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Critical Factors Affecting Supply Chain Management: A Case Study in the US Pallet Industry

Henry Quesada¹, Rado Gazo² and Scarlett Sanchez¹

¹Virginia Tech, ²Purdue University
USA

1. Introduction

Supply chain management is applied by companies across the globe due to its demonstrated results such as delivery time reduction, improved financial performance, greater customer satisfaction, building trust among suppliers, and others. According to D’Amours, Ronnvist, and Weintraub (2008), companies resort to supply chain practices to improve their performance. Thus, it is important to first understand how their supply chains work. Figure 1 shows a generalized supply chain in the forest products industry.

![Diagram of a forest and wood products supply chain](image1)

Fig. 1. Forest and wood products supply chain (Campbell and Kazan, 2008)

Figure 2 illustrates another example of the steps in a supply chain for wood pallet manufacturing industries. This process begins with logging operations, logs are then sent to the sawmill where cants and/or pallet parts are sent to the wood pallet manufacturer (pallet operations). Lastly, once wood pallets are manufactured, they are sent to a distributor or directly to the final customer.
2. Identification of Supply Chain Management factors

In order to understand how a supply chain works, it is important to identify the factors affecting supply chain management. The identification of these factors has been based on previous work by Li (2002), and Quesada and Meneses (2010). The following sections show generic supply chain management factors and sub-factors that might affect supply chain management activities.

2.1 Environmental uncertainty

Environmental uncertainty refers to the environmental issues in the product chain (Dwivedi and Butcher, 2009). Ettlie and Reza (1992) described this as the unexpected changes of customer, supplier, competitor, and technology. It was said by Yusuf (1995) that government support plays an important role for business success. Paulraj and Chen (2007a) mentioned that environmental uncertainty is an important factor in the realization of strategic supply management plans. The increase of outsourcing activities in the industry had augmented the awareness of the importance of strategic supply management, which leads to better relationship among organizations. Under this factor, three sub-factors were identified: environment, government support, and uncertainty aspects from overseas.

2.1.1 Company environment

This sub-factor is related to the company’s relationship with suppliers and their level of trust and commitment. Company environment is also related to the company’s expectations of quality, on time delivery, competition in the sector, and the level of rivalry among firms. In order to respond effectively to demand, companies realize that imports are a good option for obtaining flexibility in response, even though working with countries from overseas implies working with uncertainty (Wu, 2006). According to a study carried out by Ambrose et al. (2010), uncertainty negatively affects company performance. But this can be reduced if a strategic relationship with critical suppliers is established (Chen et al., 2004). Thus, companies need to implement new strategies that allow them to deal with environmental uncertainties in the supply chain (Wu, 2006) in order to perform in a proficient manner.
selected for the non-response bias analysis: number of employees, revenue, and pallet production output.

All the responses were coded and entered into electronic spreadsheets. The statistical analysis was carried out using spreadsheet software for processing the data and presenting results, and statistical tests were carried out using SAS® and SPSS® statistical software. Excel was used to perform most of the charts elaborated during the research. Mann-Whitney test and Chi-square were used to analyze non-respondents bias, the former for interval data and the latter for categorical data.

### 3.3 Model testing results

Results show that there are relatively strong associations between the proposed factors as explained in the hypothesis. Table 1 shows the P values for the hypothesis test. For instance, supply chain relationships (SCR) have a positive effect on Customer Satisfaction (CS). This has been asserted in the literature by several authors. For example, Fynes et al (2005) found association between the quality of supply chain relationships and customer satisfaction, chiefly through the improvement of conformance and design quality. Improvement in customer satisfaction from supply chain collaboration can originate from several sources. For example, customer satisfaction is more likely if customers are more actively involved in the product development process or when defining order specifications (e.g., sawmills developing “custom grades” specific for pallets). Another way in which collaboration leads to customer satisfaction is when an industrial customers (e.g., pallet manufacturer) actively participates in improving the supplier’s (sawmill) internal processes (e.g., sharing improvement methodologies or even sharing costs of improvement programs).

