpose is to extend knowledge of dynamic supply chain design and management when the product is in the decline phase of its life cycle. A case study from a global telecom company reveals several challenges for supply chain management and solutions for handling these challenges when a product is beyond the peak. The findings are summarized in a tentative model that specifies supply chain challenges and strategies over the life cycle.

Keywords: Supply chain strategy, product life cycle, decline phase

Introduction
Today's supply chain management is increasingly challenging, since customer demand is very volatile and product life cycle (PLC) is shortening dramatically. According to Horn (2013), 50 percent of annual revenues across a range of industries are derived from new products launched within the past three years. This means that products with long life cycles, considered a company's "cash cows", are becoming a thing of the past (ibid.). This changing environment demands that supply chain strategy be managed less statically and more dynamically, when the PLC rapidly switches between the different phases. While there has been great interest in how product variety affects supply chain practices, there are few studies that have specifically analyzed the challenges and the possible responses of the supply chain during the decline phase of the PLC. The decline phase has become increasingly important as PLCs shorten.

The purpose of this study is to extend knowledge of dynamic supply chain design and management when the product is in the decline phase of the PLC. Through a case study of a high-tech company in the telecom industry, we analyze what challenges the product life creates and how the supply chain can be dynamically formed during the different phases, especially in the decline phase.

Supply chain management during the product life cycle

The supply chain strategy for different products depends on many aspects, such as product characteristics and variety, demand predictability and lead times. Fisher (1997) suggests that a functional product with a predictable market demand requires an effective supply chain, whereas an innovative product with an unpredictable demand requires a responsive supply chain. The theory of "one size does not fit all" (Shewchuck, 1998) explains that supply chain strategy varies with different product-related classifications. Pagh et al. (1998) argue one size does not even fit one — supply chain strategies ought to differ as a product proceeds through its life cycle. Birou and Fawcett's (1997) study of integrating PLC and purchasing strategies argues that the sourcing strategies vary in different phases of the PLC. Mendelson and Pillai (1999) address the impact of the PLC on supply chain measurement and operation implications in general, but do not show differentiation in the different phases. Towill (2001) shows cost control of various types of automotive components at different phases of their life cycles.

As a further development, Aitken et al. (2003) argue that the product characteristics are not frozen in time. Since the PLC time and market demand are changing, the supply chain strategies must be dynamic and adaptive to these changes and "*each stage of a product's life cycle has significant impact on strategy, especially in relation to supply chain management*" (Aitken et al., 2003, p. 138). Thus, Aitken et al. suggest a dynamic appraisal of product routing based on the stages of the PLC. Through a case study of a lighting company, the authors demonstrate a dynamic supply chain internal process from "design and building" in the "Introduction" phase, through "MRP" (material requirements planning) and "Kanban" in the "Growth" and "Maturity" phase, to "Packing Centre" and "MRP" in the last two phases of the "Saturation" and "Decline". Wang (2004) mentions that a dynamic supplier relationship management varies through the PLC, based on a case study from a telecom company. Juttner et al. (2006) found that the demand-supply chain alignment competence is closely linked with PLC management. The authors use the example of a mutually reinforcing relationship between PLC management and demand–supply chain alignment at the same time.

To summarize, there is a long history of discussion on the relationship between supply chain management and the PLC in general. There is no doubt that the topic of the integration of supply chain management with PLC has raised the interest of academics and practitioners continually. However, as a product proceeds through its life cycle, the demand characteristics change. Supply chain management encompasses not only planning but also management of all activities concerning sourcing, production and delivery. It is well-known that a product proceeds through its life cycle, which includes the phases of introduction, growth, maturity and decline, and that supply chain management encompasses not only planning and also management of all activities involved in sourcing, production and delivery.

The study by Juttner et al. (2006) is one of the few in the area that addresses the topic of PLC, but the study does not differentiate between different phases or different supply chain processes, which ought to consider whether planning, purchasing, production and delivery vary with an entire PLC.

There is a lack of comprehensive analysis and models that combine PLC and supply chain strategies along the value chain of sourcing, production and delivery. The latter discussion has only been analysed separately and partly. The shortcoming is even more evident when a mature product has passed its peak time and dropped into the decline period. It is not surprising that both academics and practitioners commonly pay attention to new product introduction and growth, but are less interested when the

product is going into the decline phase. There is thus a specific need to further analyse the supply chain strategies and how to handle the challenges that appear during the decline phase.

