Sustainable Packaging: Metrics, Standards, and Best Practices for Materials

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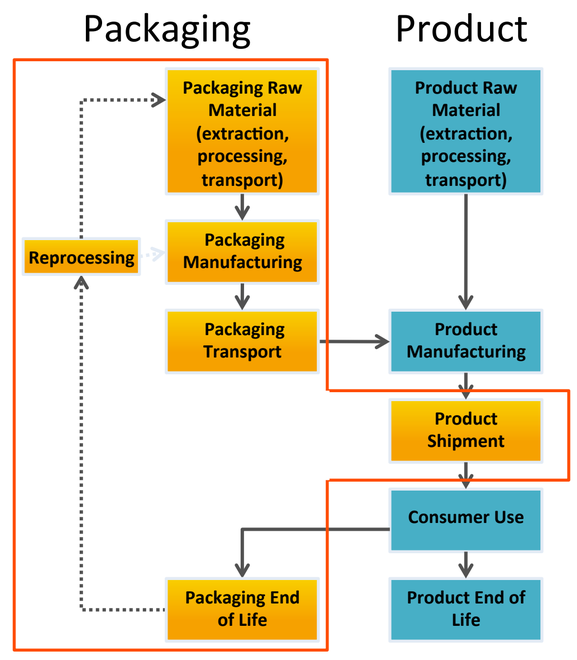
Motivation & Objectives

- The focus of this research project is to determine the best methods for improving the sustainability of the packaging industry. Of particular interest is the establishment of measure for sustainable manufacturing (metrics, best practices, standards/performance measures), and manufacturing processes (resource reduction, material improvement/substitution).
- LMAS research for this project has consisted of:
  - Defining metrics for sustainable manufacturing,
  - Analyzing the supply chain and manufacturing processes,
  - Ascertaining policy and standardization issues
  - Identifying sustainable packaging practices that have been recommended by various researchers and organizations,
  - Analyzing the packaging markets and waste streams over the past decade to investigate the development of trends of the most relevant sustainability practices,
  - Identifying the drivers and barriers associated with the growth of these practices,
  - Modeling and projecting the future uptake of these practices, and
  - considering the sustainability impacts of these trends

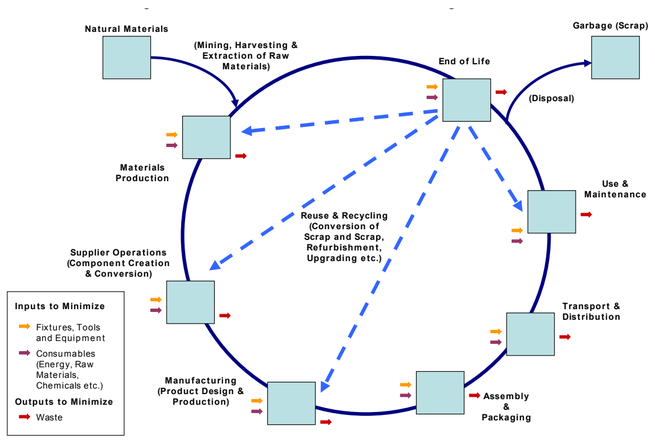
Packaging as a Component of the Supply Chain

Packaging distinctively represents the pressures that producers face in making more sustainable sourcing choices. Of all possible product components, it is one of the most pervasive, as it spans across the supply chain of nearly all products. Also, packaging suffers from a profound image problem. It serves a very significant function by protecting products during transit and storage, thereby reducing the amount of waste that would occur in its absence. Yet, because the utility of packaging occurs primarily before the use phase that it is an ideal candidate for an investigation into the opportunities for sourcing and manufacturing improvements.



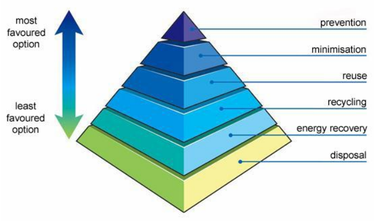
Moving Towards a Sustainable Industry

Providing packing that is sustainable will first require an industry understanding of the traditional pillars of sustainability (attention to economic, societal, and environmental concerns). Then, these concepts must be translated into principles of sustainable manufacturing and further refined into principles and metrics for the packaging industry. Such guides are necessary in order to frame the tradeoffs between important impacts associated with the different ways of manufacturing a product.



Sustainable Packaging Practices

- Several organizations have developed tools and guidelines to help manufacturers make greener packaging choices. These recommendations have evolved out of experience, best practices, and assumptions about the hierarchy of waste Sustainable packaging practices can be organized into three categories, those relating to: sourcing, production, and end of life.



