

SUPPLY CHAINS COSTING CONCEPT AND APPLICATION IN THE FASHION INDUSTRY

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ABSTRACT

Due to required environmental criteria, green products cannot be purchased on “normal” markets. Therefore, it is necessary to manage the whole supply chain from raw materials to customer delivery and disposal. While these needs drive up costs, no concept exists that allows a cost management within the supply chain. Traditional cost accounting and cost management techniques look at the internal costs of a company only.

Therefore, these systems have to be integrated with the concept of transaction costs, yielding a cost management framework on three levels: direct costs, activity-based costs and transaction costs. After describing the supply chain for apparel, this paper outlines a framework for supply chain costing. The second part shows how this framework can be applied to analyse and optimise costs in the design and production of green products in the fashion industry.

Key words: supply chain management, cost management, transaction cost, fashion industry

1 INTRODUCTION

Over the past few years, green products have been introduced into various fields of consumption. While customers would prefer green products, if their prices were equal to those of “normal” ones, they are not willing to pay considerably more for green products. This has led to a situation, where green products have regularly remained within small niches, mostly holding a market share below 5%. The reasons for this are multiple, but two issues are evident:

1. The greening of products drives costs up, as additional requirements have to be met at each stage of the supply chain.
2. No cost management is used in product design and manufacture.

This problem applies to various products, but the focus of this paper will be the fashion industry. Even though the disposal of used textiles encounters enormous problems, only the supply chain from raw materials production to distribution, as displayed in Figure 1, will be covered subsequently. This allows one to address the design and production of the products. The inclusion of later stages in the life cycle raises different issues that are beyond the scope of this article.

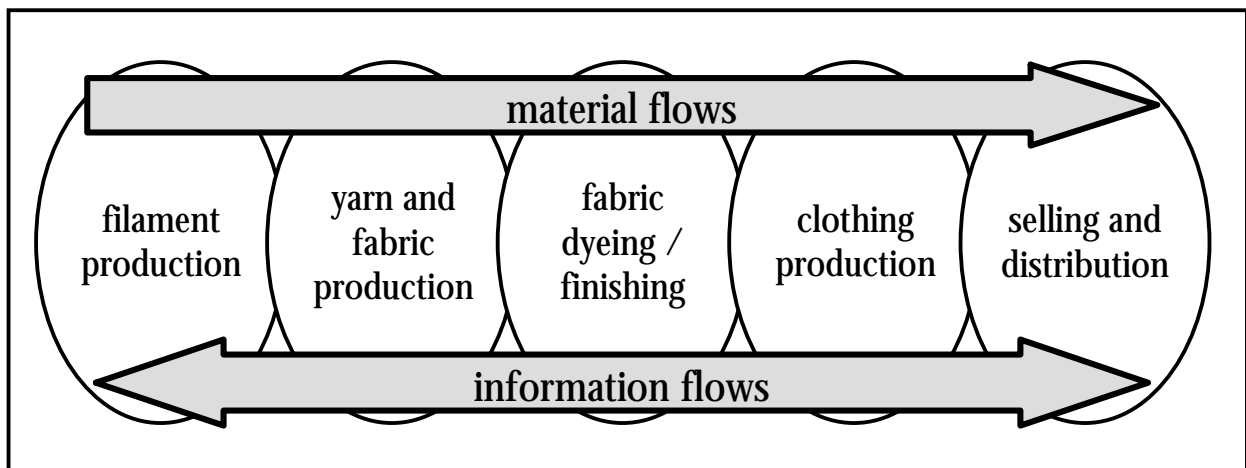


Figure 1: A typical supply chain for clothes

Brief explanations for the activities carried out at each step of the cotton supply chain and the environmental problems associated with them are provided (for details see e.g.: Myers and Stolton 1999). Furthermore, some reasons for rising costs in apparel production from organic cotton are pointed out. (For the discussion within this paper, it is not necessary to refer to a specific standard of organic cotton.)

1. Cotton production

Cotton is the single crop that was cultivated at four different places world-wide. Therefore, it is a traditional crop grown by farmers within the cotton belt.

Caused by the mechanisation and chemisation of farming, vast amounts of water and

pesticides are applied during the conventional farming of cotton. As the application of the latter is forbidden in organic cotton farming, extra (manual-) work is needed to protect the plants from insects and weeds. Furthermore, irrigation has led to water shortages in various regions of the world as can be seen most dramatically in the drying out of the Aral Sea in Uzbekistan.