Hence, two research questions raised in this article are:

1. What are the challenges for the supply chain when the product is entering the decline phase?
2. How can the challenges be managed when the product is beyond the peak?

Methodology

This paper is based on a single case study and follows the guidelines of Yin (2005). Drawing from the research questions, an explorative single case study was conducted at a leading company within the telecom industry. The case study analyses how the company has changed the supply chain strategies throughout the PLC for the third generation of their radio base stations (RBS). A specific focus has been on how sourcing, production and delivery have been redesigned during the decline phase and the challenges the company is facing during this phase.

The analysis in this paper is based on individual semi-structured interviews with managers in the units of product management and supply chain management, including managers responsible for hardware (HW) product supply management of the third-generation products. The interviews covered questions on competitive priorities, supply chain strategies and challenges they have experienced. In addition, we participated in workshops concerning experiences and lessons for how supply chain design links to the PLC, especially in the decline phase.

In order to enhance the validity of the paper, the case study findings and analysis were validated by the interviewees.

Case study

Ericsson RBS products' life cyle generations

Ericsson is the world's leading provider of communications technology and services. Today more than 40 per cent of the world's mobile traffic goes through Ericsson-supplied networks serving about 950 million subscribers worldwide. Ericsson operates in 180 countries and employs more than 100,000 people (Ericsson, 2012). Ericsson Networks' strategic focus is on evolving networks from 2G to 3G to 4G. Ericsson main product is radio base stations. GSM is a standard 2G product originally introduced in early 1990s and redesigned many times to reduce manufacturing costs, which contributes a significant share of sales and was the company's cash cow for many years.

Today, with the transition toward 4G, Ericsson is taking further steps towards higher capacity and higher throughput. 4G covers only 5 to 10 per cent of the global population today, but by 2017 it is expected to cover roughly half the population of the world. The ramp-up of 4G is quicker than for earlier generations. Figure 1 shows the evolution of Ericsson network products' life cycles since the 1990s. The 4G product is now replacing 3G and 2G, although some customers still want the older systems.

To see how the PLC has impacted supply chain management strategy, we reviewed the main supply chain events for the RBS 3000 (3G) product during its life cycle though a joint workshop with Ericsson staff. The product introduction and first production of RBS 3000 started in Ericsson's master factory in Gävle, Sweden. As soon as customer demand grew in Europe, Ericsson extended part of the production to several Electronics Manufacturing Services (EMSs) in Europe. When RBS 3000 was growing in the global market, the production sites changed to a regional strategy, i.e., Ericsson set up the

product manufacturing in five different regions with both factories and Electronics Manufacturing Services (EMS) resources. However, when global sales started to decline after 2010, the production of the RBS 3000 was consolidated to fewer regions. Figure 2 shows how the RBS 3000's production strategy varied in different phases of its life cycle. This variation is, of course, caused by differentiation of sourcing and delivery strategy changes.

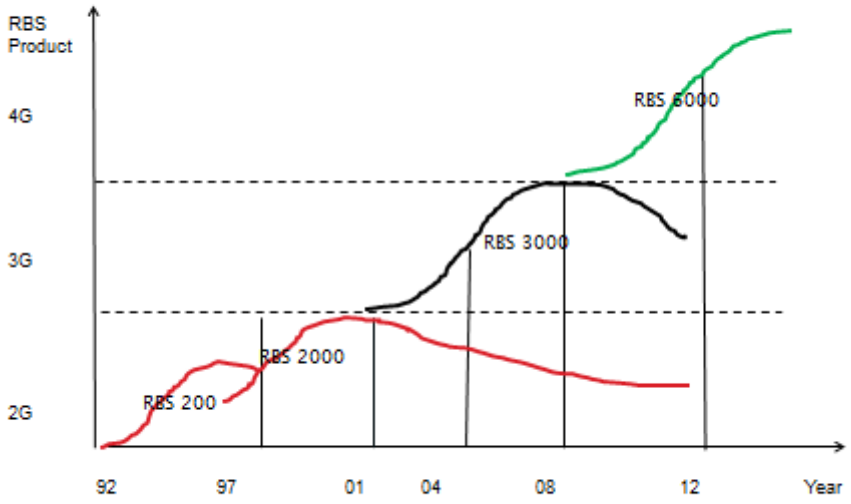

Figure 1 - The evolution of Ericsson network products' life cycles

The "Safe driving project" at Ericsson

In order to identify and manage the challenges in the decline phase, Ericsson runs a project called "Safe driving". Since the Ericsson core network 2G product came to market in the 1990s and 3G in the first decade of the 2000s, 2G and 3G have played important roles as Ericsson's cash cows for a long time. The company has redesigned and re-engineered many times in order to sustain the "peak" on the market for many years. However, the fact is that 2G and 3G are on the way to decline after so many years of prosperous development. 4G products are rapidly replacing them in the market. Facing a new problem of substantial scrap costs after the products have been phased out; Ericsson has now put its focus on how to handle these products after they are out of peak.

