

manage increased complexity [6]. The information and material flow among the four categories have been theorized [8] to validate the interrelationships between transportation and customer service. Material flow occurs as a result of integration of transportation and distribution systems, and information flow is essential to integrate the four categories.

To implement 3PL, real-time information flow is essential. A framework of 3PL provider functions and evaluation criteria can be derived that revolves around the information flow that affects the 3PL provider functions, as illustrated in Figure 2. First, material is transported to distributed-warehousing facilities. Then, using efficient inventory management and logistics techniques, global warehouses are fulfilled according to customized, dynamic allocation levels. The material is distributed either by 3PL or 4PL global transportation freight carriers, and global customer services including reverse logistics are provided. Here, I detail descriptions of the four categories of outsourced functions, and discuss global information flow.

*Global warehousing.* Customers are demanding just-in-time delivery of material and warehousing. The warehousing component necessitates the strategic placement of global mini-distribution centers. Companies need an efficient end-to-end supply chain, and a single point of failure in warehousing can create disaster in order fulfillment. 3PL providers are ramping up their warehouses by investing in new fulfillment equipment and advanced technologies. Warehousing functions include receiving, sort and direct put-away, directed put-away, wave management, merge and pack-out, manifest documents, label or bar code printing, kitting, and pick/pack activities. Many companies, including Nabisco and International Paper, have outsourced their warehousing operations to concentrate on their core competencies.

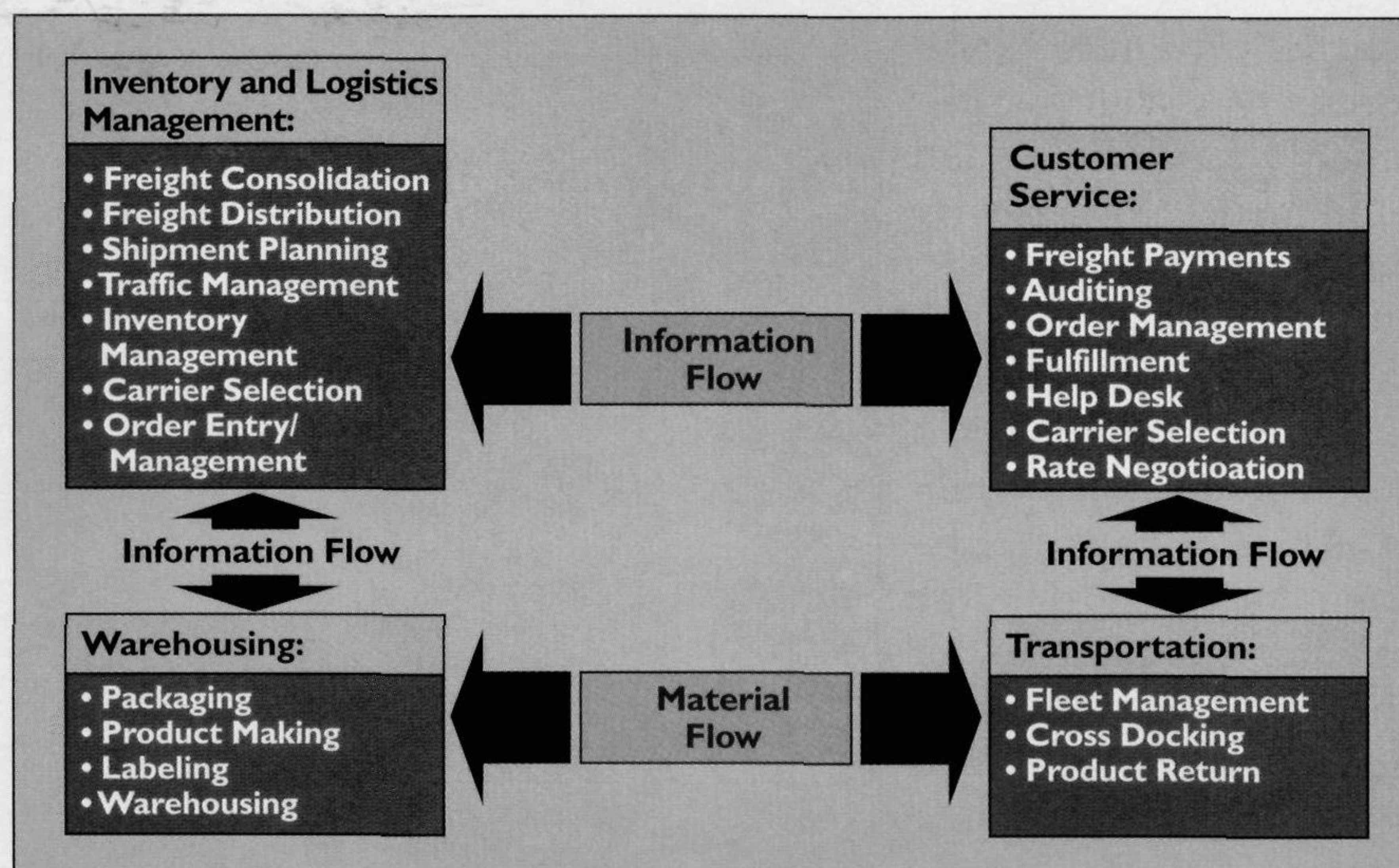


Figure 1. Categorization of logistics functions.

