

Regulatory Factors and Supply Chain Planning in Chemical Industry

Hong-Choon Oh¹, I.A.Karimi^{2*}

¹*The Logistics Institute-Asia Pacific*

²*Department of Chemical and Biomolecular Engineering*

4 Engineering Drive 4, National University of Singapore, Singapore 117576

Regulatory factors are the legislative instruments (duties, tariffs, taxes, etc.) that a government agency imposes on the ownership, imports, exports, accounts, and earnings of business operators within its jurisdiction. The primary goals of these factors are to boost a country's coffer or protect the interests of local businesses. Countries around the world may share similar types of regulatory factors, but the details of these regulations are extremely important and vary from country to country. Inevitably, they create a heterogeneous global network of business landscapes that have different levels of influence on the supply chain operations and bottom line performance of any business operator.

Most chemical companies are multinational in nature due to the global spread of their manufacturing facilities. The current competitive and dynamic environment in which companies across the globe are merging and streamlining their resources also accentuates the global nature of their businesses. Clearly, this makes it imperative that they adopt a global perspective on supply chain planning decisions whereby the latter are made with all the globally dispersed supply chain entities considered. In other words, the decisions should be on a global and integrated basis and must account for all key the regulatory factors.

Both supply chain operation and strategic problems have received extensive attention from research workers for some years now. However, most existing models that address supply chain problems do not consider any of the regulatory factors. This limits their application in the industry, especially by multinational companies, since solutions of these models are unlikely to remain optimal in the presence of appropriate regulatory factors. On the other hand, among the models that have been developed with regulatory factors to address supply chain problems, there is ample room for improvement to enhance their applications in the industry. This improvement may appear in the form of more realistic representations of regulatory factors or more generic problem formulations to allow wider application by the companies with different operational characteristics.

To address this deficiency in the supply chain research, we focus on three main issues. Firstly, we introduce and classify key regulatory factors that can significantly influence the earnings or business operations of multinational companies. We classify them into two main types: domestic and international. The former such as local content rule and corporate taxes govern business operations and trade activities within a country. In contrast, international regulatory factors such as import tariffs and quantitative import restrictions regulate the transnational movement of goods and funds across international boundaries. Secondly, we present two new planning models for chemical supply chains, which explicitly account for domestic and international regulatory factors. The first model addresses the capacity expansion planning problem that is an important class of the strategic supply chain problem, while the other one deals with a production-distribution problem (a supply chain operation problem) for a multi-product chemical company. Both models address regulations pertinent to

* Corresponding author (e-mail cheiak@nus.edu.sg, phone +65-6874-2186, fax +65-6779-1936)

important and significant regulatory factors such as corporate tax, import tariff, etc. We discuss the merits of these two models relative to the existing ones. More importantly, we use them to illustrate the vital need for incorporating multiple regulatory factors when addressing supply chain management problems. For instance, our capacity expansion planning model yields a solution that generates more cash flow by almost \$400 million in a realistic example problem compared to the solution that neglects the regulatory factors.

Our main message through this paper is that regulatory factors cannot be neglected in supply chain design and management problems. Research in this area should focus on more work similar to the one to be presented in this paper.