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## Supply Chain Management Model of Garment Company With R&D Perspective

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### Abstract

The supply chain has not been given the anticipated recognition it needs in garment industry. This is due to the overdependence on the old management techniques that have less priority for the supply. The article proposed a SCM(supply chain management) model with R&D perspective in order to solve the R&D efficiency and moral risk among of garment companies. It seeks to construct the cooperative model in the integrated supply chain through studying the investment strategy among the members. The model indicated that the garment company would increase the R&D investment when the average interest will be distributed in the supply chain cooperative R&D process. There are different results of the importance of incorporating the supply chain into the activities of enterprises in the garment industry. The study shows that the garment companies interest should be distributed in average in their supply chain alliance. Especially, they must strengthen cooperation if they want to achieve the success when the market risk increased.

Key words: GARMENT COMPANY, R&D FORM, INTEREST DISTRIBUTION, SUPPLY CHAIN MANAGEMENT.

### 1. Introduction

Many firms have ventured into the garment industry in China without the basics of management of the production and distribution procedures.[1]This information shall be deeply analyzed in this document as a way to provided firsthand information to the firms on the essence of the supply chain. Various garment firms shall be analyzed to identify the techniques they have employed to ascertain if they are fit for the success of the business.[2]The great importance is the significance of supply chain management toward the improvement of the product quality. Besides this, how does the supply chain contribute to the improvement of the innovation though such things as fashion. Various businesses have come up with methods that

are not fit for the success of the businesses in terms of the supply chain, as a result called for the need to improve the supply chain methods that are already in use within most of the Chinese firms [3].

Some firms have already adopted proper supply chain management methods through they still lack proper management procedures. For a firm to fit properly to the ever changing needs in the supply chain, innovation should always be given a priority. Once the interests of the market shift, the supply chain should equally shift since the markets will be interested in latest designs and low priced products. An example for changes to the supply chain is through the removal of the supply chain intermediaries who mostly make additional expenditure on the customer

and embrace partnerships. The objective should be to ensure they acquire necessary competitive advantage in the market[4].

Whereas some of the firms have no proper management skills for the supply chain, some participants in this industry have already adopted the supply chain and there are clear benefits associated with this. Unfortunately, it's important to note they have not implemented this entirely, and they have not gotten the opportunity to enjoy these benefits fully. Big enterprises are more likely to implement the supply chain procedures unlike the small businesses.

Actually, the supply chain in China lacks product flexibility, and there is the need for them to make plans to change the inventory and adopt a new product preposition style. This industry is very sensitive; due to the competition that exists from other well established firms China firms should consider an improvement to their value chain[5]. This will enable the market to readjust quickly to the new demands. For the case of poor communication that has always been propagated in the enterprises, understanding among the participants should always be regarded with high priority if at all the plan has to be a success.

Additionally, the garment industry is highly sensitive to the effects of the current supply chain procedures; this is due to the introduction of factors such as technology which have been of intense impact. Technology has a positive effect towards high quality products, better designs, faster production and efficiency at work; this has an overall impact on the expenditure since it drops. It's for this reason that current technology should be adopted in the supply chains so as to improve on performance in this industry[6]. In order to solve problems, the article established the interest distribution model based on the supply chain resources optimal allocation.

### 2. Optimal model

The main objective for this case is the identification of the essence of incorporation of better supply chain management tactics to the development and betterment of the China garment industry[7]. Various factors can be incorporated into the supply chain management tactics to ensure the success of the garment industry in China. One such factor is the adoption of the new supply chain management styles such as incorporation of technology in most of the procedures[8]. Most china firms have less priority for technology which has made them to compete less competitively with the other firms that have already implemented this by a huge extent[9]. These factors shall be the basis for an evaluation for competitiveness, technology, innovation and management in this

industry. It's also important to analyze factors that have been of negative impact to the implementation of the supply chain methodologies fully[10]. Some of the research questions to be addressed include:

(i) What are some of the factors that have an effect to the global competitiveness of garment industry;

(ii) What are the factors that have been of great negative impact to the garment industry;

(iii) What are the major garment industry chain models in China and what improvements need to be done;

(iv) How can the supply chain be improved for the success of these garment firms in China;