The "Safe driving" project was initiated by the top supply chain management and involved people from product management, design and sales management at different levels. The purpose of the project is to minimize the potential scrap cost of the phased-out products. The goal is to decrease more than 30 percent of the scrap cost in the next two years.

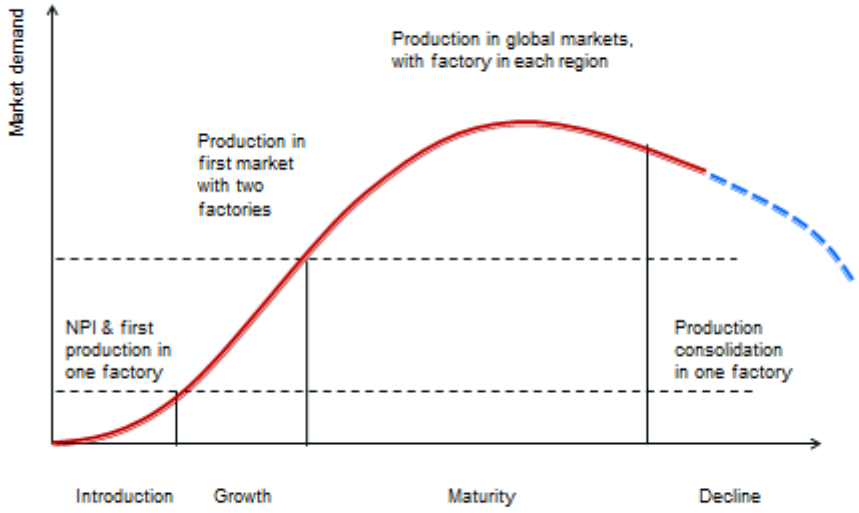

Figure 2 – Changes in production strategy during the PLC for 3G products

The project started a scrap cost analysis to find the reasons behind the high scrap cost problem and create best practices for a product's safe end of life. Using Cause and Effect analysis (Fishbone Diagram), the project found that the high scrap cost was caused by the supply not slowing down in time, when a product started to decline. One example is missing a warning signal when sales volume is going down, and the supply department has purchased components and raw materials that exceeded the market demand. This problem emerges in supply, but there are links to the product owner, market and sales staff, and even product design also. Thus, the safe driving of products in decline is becoming a cross-functional project in Ericsson. Figure 3 explains the safety driving concept with PLC.

Identified problems

Ericsson uses predefined product decision (PD) points from PD0 to PD7 to monitor the PLC. Each PD point corresponds to one or several other PLC codes. The product owner is formally responsible for product decisions in the PLC codes. As an example, Figure 4 shows how product decision (PD) 5 relates to the PLC codes. PD5 means "Approval of the start of the phase-out". This product decision is followed by three other PLC codes of RE1, RE2 and RE3. For instance, the restriction code RE1 means "Warning, phase-out process is starting and the last time buying will be in 6 months".

The main problems identified in the case study concern:

(1) A proper signal: The warning signal (RE1) is missing when sales volume drops. The existing product decision PD5 is announced too late for the supply chain to take action and slow down. For instance, when PD5 is released by the product owner, supply has already purchased too much material in the warehouse. The effect is that purchasing exceeds market demand and overproduction creates high scrap cost directly.

