



## Editorial

### Beyond the conventional “life cycle” assessment



Since its concepts emerged in 1960s, life cycle assessment (LCA) has grown to be a major tool to evaluate the environmental performance of products. Today, it is applied to economic activities of all kinds, from extractive industries to services, and of different scales, from process design to global trade. The idea of LCA is indeed compelling. It covers the entire life cycle of a product, from resource extraction, manufacturing, transport, wholesale and retail, to use and end-of-life management. It also strives to cover almost all the environmental stressors that contribute to all the problems facing us, from resource depletion, climate change, smog formation, acidification, eutrophication, to noise, ecological toxicity, biodiversity loss, and human health cancer and non-cancer effects. Embedded in the comprehensiveness is the goal to prevent or minimize burdening shifting across life cycle stages, environmental areas, and regions.

The effort to improve our understanding of how various economic activities affect the environment and our own health is recommendable. However, the simplification of a product's role in our complicatedly knotted global economy to “life cycle” warrants further examination. The conventional, yet still dominant, practice of attributing everything along the life cycle of a product to the service it provides embodies a specific type of supply-chain based thinking with final consumption being the “original sin.” That is to say, everything is caused by our final consumption, and its economic effects only ripple across the supply chain of the products consumed.

There are at least two major problems with this conventional practice of LCA. First, not everything is caused by final consumption, as final consumption itself may be a result of other things. For example, we tend to waste time on Facebook, we regret it all the time, and we even feel guilty and question our self-control ability. But we should also know that there are thousands of computer scientists working tirelessly on the other end of the

screen at Facebook with precisely the goal of grabbing our attention. They do so through design tricks that exploit our psychological vulnerabilities. In this case, causality runs both ways. Our need to communicate in the digital age contributes to the creation of Facebook and their designs increase our consumption of their products.

Second, supply chain can be seen as one pathway of economic effects, but focusing on it exclusively misses other important economic mechanisms, such as the crowding-out effect (Rajagopal et al., 2017; Yang, 2017). For example, simply tracing corn ethanol down its supply chain from ethanol refining and corn production to fertilizer and pesticide production and their upstream processes is of little relevance to our decision whether to promote corn ethanol or not. Due to the land constraint, corn expansion could occur at the expense of natural habitats or other crops, which could further displace natural habitats. They are known as direct and indirect land use changes (Yang, 2016). In either case, environmental emissions of the additional corn would differ substantially from that based on corn supply chain.

Biofuel and bioenergy will remain an important contribution to a sustainable energy future as we continue to combat the climate change (Robertson et al., 2017). It is also an area where LCA has been widely applied. As the Biofuels Research Journal aims to become a leading venue on the topic, we welcome biofuel and bioenergy LCA studies of significant impact. We especially welcome LCA studies employing new approaches, beyond the covenantal supply-chain based linear methods such as process LCA and input-output models, that better model how the market works (Rajagopal, 2016; Yang and Heijungs, 2017).

## References

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Editor

Yi Yang

CSRA Inc, USA

University of Minnesota, USA

Email Address: [yang1385@umn.edu](mailto:yang1385@umn.edu)