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description of Hypothesis</th>
<th>Model Equation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₁</td>
<td>Business Management (BM) positively affects Value-Added Process (VAPM)</td>
<td>VAPM = b₀ + b₁BM + b₂IT + ξ</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>H₂</td>
<td>Information Technology (IT) positively affects Value-Added Process (Manufacturing) (VAPM)</td>
<td>SCR = b₀ + b₁VAPM + b₂EU + ξ</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>H₃</td>
<td>Value-Added Process (VAPM) positively affects Supply Chain Relationship (SCR)</td>
<td>SCR = b₀ + b₁VAPM + b₂EU + ξ</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>H₄</td>
<td>Environmental Uncertainties (EU) positively affects Supply Chain Relationship (SCR)</td>
<td>SCR = b₀ + b₁VAPM + b₂EU + ξ</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>H₅</td>
<td>Supply Chain Relationship (SCR) positively affects Customer Satisfaction (CS)</td>
<td>CS = b₀ + b₁SCR + ξ</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>H₆</td>
<td>Supply Chain Relationship (SCR) positively affects SCM Performance (SCMP)</td>
<td>SCMP = b₀ + b₁SCR + ξ</td>
<td>0.0064</td>
</tr>
</tbody>
</table>

Table 1. Results of model validation
Also, it was shown that Information technology (IT) has a positive effect on value-added process (VAPM). Information technology can be a powerful tool when reducing inventory (non-value adding) and improving supply chain responsiveness (value-adding). Sanders and Premus (2005) had proven the positive relationship between Information Technology capability and collaboration and company performance, as measured by, among other items, costs reduction and time performance improvement.

Value-added processes (VAPM) and supply chain relationships (SCR) are related as well (see Table 1) and line up with previous research results. Stiess (2010) for instance, supports that information sharing helps to reduce wasteful activities, specifically improving material flows and reducing inventories. Wikner et al (1991) demonstrated that high levels of information sharing result in reduced “demand amplification”, which is directly related to unnecessary inventory levels throughout the supply chain.

3.4 Practical implications

These results, although specific to a certain industry sector, can help manufacturers to have a better understanding of their supply chain management practices. Findings provide a theoretical framework for supply chain management by identifying and testing seven factors. Manufacturers could achieve improvements in supply chain performance through the effective management of critical items and factors identified in the research. Industry support organization can use the results from this research to better design technical assistance and educational programs for the wood pallet manufacturing sector.

Manufacturers should focus on the effective management of value-added process (manufacturing) since it was demonstrated that they directly affect the supply chain relationships, and as a consequence to supply chain management performance.

Manufacturers should be aware of how critical it is to communicate, and to plan jointly with suppliers. Increasing the importance of supply chain relationships and understanding the significance of this concept will increase customer satisfaction. Practitioners must realize that the flow of information in a coordinated manner, access to information and data interchange greatly improve customer and supplier relationship. This identifies information technology as a potential area for improvement.

Manufacturers should also be aware that fast changes in customer demand, globalization of markets, and changing of technology require companies to focus their efforts on improving competitiveness by trying to achieve customer satisfaction through adding more value to their products. The implementation of process strategies will improve manufacturing performance and supply chain management performance.

4. Prioritizing success factors

The previous section identified and tested a model for supply chain management that includes seven factors. However, as the company moves forward to improve their supply chain management activities, it is important to identify which of the seven are the most critical factors that need to be improved in order to lead the firm to an overall success. In this section the authors developed a procedure to help practitioners to identify which of the previous seven factors have the highest priority.
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Over the last decade, supply chain management has advanced from the warehouse and logistics to strategic management. Integrating theory and practices of supply chain management, this book incorporates hands-on literature on selected topics of Value Creation, Supply Chain Management Optimization and Mass-Customization. These topics represent key building blocks in management decisions and highlight the increasing importance of the supply chains supporting the global economy. The coverage focuses on how to build a competitive supply chain using viable management strategies, operational models, and information technology. It includes a core presentation on supply chain management, collaborative planning, advanced planning and budgeting system, risk management and new initiatives such as incorporating anthropometry into design of products.

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