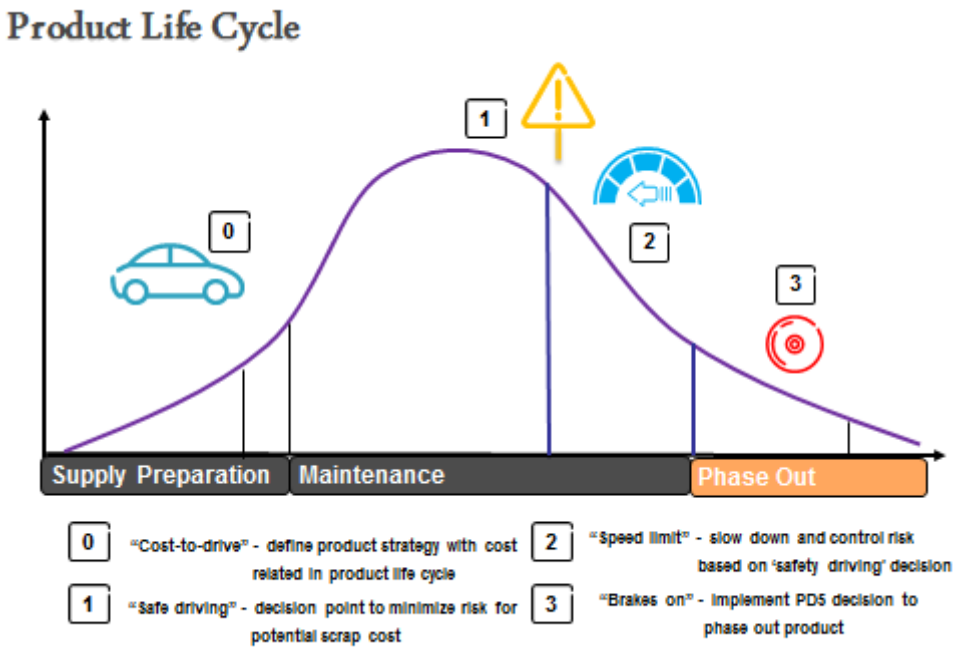

Figure 3 - Safe driving when the product is going to "decline" (Source: Ericsson)

(2) Internal information system support: Product management as product owner has a strong link with the product design and regional sales departments. However, there is weak information feedback from both product management and marketing/sales to the supply chain.

(3) Different planning horizons: The HW PLC plan is made by the product owner when planning quarterly, but is not clearly integrated into the company's business process.

(4) Reactive rather than proactive: The supply chain department lacks the process and strategy to handle the phase-out of a product.

All these identified reasons have caused the problem of high scrap cost. As Figure 4 shows, if the supply department starts to take action after PD5 is released by the product management, the gap between the supply chain curve and real sales demand curve has created a surplus area. This area presents serious problems, causing capital to tighten up and of course the high scrap cost, etc.

Discussion

The challenges for supply chain when the product is beyond the peak

Previous studies have mainly discussed the challenges of adapting the supply chain to the changes to PLC on a general level (Aitkten et al., 2003; Juttner et al., 2006) without deep consideration of each phase of the life cycle.

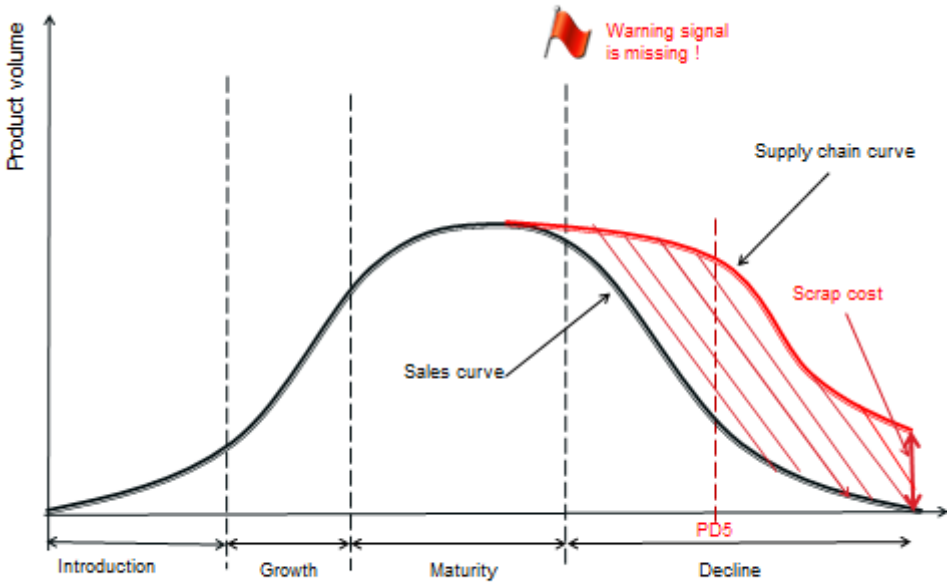

Figure 4 – The Ericsson PLC and the product decision (PD) points

Drawing from the case study, we can see that a supply chain faces three challenges when the PLC is heading for decline.