After the completion of the research and the collection of the necessary data, it's expected that the information obtained will be of great help in the improvement and the development of the China garment industry. Based on the data obtained, analyses can be done, essential for the purpose of decision making. Most of the researchers have ignored the supply chain management section with regard to its contribution to the growth of the garment industry. This article seeks to offer this essential information to the public for use. The information hereby provided will be of great essence in making of decisions[8]. This study is bound to encounter a lot of repulsion from the industry. Some may not trust the information provided to them courtesy of the research, since some may proceed without any form of facts implementation. The objective of the study is the provision of supply chain solutions to these enterprises that have not been performing well in the industry[9]. Due to the difficulty in determining the credibility of the information, some details may have been left out. Some of the countries have recorded success without necessarily adopting wholly a proper supply chain. Despite this, the supply chain has proved to make the firms perform even better due to the better organization of ideas. This may also make it problematic to convince the enterprises to adopt the information mentioned here; therefore, the information provided here may not be fully dependable[10]. A supply chain can be termed as a system that allows the normal flow of goods and services from one section to another. This usually involves a chain of activities majorly manufacturing, supplying, warehousing services, inventory management, order processing and all the process are important for the success for an enterprise. The main objective of a supply chain is to ensure efficiency in management of activities involved in a business. Various other factors come in for this case such as the timing, the product quality and ease of accessibility of the premises and

products for the customers. Statistically, the following figures represent the percentage of firms lacking technology, training, skills, vision or proper communication for the success of their activities.(see table1)

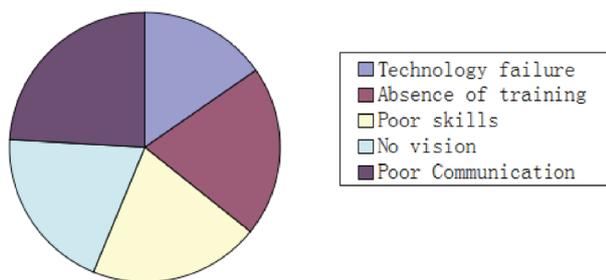
**Table1.** Percentages of influencing factors

Technology failure	42.00%
Absence of training	56.00%
Poor skills	56.00%
No vision	54.00%
Poor Communication	66.00%

This represents quite a huge figure, which means that most of the firms do not have a proper running supply chain. Various improvements need to be done to their supply chain in order to achieve maximum potential in production, high quality products and hence better competitive advantage.

In the second findings, it showed that information distribution to the people was of great essence to the success of the garment firms. It makes it easier to manage the supply chain and correction can be made with ease. Also, ideas can be easily shared out between the employees for the betterment of the firm.

Obviously, it shows a representation of the findings on essence of communication in a firm as an element of the supply chain.(see figure1)



**Figure1.** Awareness for SCM

**Table 2.** The profit matrix in the average distribution strategy

		downstream		
		0	c/2	c
upstream	0	R11/2,R11/2	R12/2,(R12-c)/2	R13/2,R13/2-c
	c/2	(R21-c)/2,R21/2	(R22-c)/2,(R22-c)/2	(R23-c)/2,R23/2-c
	c	R31/2-c,R31/2	R32/2-c,(R32-c)/2	R33/2-c,R33/2-c

There are,

$$\rho^2(\rho_2 + \rho_3)[1 + \rho_2 + \rho_3 + (1 - \rho^2)(\rho_2 + \rho_3)] = c / m \quad (4)$$

$$\rho^4 \rho_2 \rho_3 (\rho_2 + 2\rho_3) = c / m \quad (5)$$

$$\rho_1 + \rho_2 + \rho_3 = c / m \quad (6)$$

In order to achieve the continued R&D power, the garment company could get the reasonable interest from the supply chain alliance. As we know, there are two model of interest distribution. The first is average distribution, and the second is distributed according to the proportion. So, the article proposed the following interest distribution model.

$$\max r_i = \begin{cases} \frac{R_i - c_i}{2} & (\text{average distribution}) \\ \frac{c_i}{c_{i-1} + c_{i+1}} R_i - c_i & (\text{proportion distribution}) \end{cases} \quad (1)$$

$$R_i = \begin{cases} m & (\text{cooperation}) \\ 0 & (\text{others}) \end{cases} \quad (2)$$

$$m = \min(c_{i-1}, c_{i+1}) \quad (3)$$

Where,

$r_i$  --it was company i net profit

$c_i$  --it was the total profit of the supply chain alliance including company i

$c_i$  --it was company i product's R&D expenses.

