Environmental Implications of Strategic Supply Chain Decisions: The Role of Location and Scale

Strategic level supply chain decisions such as manufacturing facility size and location have implications for green supply chain goals. In recent years, many firms have embraced key trends in off-shoring by purchasing from or producing in low cost regions of the world. In this situation, transportation costs were fairly low and were not a key factor in these decisions. However, rising fuel costs and environmental concerns have become increasingly significant in recent years. Moreover, regional environmental production regulations also drive facility size and location decisions. To illustrate, due to high gas costs and excessive emissions, companies such as IKEA are relocating their manufacturing closer to their customers in an attempt to reduce the transportation of materials, parts and finished goods.

In this paper, we investigate the environmental effects of plant size and location decisions. We first consider capacity expansion and scale choices, given regional regulations on production emissions. Specifically, we base our model on the CERCLA and the Superfund Amendments and Reauthorization Act for hazardous substances. We propose an algorithm that provides an efficient solution to this NP-complete problem. We also utilize a realistic dataset from the auto industry gleaned from publicly available sources to highlight key results of the model. Through analysis of this data, we identify the environmental limits and penalties that drive the company to compliance. Specifically, we find that stricter regulations without high penalties will not assure compliance as the benefits of increased scale associated with a centralized plant frequently outweigh the regulatory penalties.

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