The first challenge is to identify the "decline" phase in the PLC, which is a problem of making proper prognosis of the market evolution. The Ericsson case shows that if we don't know when the product is going to decline, all actions will occur too late, which will cause high costs in terms of overcapacity and scrap. In our example, the warning signal (RE1) and the product decision code (PD5) were too late. Therefore, "when" and "how" to identify the "decline" (which in this example was PD5) and warn supply to put the brakes on is the first challenge.

A second related challenge is to synchronize with product management. From the Figure 4, we can see that if supply chain action is delayed during the decline phase, there is a big risk of creating large amounts of scrap in the warehouse after the product's end of life. With some critical components, lead time can be up to 24 weeks. There are several things that caused the supply action delay in the Ericsson example. The product decision to phase out was made too late, and the missing "decline" warning signal is not the only reason. The problems of poor information transparency and communication between different functional units in the whole business process were also found in the case study. For instance, an "HW PLC" plan document is made by the product owner, which defines the PLC's phase in each quarter. However, the plan is not really followed up by supply chain staff, since the HW life cycle plan is not fully integrated into the current business process yet.

The third challenge concerns how to redesign the supply chain properly**.** When the product is beyond the peak, the supply chain ought to slow down smoothly, and the supply department should proactively plan an appropriate supply strategy, including considering lean sourcing, consolidation, cost-efficient logistics, etc. It requires a well-planned process, not only action.

Managing the challenges when the product is beyond the peak

Drawing from this case study, we suggest three approaches to handle the phase-out challenges.

A first task is to identify the PLC curve and the decline phase start point clearly. To handle this challenge, it is necessary to define and continually revise the PLC for each product. This includes identifying the decline signal as soon as the sales volume starts to drop or when a newly designed product is replacing the old one. As with the Ericsson example, defining the product decision code and identifying the decline signal at the "right time" are key factors of a good solution. Since the product owner or product management organization is responsible for both the product decision code and the PLC code, a special project team in Ericsson's product management is now working hard to find the solution about the right time for the PD5 decision and warning signal RE1. The difficulty to identify the start of the decline phase is basically a problem of making proper prognosis of how the market will change over time. This development is, however, not completely out of control, for market leaders like Ericsson. So, being and staying in the technological forefront is a strategic choice that milder the challenge of identifying the decline phase.

A second approach is to improve information transparency and coordinate seamlessly between cross-functional actors in the whole business process. To be able to successfully manage the challenges, good teamwork and communication for all related actors within the entire business process is needed. In order to manage the challenges of the decline phase, at least four partners – product management, design, sales and supply chain management – are working together.

- Product management, being the product owner, is responsible for the product decision and PLC codes, as well as the entire PLC's profit and loss.
- The design department is responsible for designing the product and its life cycle – which includes both the old product phase-out and the new product introduction.
- Marketing and sales are directly responsible for forecasting and customer demand feedback, and are, of course, the first detectors of product decline.
- The supply department is the car driver responsible for driving the car with a safe braking distance, going to end of life with total supply chain cost control.

In this case study, all partners are related to each other and face problems. As the supply department has the last position in this action chain, it is not surprising that the information supply got was already too late, if communication and cooperation do not work well within the process. Improving communication and coordination across functions in the company will make supply chain actions synchronous with all actors when the product is going into decline. The result would be the creation of good supply chain control from purchasing to production to delivery, and a reduction in the risk of high scrap cost from all related levels, i.e., from the component level all the way to the finished goods level.

A third approach to manage supply chain strategies beyond the peak, the supply chain needs an ability to act proactively to adapt to the changing environment quickly. There is a need to redesign the supply chain strategies and practices when abandoning former volume-based sourcing, production and delivery. This includes questions on how to implement lean sourcing, consolidation of production units or outsourcing to EMS, location of warehouses and distribution channels, etc.