2. Yarn and fabric production

After the cotton is harvested, the yarn (one dimensional) is produced by spinning the cotton fibres. Weaving or knitting the yarn leads to the creation of fabrics (two dimensional). During these manufacturing steps, a number of often environmentally harmful additives is used to allow for an easier production. Furthermore, huge amounts of heavily polluted waste water as well as dust and noise are side effects of the yarn and textile production.

3. Fabric dyeing and finishing

Textile finishing includes processes that improve the wearing properties of the fabric or modify its look or feel. The environmental problems of these steps are similar to those in yarn and fabric production.

To avoid these problems during production, dyeing and finishing of the yarn and the fabric, more expensive colours and additives are used. Additional storage and handling processes are required to separate the cotton fibres, yarn or fabric from the “normal” material.

4. Clothing production

The next step is the manufacture of the apparel itself. The finished fabrics are combined with other materials, such as zippers or buttons. While this step creates only a limited environmental burden, the work is regularly carried out in second or third-world countries where the workers, mainly women, work under enormous pressure and humiliating labor conditions.

5. Selling and distribution

This step of the supply chain is of great importance as it represents the companies in the chain that decide which fashion is produced in which style and quality. Hence, this step has a major influence on all previous steps since product variety and quality are defined at this level. Apart from transport, only limited environmental problems occur. Selling and distribution can be carried out by a single company or within a tier supplier system of varying depth.

In traditional, market co-ordinated chains, the fashion industry usually does not take into account the single production stages. Apparel is bought on spot markets, where suppliers might change from part to part and even more from season to season. Hence, within a time span of six months or less the market is mixed up completely.

Among this set of conditions, it is not possible to buy green products. Green cotton is not available on spot markets due to the limited amount available world-wide (only about 0.05% of all cotton is produced under organic standards). Therefore, if a fashion company plans to

offer products made of green cotton it has to search for partners along each stage of the supply chain. After finding the partners, the company has to train them to meet the additional requirements. This even includes working with cotton farmers in various areas of the world. Several companies have set up special programmes to work with their suppliers (see Myers and Stolton 1999; Hummel 1997).

These are only a few of the issues that highlight, why green products are often more expensive, but these examples provide sufficient evidence to justify why a smaller amount of output is not the only reason that accounts for the higher prices. To address these multiple reasons, a cost management along the supply chain is needed. Such a concept has to take all costs along the supply chain into account.

2 SUPPLY CHAIN MANAGEMENT

Supply chain management and cost management are recent developments in management theory and practice and are induced by increased competition on international markets. Within this increasingly competitive environment, single companies are not able to survive on their own, but only as part of a supply or value chain, a concept that has gained importance since its introduction by Porter (Porter 1998). Together with recent developments in logistics and information technology, it forms the basis for the concept of supply chain management (SCM).

Two major streams can be distinguished within SCM (Cooper, Lambert and Pagh 1997:1; Ross 1998: 4 and 72). The first one puts SCM into the context of logistics. While logistics organise the flow of materials from suppliers to the company, within the company and from the company to the customers, supply chain management provides a framework where all flows of materials and information within all stages of the supply chain are taken into account simultaneously. Typical objectives of SCM are the reduction of stocks and cycle times that are achieved by functional integration (see e.g. Christopher 1998: 16).

Yet, the issues that arise from partnering with other firms in the chain are not addressed. The second, wider definition covers this and is given as follows: “The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through to the end user, as well as the associated information flows. Material and information flow both up and down the supply chain. Supply chain management (SCM) is the integration of these activities through improved supply chain relationships, to achieve a sustainable competitive advantage” (Handfield and Nichols 1999: 2). Therefore, all managerial and organisational aspects that evolve within the supply chain are included, such as searching for and partnering with suppliers or customers.

Among both definitions of SCM, various techniques and measures have been developed to help companies to optimise their supply chain activities. As costs are considered an important factor, links to cost management techniques have recently gained influence (see e.g. LaLonde and Pohlen 1996; Cooper and Slagmulder 1999; Seuring and Schneidewind 2000).

