



Product deletion and its impact on supply chain environmental sustainability

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In 2009, General Motors decided to discontinue cars sold under the Saturn brand; making a product/brand deletion decision. What if General Motors decided to discontinue Chevy Volt in the future? Although Saturn was a regular product/brand, the Chevy Volt could be considered a 'green' product/brand. Product deletion's implications on environmental supply chain issues can be quite profound, whether it is a green or regular product, whether it is a profitable or loss-making product.

Much of product management influence on environmental issues of the supply chain occurs in early (new product development; eco-design) and mature (improving efficiency; eco-efficiency) stages. Product deletion, typically occurring at the end of a product's life cycle, the decline stage, can also influence a supply chain's environmental and resource conservation practices and outcomes. Product deletion or elimination refers to firms' decision to discontinue, remove, or withdraw a product from its product line without offering a replacement for it (Avlonitis and Argouslidis, 2012). In many organizations, product deletion is a well-planned, proactive, and formalized process led by the product and research and development teams (Shah et al., 2017).

However, supply chain activities such as sourcing, operations and manufacturing, distribution and logistics, and usage to reverse logistics that close the loop, are also influenced by product deletion. The research community needs to consider these strategic 'end-of-life' issues. This 'end-of-life' is unlike the more operational end-of-life that occurs after product usage and has seen research from an extended producer responsibility (EPR) perspective. This article explicates the influence of product deletion on various supply chain activities and provides directions for future research in order to develop and expand this under-researched field at the crux of product deletion and supply chain management.

1. Sourcing

Supplier selection, monitoring, communication, and collaboration are among important sourcing activities. When a product is designed with an environmental focus, a green product, environmentally based supplier selection criteria might be preferred or required for certain materials procurement. If these green products are deleted, there will

be a lesser need for requiring suppliers to have environmentally sound practices; potentially resulting in less resource conservation practices. Thus, green product deletion can result in reduced overall environmental performance of the entire supply chain. However, even regular (non-green) product deletion can result in environmental implications. For example, product deletion may bring a decrease in overall material sourcing, energy usage, and waste output to the environment as the product is no longer being manufactured and distributed.

2. Manufacturing

Environmental aspects of internal operations and manufacturing include policies, systems, technological support, and product design. Certified environmental management systems such as ISO 14000 can be adopted to manage green products. Green technologies including renewable energy and environmentally sound materials are used to manufacture these products. Eco-design is a process technology where the green value of products is implemented. Green product deletion may result in less emphasis on these pro-environmental initiatives. Organizations may trade off the environmental benefits of green products for internal operational investment savings (Bai et al., 2018). Although, without proper planning, the deletion decisions may result in an excess of obsolete inventory of materials and finished components which could add to the waste. Overall, product deletion management and planning can facilitate the collection, remanufacturing, and conversion to new or existing products. Planned reclamation of deleted products can reduce operational and manufacturing waste.

3. Distribution and logistics

Distribution channels, warehousing, packaging, retailing, delivering, sorting, and collection of ordered products are all influenced by product deletion (Ashayeri et al., 2015). Ecological and energy efficiency are important criteria in pro-environmental logistics selection. *Ceteris paribus*, product deletion, by reducing and rationalizing the product portfolio, will result in decreased number of delivery trips due to fewer quantity of product categories and variants (i.e. SKUs). Rationalization across the supply chain provides profound waste reduction

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opportunities. Alternatively, it is possible that logistics infrastructure such as warehouses and delivery trucks could have slack capacity that is squandered after product deletion, resulting in wasted assets and energy resources.

4. Product usage and service

After-sales service and individual consumerism can also contribute to supply chain environmental sustainability. EPR is an important environmental supply chain design issue at this stage. EPR represents an organization's responsibility for a product in its post-usage stage in its lifecycle. When a product is deleted, the attached EPR activities such as product recycling, waste control and reclamation may no longer be needed. An open question remains on whether EPR is in effect after product deletion. If not, then there is a likelihood of poor environmental performance through greater waste generation. A contingency in this deletion situation is whether EPR is required by regulatory policies.

5. Reverse logistics and a circular economy

A closed loop supply chain consists of both forward (sourcing, manufacturing, delivering, and retailing) and reverse (recollecting, repairing, remanufacturing, recycling, and disposing) supply chain activities. Closed-loop supply chains are an important aspect for a functioning circular economy (Kirchherr et al., 2017). Product deletion helps firms to reallocate resources from underperforming products to better performing products. When the product portfolio is rationalized by deleting underperforming products, there will be a decrease in total amount of resources required for the entire product portfolio or the freed resources may be channeled to fortify profitable products in the portfolio. As a result, overall supply chain practices will consume fewer natural resources while creating less waste.

Research has extensively considered operations and supply chain implications from a new product development perspective. Existing investigations have mainly focused on product introduction or growth strategies, but not on product deletion or discontinuation. We completed a precursory review of *Resources, Conservation, and Recycling*, the *Journal of Cleaner Production*, *Resources Policy*, *Waste Management*, *Journal of Industrial Ecology*, and the *Journal of Environmental Management*. We were hard pressed to find any related, even peripheral, research on the relationship between product deletion and its relationship to environmental and natural resources management.

Theories considering product deletion of unprofitable, obsolete or

mature product categories, in general, do exist. However, product deletion has a broader scope of organizational decision-making that could occur at each stage of the product's lifecycle, for several reasons, and impact multiple operational activities and supply chain processes. We understand that environmental sustainability is still a relatively current and novel phenomenon in supply chain management strategies. A major gap in this expanding research stream is the work on product deletion. Product deletion is an under-investigated practice that influences various aspects of supply chain environmental sustainability performance.

Whether these influences and relationships are parlayed to supply chain implications is an open research question. Specific questions include:

- Should organizations design a product with product deletion in mind?
- What are the resources, recycling, and conservation implications with various product deletion scenarios and forms of product deletion?
- What are the roles of supply chain stakeholders including multi-tier suppliers in helping organizations make environmentally sound product deletion decisions?
- How can product deletion aid organizations in achieving economic and environmental win-win outcomes?
- What decision aids and tools should be developed to facilitate product deletion decisions?

A multitude of product deletion decisions are made annually, throughout the world. This pervasive organizational decision has implications for environmental and natural resources management. We are calling on the academic and research communities to further investigate, understand and help guide research and policy on this topic.

References

- Ashayeri, J., Ma, N., Sotirov, R., 2015. Supply chain network downsizing with product line pruning using a new demand substitution. *J. Oper. Res. Soc.* 66 (10), 1699–1716.
 Avlonitis, G.J., Argouslidis, P.C., 2012. Tracking the evolution of theory on product elimination: past, present, and future. *Marketing Rev.* 12 (4), 345–379.
 Bai, C., Shah, P., Zhu, Q., Sarkis, J., 2018. Green product deletion decisions: an integrated sustainable production and consumption approach. *Ind. Manage. Data Syst* (forthcoming).
 Kirchherr, J., Reike, D., Hekkert, M., 2017. Conceptualizing the circular economy: an analysis of 114 definitions. *Resour. Conserv. Recycl.* 127, 221–232.
 Shah, P., Laverie, D.A., Davis, D.F., 2017. Brand deletion. *J. Brand Strategy* 5 (4), 434–450.