$c_{i+1}$  --is the upstream R&D expenses

$c_{i+1}$  --is the upstream R&D expenses

$i$ --it is the company from 1 to N.

Hypothetically, the R&D cooperation probability in the supply chain is  $\rho$ . The supply chain length includes 3 companies. So, the supply alliance probability is  $\rho^2$ . The probability is  $\rho_2$  when the R&D expense is zero. Similarly,  $\rho_2$  is the probability when R&D expense is  $c/2$ , and  $\rho_3$  is the probability when R&D expense is  $c$ .

### 2.1 Average distribution strategy

According to the equation(1) to (2),the profit matrix could be achieved(see table2 )

### 2.2 Distribution according to the proportion strategy

According to the equation(1) to (2),the profit matrix could be achieved(see table3 )

**Table3.** The profit matrix in the proportion distribution strategy

		downstream		
		0	c/2	c
upstream	0	0,0	0,R12-c/2	0,R13/2-c
	c/2	R21-c/2,0	(R22-c)/2,(R22-c)/2	(2R23/3-c)/2,2R23/2-c
	c	R31-c,0	2R32/2-c,(2R32-c)/2	R33/2-c,R33/2-c

Similarly, there are,

$$\rho^2(3\rho_2 + 2\rho_3)[\rho_1(1 + \rho_2 + \rho_3) + (1 - \rho^2)(\rho_2 + \rho_3)^2] = 3c/m \quad (7)$$

$$4\rho^2\rho_2[\rho_1(1 + \rho_2 + \rho_3) + (1 - \rho^2)(\rho_2 + \rho_3)^2] + 3\rho^2\rho_3(1 - \rho^2\rho_2^2) = 4c/m \quad (8)$$

$$\rho_1 + \rho_2 + \rho_3 = c/m \quad (9)$$

The model could ensure garment company's R&D (research and development) goal following closely garment market's requirements. This was the critical success factors in the supply chain.

Communication has been established as an important aspect since it ensures convenience in sharing and passing of essential information from one section to another. Therefore, while setting up a supply chain, information and technology should be adopted due to the convenience they bring along. Communication stands as a pillar to the success of a company and this stands as a very important factor to the success of the garment industry. Information can thus be shared between manufacturers, the suppliers and the customers.

Partnerships with other business should also be allowed some space. This is because it has shown some benefits for the few businesses that have already had it implemented. With partnerships, skills and tactics can be shared for the overall benefit of the two businesses. Services such as information technology, management skills can be shared between the two businesses.

There has been introduction of technology, this has affected all the departments and companies continue to realize the importance of technology. Technology

comes in under communication, machinery, design work, time saving and convenience. With adoption of this, the China garment industry stands to gain by a huge extent.

### 3. Model analysis

The present garment industry needs to adopt additional new competencies that coordinate well with the current times. They should consider adopting the current technology which some of the industries in other countries have adopted. Skilled labor also has become of consideration in the garment industry; therefore, besides acquiring cheap labor for casual work they need to consider employment of skilled labor. This is because they have the potential for creativity and can always come up with creative ideas that can help keep the enterprise and the industry one step ahead always. The China garment industry should also consider diversification of their market which should then allow them to increase their share in the garment industry.

After the abolition of the previous restrictions, the competitiveness in this industry is now dependent on the efforts by the industrial participants. China has for a long time depended on the old traditional technologies and prioritized manufacturing to the rest of the activities. There is need for them to start considering fashion and design, something that could promote the garment industry. (see table 4) They should consider the current trends and the current technologies. Effects due to the removal of the restrictions by the year 2005 to the garment industry.

**Table 4.** The present nature of the garment industry in China

Predictions	Procedure	Comments
Huge losses were expected	The major features incorporated in the industry	Analysis was done based on the secondary collected data
Drop of GDP by 0.14%, and the exports to be 15.5%	Made use of the Global trade kind of model	Based on competitiveness and the relative costs
A loss of up to 50% in the American market with an overall 35% for the other markets	Interviewing the international markets participants	Sample size has not been given
More than half of the exports could be lost	Global Trade model has been put into use to check on the level of competitiveness	Thorough analysis was done

The garment industry has been one of the largest industries in existence in China. This industry facilitates many jobs in the country, many people earn courtesy of employment they get from this industry. With the years, the rate of employment has been on the rise, attributed to by the information from the Statistics Bureau. This information shows that the employment rates rose up to about 19.6 million between the years 2005 and 2010. Returns from this were also quite high recorded at about 4.765 trillion yen; this

was the largest amount this industry had ever recorded in history.