3 COST MANAGEMENT AND SUPPLY CHAIN COSTING

Traditional cost accounting is not prepared to actively manage costs, which has led to the development of cost management techniques that are used to support specific decisions and the overall management of organisations (Hilton, Maher and Selto 2000: 6). Still, most cost management techniques look at the internal cost of companies, especially direct and indirect costs. Activity-based costing (Kaplan and Cooper 1997: 79) provides an alternative approach to the allocation of indirect costs among products. Strategic cost management (Shank and Govindarajan 1993) has emphasised the importance of costs within the value chain, but the discussion of cost drivers stays on a general level. Therefore, a concept is needed to allow for the classification of costs within the supply chain, that combines the flows of material and information and the partnerships within the supply chain.

Such a supply chain costing has to take into account both, production and transaction costs. This terminology is taken from the concept of transaction costs, that plays an important part within the new institutional economics (Williamson 1988). Without referring to this concept in detail, the term transaction costs within the concept of supply chain costing is applied in a simplistic way, that disregards the variables and explanations given by Williamson's theoretical concept.

Building on the traditional separation of direct costs and indirect or activity-based costs, this leads to a differentiation of three cost levels, direct costs, activity-based costs and transaction costs, as Figure 2 shows.

The three terms are defined as follows:

1. Direct costs are caused by the production of each single entity of a product and include such costs as materials, labour and machine costs. Mainly, these costs are controlled by prices for material and labour.
2. Activity-based costs are caused by activities that cannot be directly related to products, but are caused by administrative activities that have to be performed in order to be able to deliver products to customers. These costs arise from the organisational framework of the company.
3. Transaction costs encompass all activities dealing with the information of and the communication with suppliers and customers. Therefore, these costs arise from interactions with other companies in the supply chain.

While this classification allows for a separation of cost drivers on three levels, a further explanation is offered by taking a look at the entire product life cycle. All activities can be sorted among two dimensions, the product dimension and the relationship dimension (Cooper and Slagmulder 1999: 10).

