

Distinguishing Co-products and Waste using the Rectangular Choice-of-Technologies Model: The Role of Prices

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The reuse or sale of co-products that are the byproduct of main production processes is widespread throughout the global economy. Yet there remain many opportunities to increase this recovery and reuse of byproducts, moving away from linear disposable supply chains to circular recovery supply networks. Many of unused byproducts are deemed waste while the used byproducts are deemed co-products; in reality, the difference between them is the technological and economic capacity to utilize them. How can this subtle dichotomy between co-products and waste be resolved?

Using the Rectangular Choice-of-Technologies (RCOT) framework (Duchin and Levine, 2011), this paper first presents an approach for associating co-products/waste with the production process of a specific commodity and technology. This method, which uses physical input-output data in the primal of the RCOT linear program, has previously been developed to model the co-product "distiller dried grain with solubles", or DDGS, associated with ethanol production that is subsequently used as feed for livestock. This paper proceeds to connect this physical production quantity of co-products/waste in the primal solution with the financial price of co-products/waste in the dual solution. By comparing the prices of utilized co-products to unused wastes, this framework provides an explicit way to define these two concepts while also illustrating how changing costs and technologies can change wastes into co-products, and vice-versa. A hypothetical numerical example is presented for illustrative purposes.

Duchin, F., and S. Levine. 2011. "Sectors May Use Multiple Technologies Simultaneously: The Rectangular Choice-of-Technology Model with Binding Factor Constraints." *Economic Systems Research* 23 (3): 281-302. doi:10.1080/09535314.2011.571238.

Note: This talk is for the special session "Building a Circular Economy: Assessing the Sustainability of New Technologies for Material Recovery and Waste Cycling".