Product sales were on the increase every year; this proved the continued rise in demand from the people. Based on the amount of product sales, 2009 had an increase of about 20% which was a major shift for many years. Based on all products combined from the rest of the enterprises, the sales recorded a 35% increment. Despite the returns recorded here, this performance is low and much needs to be done for it to

show the full potential.

The garment industry of China has been split into different sections each served with a responsibility. In these different sections, we have functions such as product design work, making of purchases, products delivery, ordering and other activities involving the supply chain. Unfortunately with the Chinese market, the activities within the supply chain are very unbalanced. Activities such as branding, research and development are the most underdeveloped sections since enterprises have neglected this section. This is because of the belief that they have very little impact on the amount of returns from the sales. Some of the businesses have had the focus on manufacturing roles; this is because they term this role to be more important than the rest of the roles that are included in the supply chain (Shen D. R., 2014).

When this is compared with the product quality of the past, the products as of now are fair products is good, however, much is needed for the businesses to compete favorably in the markets. Research and development should be given top priority given their contribution to the development of better products, products of high-quality garment that can compete in the market. China has always been associated with immense capability in the garment industry; in fact they are the leading suppliers of garment products.

An analysis on the Chinese garment industry shows that there is huge potential is visible if only they decided to embrace unity. The Chinese industry is very strong and has the capability to withstand competition with the rest of the international garment handling companies. The enterprises can enter the global market and enhance healthy competition with the rest of the companies. The ferocious competition that has been witnessed internally within the Chinese garment industry should be avoided since this can be detrimental to the industries. They should consider enhancing cooperation, improvement of communication and coming up with an idea aimed at solving problems encountered within this industry.

The garment industry is one industry that is always associated with a lot of competition. Various countries have made entry into the markets; due to absence of restrictions they have also invaded the China markets. The businesses started their business long ago and they have successfully acquired great competitive advantage over the other businesses. They are the major price determinants and they serve more customers than the Chinese based garment industries.

The mode of product distribution on the supply chain has a major influence on competitiveness.

Some of the distribution channels may favor a business and help the business progress in acquiring more customers. Businesses that employ distribution channels with fewer middlemen are likely to avoid numerous expenditures. For those with many middle men such as the distributors and retailers, the expenditure is high and the price tag attached to the products most of the time is high. This may discourage customers against making purchases hence the low product demand.

Due to the continued rise in the international and domestic markets, there has been development of new forms of competition in this market. One of them is on the basis of the quality of products, the time taken for product delivery and the place for delivery of the goods. This will mostly encourage the customers and thus improves on the customer outreach. This has been considered to be the contribution of the reduction in the profits which can discourage investors against making investments.

Secondly, we have the virtual businesses whose aim is to build their name and protect their brands. They base their analyses on the customer satisfaction, the development of the products and how they can instigate an improvement in their service delivery. All this is to increase the customer satisfaction while ensuring high loyalty levels from the customers. This directly affects the sales and the profits obtained from this business.

There is a third form of competition that normally integrates all business processes by themselves. These processes include production, supply and distribution of the products to their customers. Their operations are dependent on optimum cooperation between the member participants. In this, strong emphasis has to be placed for research and development, processes that are meant to improve the efficiency for delivery of services.

In the garment industry there is a lot of products differentiation done in the market meant to deliver products that satisfy the interests of the customers, this is because the customers are increasingly becoming more specific in what they need. Fashion always goes with time and always keeps changing, this is because customers always prefer the current garment fashions, and this informs the need for updated information on the garment industry. This has contributed to the many supply techniques that are being witnessed with the supply chains. The supply chain comes in at this point for management of the fashion and how this can be involved in product design, production and supply to the market.

Competition has been witnessed in large levels within this industry with the larger companies having better competitive advantage over the smaller ones. Majorly, this competition has been dependent on fully working chains and the advantage costs that are associated with this. Reintegration of the regional industries

For the businesses to success, there is need for them to start considering operating in units and clusters. With the operation in units they stand many advantages unlike when they are working alone. Amongst the impacts shall involve technology of production, better decision making, ease outreach of resources, better competitive advantage and wider markets. This industry has been associated with obsolete technologies and the fact that they do not embrace research and development. By allowing various enterprises to work as clusters, they could stand a very high chance of success.