A tentative model

Based on the literature review and our findings in the case study, we propose a tentative model that presents dynamic supply chain priorities along the PLC as the Figure 5. As illustrated in the figure, a redesigned supply chain strategy in the decline phase needs to be considered as follows:

- Sourcing: downsize suppliers/purchasing, control key components, forecast demand
- Production: consolidation or outsourcing, and agile response to changing market demands
- Delivery: cost efficiency

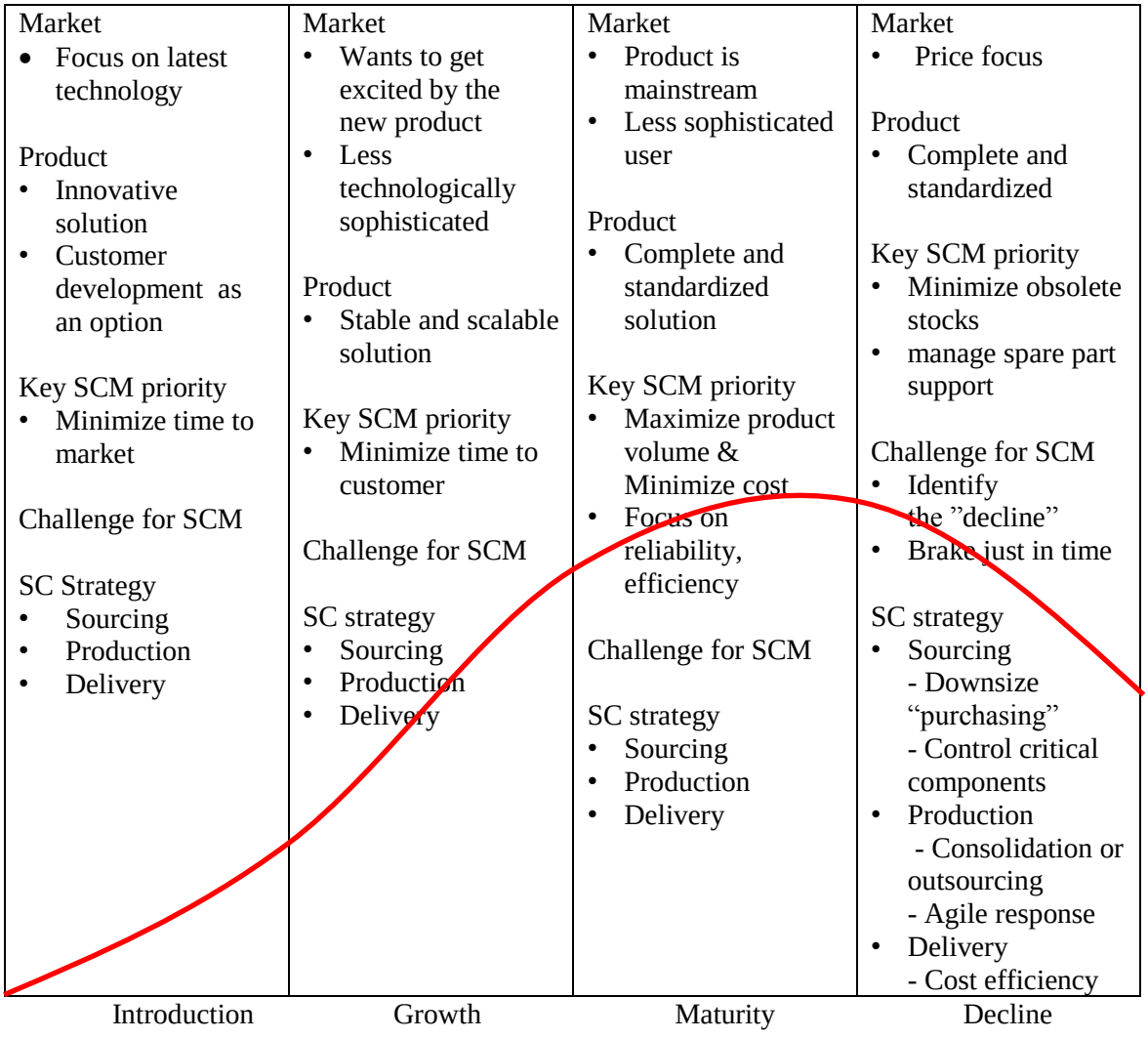

Figure 5– A tentative model of integrating supply chain management with the PLC

Conclusions and contributions

We conclude that integration of PLC and supply chain management can provide fresh perspectives and critical insights that are often missed due to the extreme fragmentation of functions within the company and across supply chains. This is a new frontier for value creation, for businesses to create competitive differentiation and growth.

One contribution of the paper concerns the overview model that integrates supply chain management with PLC. Another contribution concerns how the product decline

phase affects supply chain challenges and how the challenge can be managed. The study will be continued to: (1) set up a cost model for supply chain management in the decline phase, (2) develop and test the model of integrating supply chain strategy with PLC in different industrial branches and (3) analyze approaches for facilitating knowledge integration between the actors involved in the processes described in this paper.

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