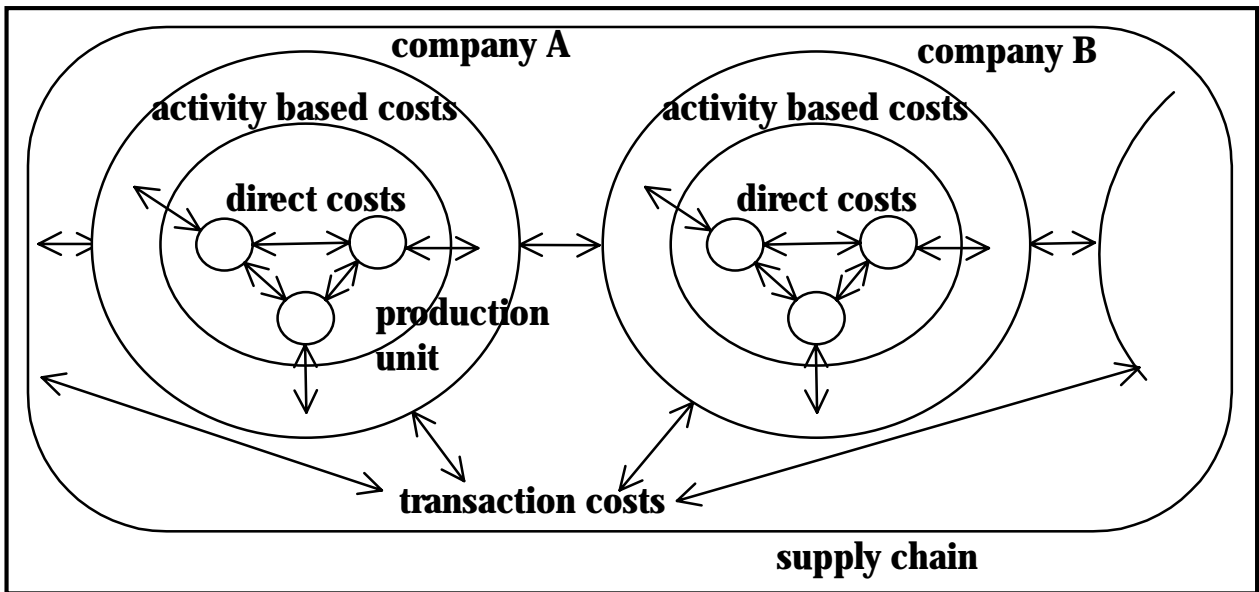


Figure 2: Cost levels in supply chain costing

Within each dimension, two phases are distinguished. The product dimension is divided into the product design and the production stage. In the design phase, the major decisions concerning product design, quality, price etc. are made. These decisions form the basis for the production of the product and influence all other companies involved in the supply chain. These issues are mainly addressed by the second dimension. Again, the first phase covers the configurative aspects, that form the network. These include the selection of and contracting with suppliers, e.g. training programmes for suppliers to enable them to meet quality requirements. After these prerequisite decisions have been made, the network is used for the production of the goods. Hence, the interfaces between the companies involved in the supply chain are of major interest, as materials and information are supposed to flow as quickly and cost effectively through the chain as possible.

Combining the two dimensions with the cost levels yields a matrix that allows a classification of cost influencing factors, as Figure 3 displays. This simplified model allows one to classify cost drivers and to estimate their influence on the supply chain in a qualitative way, without the need to model the whole supply chain and the single processes carried out.

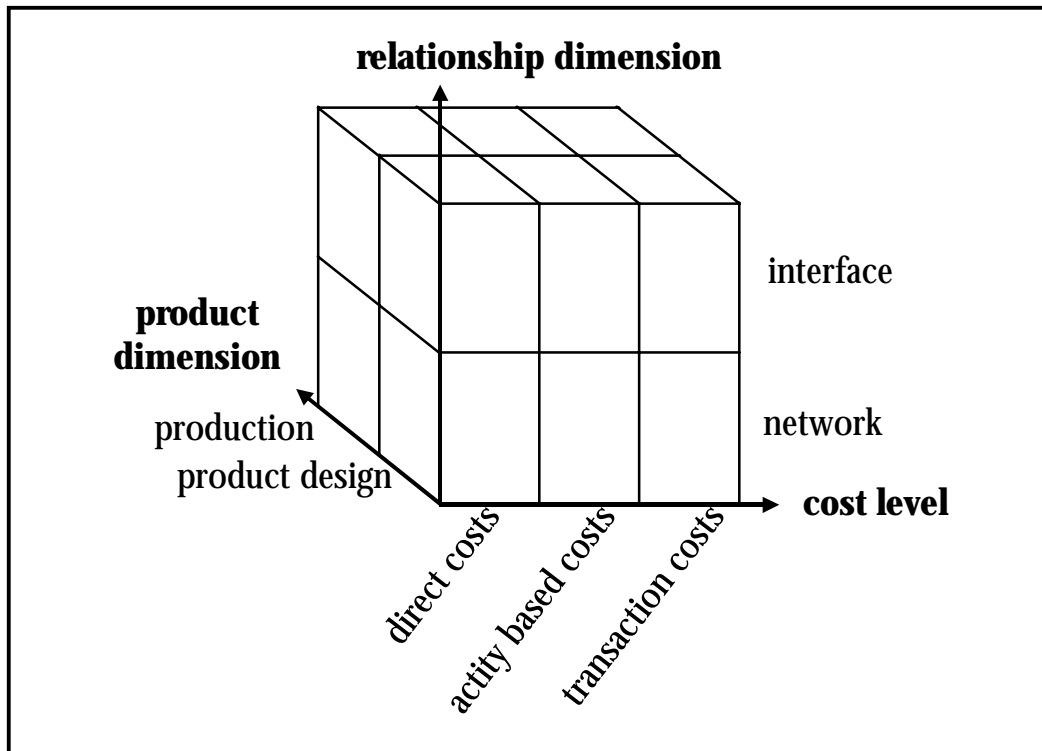


Figure 3: Classification of cost influences in Supply Chain Costing

4 ANALYSING COST DRIVERS IN THE SUPPLY CHAIN OF THE FASHION INDUSTRY

As mentioned in the first part, the co-ordination of the whole supply chain from filament production by the cotton farmers through the various production stages to selling and distribution is necessary, if a fashion retailer wants to sell green products to its customers. Looking at selected properties of the product (assortments) allows one to discuss their cost driving potential. As examples, filament quality, colour and colour diversity as well as content of pollutants in the apparel are assessed in terms of their influence on direct, activity-based and transaction costs. Like this, the cost levels are covered stepwise. Some arguments arise from a comparison of the supply chain of normal and of green cloth, which then emphasise the differences in costs.