With these clusters, very few companies have had the willingness to expand outwards to the upstream. Most of the enterprises in the same cluster have been associated with the production of similar products, something that limits their access to the market. This can turn out to be a major challenge to the smaller companies since they are exposed to intense competition. They have further made the individual businesses weaker because most of them become over dependent on the procedures and success of other businesses. All this negative effects were due to the failure of control over the business. The government of China should be urged to support these businesses especially in the management of the supply chain.

Reintegration should be done first for the companies that have already fully established themselves. It will be done on the basis of the supply chain and the geographical features of the cluster. Priority is to be given to the areas that are better advanced; ones that have already adopted high-level technology, good marketing outlets, high product value and have embraced research and development. This should involve all the businesses in the garment industry.

Local enterprises can, however, be integrated with the effort to come up with an organized league through which coordinated activities can be handled on assignment. Each enterprise will be given a role for which they are supposed to handle, and they have to make sure it's workable for the overall benefit of the cluster. This should entail the development of connections while ensuring maximum cooperation between each other. This strategy can help in the reduction of the negative effects that are associated with

the garment industry with regard to competition. This can help in the establishment of proper cooperation between enterprises while at the same time ensuring maintenance of the supply chain. The expenditure for implementing new ideas and the time spent in implementation will reduce greatly.

This is a service that is meant to ensure convenient flow of services within the supply chain. When the supply chain attains full operation, more activities of great essence can further be incorporated into the chain of activities; some of these shall involve those on the line of fashion such as product finishing. This will help bring together human resources, something that will contribute to better provision of one-stop services. Sometimes the competitive advantage accrued to a business can be lost due to poor pricing; however, with the adoption of the one stop service customers can easily be served satisfactorily.

As has been seen with the Chinese garment enterprises, most of them have specialty in the production and manufacturing line. As a result, some more profitable sections such as fashion have been left unattended. There is need for them to change to the art of service provision by majoring on improvement of designing and marketing strategies; major factors in the supply chain activities.

A brand is a name and outward appearance given to a product and the process of determination of such an appearance can be termed as branding. This is an essential activity within the supply chain as it tends to bare some relationship with fashion. With the development and the improvement of the brand name, the whole supply chain will be subject to gain from this. Poor branding has been one of the weak spot for the China garment industry resulting to the poor product promotion and thus low product sales. If this is done, the demand for the products can rise and will help boost the profits generated.

Six strategies were considered for the purpose of performing in the supply chain. Four factors were put into use specifically uncertainty in supply, demand and control of supply chain processes. The uncertainty comes about due to absence of clarity on the reflection from the supplier in terms of the rate of production. In the determination of the effects of the production procedures in the supply chain, production scheduling shall be subject to analysis.(see table5) .

**Table5.** Business strategies

Plan	Fabric	Collar	Reproduction rate	Production schedule
A	YES	NO	NO	YES
B	YES	NO	YES	YES
C	YES	NO	YES	NO
D	YES	NO	NO	NO
E	NO	NO	YES	YES
F	NO	NO	YES	NO

*Strategy A*

This is meant to show when the supply chain is at its best. For this, the utilization level stands at below 70 percent meat to cater for the low customer turn up. Reproduction can only be allowed on the basis that they are sure of the customers. There should be proper cooperation between the members which allows for better production and co-ordination of the supply chain.

*Strategy B*

This bares some similarity with the first strategy. However, there is a slight difference since with this changes can be made to the supply chain. This done so as to cater for the uncertainty that exists in terms of customer demand.

*Strategy C*

This serves as a pilot project for the purpose, of validation of the whole process. The production processes within the supply chain are not very efficient but changes are still allowed to the supply chain.

*Strategy D*

Due to the long time that is spent waiting, with this strategy the supply chain is not fully efficient. This is the least performing case in the supply chain production process.

*Strategy E*

This analyses the effects of a properly working supply chain, this is assessed on the basis of the ease

with which customers can be maintained.

*Strategy F*

This shows the worst scenario in terms of the customer demand dependent on the supply chain and the production rate.

