



## **61st Advanced Manufacturing Forum**

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### **Closed Loop Supply Chains: Product Returns as Value Streams**

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Associate Professor Dan Guide defines a closed loop supply chain as the design and management of a system to maximize value creation over the entire lifecycle of a product with dynamic recovery of value from different types and volumes of returns over time. His research on the business processes for creating successful value streams provided insights into the value recovery of product returns, reuse and remanufacturing.

Product returns represent a value stream, not a waste stream. While environmental concerns can and do dominate entire-body recovery product returns for some industries (computers, cell phones, for example), you still have to figure out what makes sense for the business and what makes money – economic attractiveness. One of the barriers to doing this is valuing the return in the first place (in terms of components and time involved). Done correctly, the supply chain is designed with optimal ways of recovering value at different points in the product's life cycle. This requires conversations with many different stakeholders – accountants, industrial engineers, marketers, vendors, users – because the contracting mechanisms and incentive-alignment mechanisms are not the same as with forward supply chain movement.

Closed-loop supply chain design also requires addressing constraints such as limited access to used products, limited technical feasibility to perform product or component reprocessing and recycling, and limited market demand. Three primary business processes operate in this environment: product returns management, remanufacturing operational issues, and remanufactured products market development.

Product returns management looks at timing and quantity, quality and return rates in order to transport a predictable supply of items with a known quality to the remanufacturing facility. Remanufacturing operational issues include reverse logistics for the testing, sorting, disassembly, repair, remanufacture and disposition of products. Marketing develops channels, remarkets, and secondary markets, and must consider potential cannibalization issues – will the reintroduction of a remanufactured product harm sales of the current generation of products.

Different types of product returns - commercial returns (mostly a U.S. phenomenon, where the customer did not buy the correct item the first time), repair/warranty returns, leasing returns, end-of-use returns (cell phones are a good example), and end-of-life returns (mandatory product take-back by the manufacturer) – will each engender their own “time value”. The longer it takes to put a returned product back on the market, the lower the value to the business. What does this imply for the design of the product and the supply chain?

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**Dan Guide, Ph.D., Penn State**

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Is it economically attractive to remanufacture in-house or perhaps seek to partner with a smaller manufacturer who is more nimble? Guide's research shows that if the product has a low marginal value of time, a centralized, efficient returns process center works best, especially where there are high volumes. It pays to get the items back on the market quickly.

Total Quality Management started out as a very internally-focused process. Quality was thought to belong to the quality control department – find defective products and weed them out before they ever get to the market-place. In the 1980s, the focus turned to designing quality into products to begin with, and to considering the long term cost of getting a defective product into the hands of the customer and the damage that it does...the waste. Now there is a different business model - designing a product and thinking about what is going to happen to it at the end or at various phases of its life cycle. It is wasteful to not consider this, to not look for ways to create value for that product long after it is sold. This becomes a way of enhancing revenue, but only if you stop thinking about it as a nuisance and making it a cost center.

For more information, visit Dan Guide's website:

[http://php2.smeal.psu.edu/smeal/dirbio/displayBio.php?t\\_user\\_id=drg16](http://php2.smeal.psu.edu/smeal/dirbio/displayBio.php?t_user_id=drg16)