4.1 Filament quality

- Direct costs

The filament quality (e.g. the length of the fibres) represents a property that determines various production processes within the supply chain. The speed that the spinning frame and the loom can run on depends directly on the filament quality.

4.2 Colour and colour diversity

- Direct costs
Colours represent one of the major environmental threats in the production of clothing. Often, heavy metal based colours are used. Their substitution by environmentally friendly products increases the direct costs.
- Activity-based costs
Colour diversity is seen as a major fashion requirement. While the application of different colours influences the direct costs only marginally, the total number of colours used play an important role within the administrative processes. Each colour requires different handling and storage as well as set up of the production equipment. Another interesting point arises from the use of naturally pigmented cotton (Vreeland 1999:47-49). While this kind of cotton allows one to skip the dyeing, it requires a different handling of each colour at every single step of the supply chain. This is of special importance to the logistic processes in farming, spinning and weaving as these steps normally are consistent for all cotton batches.

4.3 Content of pollutants in the apparel

- Direct costs
The content of pollutants is of great importance both to human health and environmental problems. These pollutants are various heavy metals and organic chemical substances, that arise from the application of pesticides in farming or textile additives. Avoiding them causes rising costs, as alternative methods of crop protection in farming have to be applied. Often, additional handwork is carried out in integrated pest management.
- Activity-based costs
The difference in activity-based costs arises mainly from the separation of cotton batches. Organic cotton has to be kept away from normal cotton. Regularly, firms deal with normal and with organic cotton, as the amount of organic cotton used world-wide is small compared to normal cotton. Each machine processing organic cotton has to be cleaned extensively to avoid spill-over effects of forbidden substances from the residues of normal cotton treatment.
- Transaction costs
The specifications of organic cotton properties and green apparel products are set by international organisations and enforced by retailers in Europe and North America. Usually, farmers will change their way of cotton production only if they are offered long term contracts. They have to cover their losses caused by the transition from normal to organic cotton production, a process that takes several years. Furthermore, increased costs for integrated pest management and decreased cotton yields have to be paid for (see the chapters on various organic cotton projects in Myers and Stolton 1999). These are transaction costs as they can be attributed to specifications set by the retailers. These costs include the information, communication and transition within the supply

chain. Once more, their importance can be understood by a comparison to normal cotton, where these costs do not exist.

All issues addressed so far point out that costs rise within the supply chain. Yet, there are various opportunities for controlling and reducing costs, as will be explained in the next paragraph.

5 OPTIMISING COSTS IN THE SUPPLY CHAIN OF THE FASHION INDUSTRY

While this presentation has so far centred on the cost levels, the product and relationship dimensions also need to be taken into account. Single issues discussed are related to various fields of the matrix presented in Figure 3. A systematic analysis of cost drivers is difficult to conduct, as it would have to cover the activities at each single stage of the supply chain. This would be far beyond the scope of this paper.

5.1 Product design

Normally, about 80% of all costs are defined during product design (Cooper and Slagmulder 1999: XXI). This fact, usually attributed to material and production costs, is valid for transactions costs, too.

- **Direct cost**
Material, design, colours etc. are all specified in product design. This influences all production steps carried out.
- **Activity-based costs**
These aspects cover the activities carried out during the design stage. The chain of processes includes market analysis and product specification. The fashion industry pays great attention to fashion and design trends. Often product specifications are altered late in the design stage, which might result in different manufacturing or even in a search for new suppliers.
- **Transaction costs**
A close co-operation with suppliers during the design stage can avoid specifications that cannot be met at all or only at higher costs. The integration of suppliers into the design process is common in other industries, but still rare in the textile and fashion industry.

5.2 Network formation

Network formation is the second important part of decisions to be made. The selection of suppliers means that a particular structure of costs is opted for. This implies a dynamic perspective, as the cost structure of suppliers might increase or decrease over time.

- **Direct costs**
The transition of farmers to organic production is a good example of these issues. Profit will decline dramatically within the first years following the decision to grow organically, as on the one hand yields decline and on the other hand farmers are not allowed to sell

their existing cotton as organic. This transition is true for other stages of the supply chain, too. Dye works will have to optimise their processes when using new types of environmentally friendly colours.