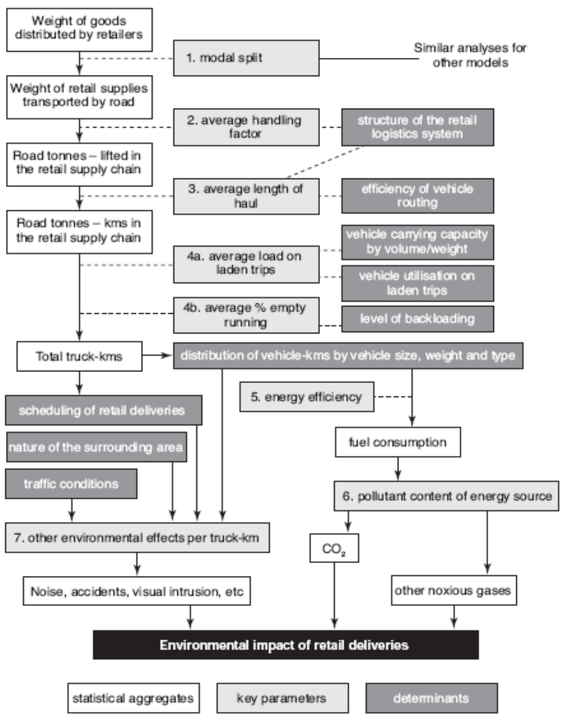
  - Sourcing practices refer to the type of material that goes into the package, such as sourcing from “eco-friendly,” or from recycled stocks
  - Production practices are associated with how materials are processed and handled in the creation and distribution of the package. Examples include packaging designed to have a minimal carbon footprint; packaging that helps achieve efficiencies in distribution and logistics (e.g. pallet efficiency); multi-functional packaging that may be incorporated in with other product components; separate auxiliary refill packaging; packaging whose weight has been minimized; and packaging designed to minimize the use of specific materials in processing such as water or energy.
  - End of life practices deal with what is done with the packaging materials after the product has been consumed. These include making it: biodegradable or compostable; recyclable; and reusable, specifically for another purpose.

Comparing the Potential Life Cycle Opportunities

Each of the sustainable packaging practices has a different potential to improve impacts. By exploring the impacts of each stage of the packaging life cycle, the best practice to improve packaging can more appropriately be identified. In addition generalizations can be made by comparing the practices numerically for specific packaging case studies.

	GHG Emissions					Waste				
	Raw Materials	Packaging Manufacturing	Packaging Transport	Product Transport	EOL	Reprocessing	Fuel Production and Use	Packaging Manufacturing	EOL	Reprocessing
Lightweighting	↓	↓	↓	↓	↓		↓	↓	↓	
Reuse	↓	↓			↓	↑	↓	↓		↑
Recyclable					↓				↓	
Recycled Content	↓					↑	↓	↓		↑
Biobased										
Biodegradable					↓					
Pallet Utilization			↓	↓			↓			

The Contribution of Packaging to Shipping



The influence of packaging on the transportation of the product has been an area of particular interest, as the potential for improvements is far greater. McKinnon and Edwards (2009) present a framework for identifying the opportunities to reduce the environmental impacts of delivering products to retailers via truck. This framework, adapted from the work of McKinnon (2008) maps the environmental impacts of transporting goods to a retailer based on seven factors as can be seen to the left.

Source: McKinnon, A.C. and Edwards, J.B. (2009) 'The Greening of Retail Logistics' in Fernie, J. and Sparks, L. (eds) *'Logistics and Retail Management'* 3rd ed Kogan Page, London.

The Limitations of Current Assessments

In general, the environmental impact of any of the sustainable packaging practices depends largely on how assessments are conducted. This is especially true for approaches focused on the end of life of a package, such as recycling, recycled content, composting, and reuse. All practices, even those that recapture materials, have associated inputs and outputs, relating to collection, cleaning, or reprocessing, to make packaging into a form that is usable. Many of the existing assessments of sustainable packaging practices are not comparable due to differences in underlying assumptions, system boundaries, functional units, impact assessment methodologies, and quality of data. This leads to a great degree of ambiguity in comparisons between the differing proposed trends.

Current issues that may not be appropriately considered in assessments are:

- The shipping impacts of items to be reprocessed to and from China
- Differences in how credit is allocated amongst packaging that is recycled or reused, or that comes from these feedstock
- Assumptions about what may happen to packaging at the end of its life cycle may not be a feasible option
- Shipping impacts can be based primarily on weight, thereby neglecting the volume occupied by products and their packaging

- Continued research is required on the different sustainability practices to achieve products and packaging that are truly sustainable.
  - Future work will involve an assessment of the different evaluative methodologies for supply chains in general, and packaging specifically, to determine the role different considerations play in achieving more sustainable sourcing.
  - In addition issues relating to assumptions about actual versus ideal end-of-life scenarios, the allotment of impacts between multiple life cycles, and the physical contribution of materials will be explored. For instance, LCA practitioner often include provisions for end of life scenarios that are technical possible, such as the capability for a material to be recycled, reused, or composted, but do not consider the realities of infrastructure or consumer behavior

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