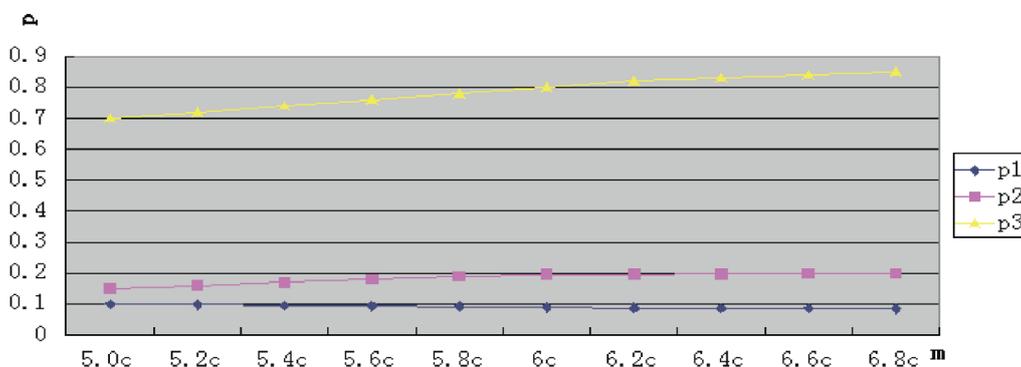
For the supply chain, this has been done in such a manner that a process approach has been use. The strategies that were handled above have been fitted into a single model and the lead time has been utilized for this case as the measurement.

**4. Empirical study**

This is a special kind of model with which products are managed from a central location; this can be from the offices or from the stores. Constant monitoring is done for the products; once they get finished new products are brought in as replenishment. This model has been found suitable with the garment industry given it tends to address the common problems experienced by the inventory management.

So, when the vector  $\rho = (0.90, 0.91, \dots, 0.99)$   $m = 6c$  all companies' probability could be achieved in the average strategy according to equations(4),(5),(6). (see figure 2)

$$\begin{aligned} \rho_1 &= (0.099, 0.097, 0.095, \dots, 0.090) \\ \rho_2 &= (0.15, 0.16, 0.17, \dots, 0.2) \\ \rho_3 &= (0.7, 0.72, 0.74, \dots, 0.81) \end{aligned}$$



**Figure2.** R&D profit average strategy

Similarly, according to equations(7),(8),(9),the proportion strategy is, (see figure 3)

$$\begin{aligned} \rho_1 &= (0.15, 0.14, \dots, 0.105) \\ \rho_2 &= (0.08, 0.085, \dots, 0.10) \\ \rho_3 &= (0.7, 0.72, 0.74, \dots, 0.81) \end{aligned}$$

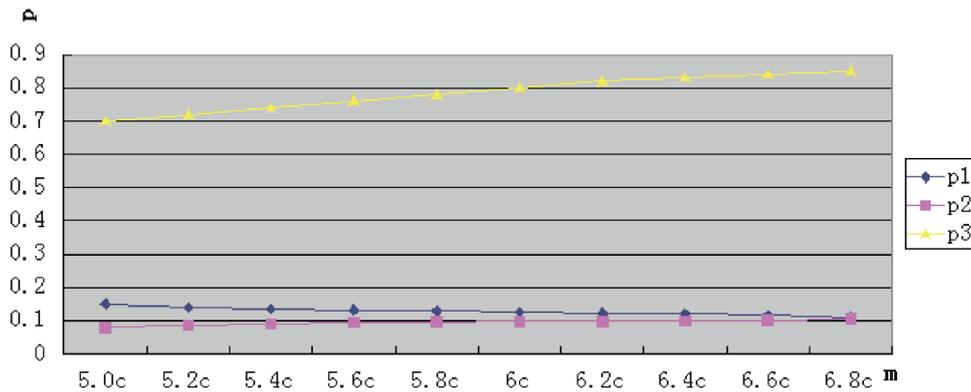


Figure 3. R&D profit proportion strategy

## 5. Conclusion

It's clear the supply chain plays central role to the success of the garment industry. Most businesses in other industries have already recorded a huge extent of success. One majorly accomplishment they have made is the adoption of the supply chain and managing their activities properly. Through the findings made, it has been identified that the supply chain management style plays a role in the lead time. It's of great importance to adopt the current systems such as technology to help improve on the lead time.

The study shows that partners would increase the R&D investment when the new products' market profit will be increased. In order to achieve the stable cooperation between companies in during the supply chain, there tendency hope that there profit could be distributed in using average mode.

## Acknowledgment

Authors would like to acknowledge funding received to enable this research to be undertaken. The research was funded by Jiaxing municipal science and technology bureau (Jiaxing science and technology project's contract number was 2015AY11023).

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