*Global transportation.* This function must be completed by a freight carrier who can move any-sized units by land, sea, rail, river, and air in a timely manner. A partnership effort between the customer and a 3PL provider may be extended to a 4PL provider, but 4PL providers must work with 3PL providers to bring synergy to the information flow and to realize cost savings. Many companies, including Ford, Honey-

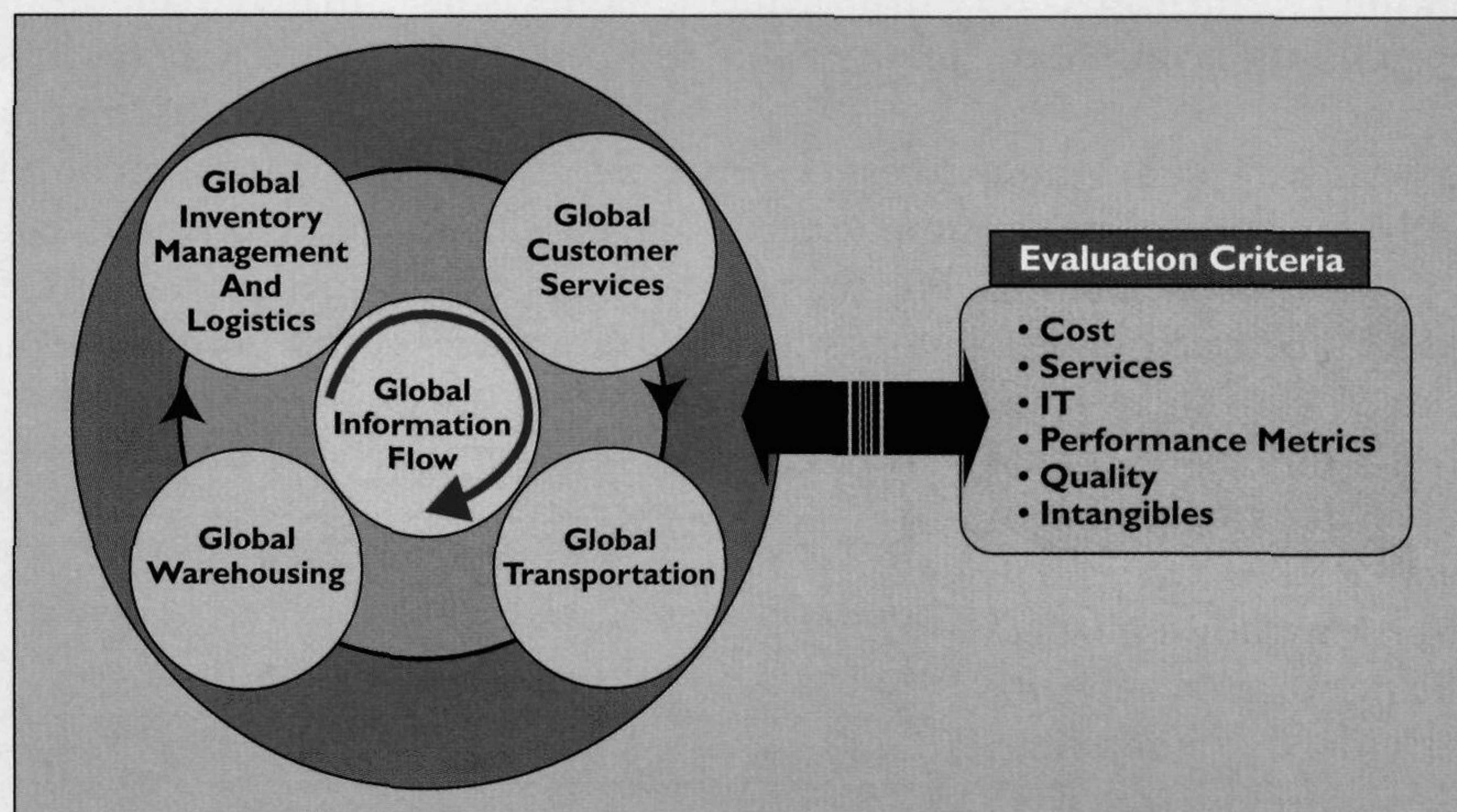


Figure 2. A framework of 3PL provider functions and evaluation criteria.

well, National Semiconductor, and Cisco, have outsourced transportation operations.

*Global customer services.* 3PL providers offer a wide range of customer services including warranty parts recovery, financial services, automating letters of credit (LOC), auditing, order management, fulfillment, carrier selection, rate negotiation, international trade management, and help desk or call center activities. In addition, with the increased returns generated by e-business, 3PL providers are playing a lead role in developing and executing reverse logistics. Many companies, including Nike, Scovill, Oneida, and Cisco, have outsourced customer services.

*Global inventory management and logistics.* This