- Activity-based costs

Time integration of processes plays an important role in the supply chain management of the fashion industry (e.g. Fisher et al. 1994: 105). The reservation of processing capacities among suppliers leads to better planning for firms involved, which decreases activity and transaction costs.

- Transaction costs

One major issue concerning transaction costs is that the costs for supplier selection and training are higher for organic cotton products. Often, suppliers are not able to reach the technical and environmental standards set by the retailer on their own. They might need technical support to alter their production processes. While the raising of organic cotton is and will stay more expensive, most other processes can be expected to reach the same cost level as the one of normal cotton. Hence, the payment of compensations will only be necessary for a limited time span.

If a supplier does not deliver products according to the specifications set, measures might have to be taken that allow one to stay in the market. Therefore, multiple sourcing might be necessary to be able to deliver products to customers on time. In contrast, establishing a trusting relationship with suppliers of high quality will reduce the need for a backup supplier.

5.3 Production

Production is included in the traditional focus of cost accounting, but integration of the supply chain has put new pressure on the single companies involved.

- Direct costs

The use of environmentally friendly dyes and additives will reduce the amount of money spent for example on waste water treatment. Staff exposure to harmful substances and illnesses caused by them will be reduced.

- Activity-based costs

One important issue is the volume processed in a single batch. For organic cotton, batches are often smaller than for normal cotton, which leads to rising setup costs. Administrative processes for smaller batches cause higher costs, as well.

- Transaction costs

The processing of organic cotton might require investments in new equipment, which suppliers will only carry out, if they expect to amortise the money. As another example, the transition of farmers guaranteed by long term contracts can be recalled.

5.4 Interface optimisation

The close co-operation of firms in the supply chain is ensured by the integration of technical and managerial processes. Logistical and supply chain management measures can be implemented to fight rising costs.

- Direct costs

Setting technical standards for all partners in the chain allows for the avoidance of typical problems in uncoordinated supply chains. On the direct cost level, this might decrease production costs, e.g. the use of certain additives during spinning will affect the weaving costs. Agreeing on better additives that reduce yarn splits during weaving might increase costs for the spinning company. If the weaving company compensates these costs, it might reduce its own costs considerably.

- Activity-based costs

The example given for the direct costs affects the activity-based costs, too. Another important part of the activity-based costs in the chain arises from the close coordination of administrative processes. The use of electronic data interchange has decreased these costs dramatically in recent years.

- Transaction costs

A supplier does not only incur direct costs. If the goods deliveries do not conform to the specification set, rework might be necessary. Quality control at the shop floor of the supplier can prevent these costly processes. Hence, the total costs of working with a certain supplier need to be considered.

Only a limited number of factors have been presented above, but evidence is provided for the consideration of supply chain costing. Searching for cost reduction potentials at all stages of the supply chain will yield significant cost reduction.

6 CONCLUSION

If fashion companies are willing to bring green products to the market, they have to manage the whole supply chain. First of all, this is necessary in order to bring such products to the customer. Furthermore, various costs will rise due to the higher requirements the green products have to meet. Yet, an active management of processes and suppliers in the supply chain allows cost drivers that are usually beyond reach for a single company to be influenced. This requires partnerships in the supply chain that aim for conjoint cost reductions.

This has various implications for management. First of all, it emphasises the need to think beyond the own factory gate. Supply Chain Management requires a different attitude if better solutions for all partners in the chain are to be reached. Hence, conflicting goals will have to be managed, not only inside the single company, but along the production and sales units of all firms in the supply chain. The integration of production technologies and schedules will provide opportunities, but also raise obstacles, which might only be reached in a joint learning process among the production management staff of the different companies. A second issue to be considered, are the costs to run such a system. Companies investing in organic cotton and

clothing believe in the medium to long term benefits, both in environmental and in economic terms. While such solutions are not ready available, the benefits as well as the costs need to be evaluated.

The concept of supply chain costing presented, provides a framework for identifying and optimising costs. Future work has to be carried out that will adjust and broaden existing cost management techniques so as to take up the challenge of supply chain management. This will allow for a simultaneous decrease of the costs generated and the environmental problems caused. The example of the fashion industry portrays this, but most issues addressed would be applicable to other industries, as well.

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