

## **Thesis Project Portfolio**

### **Un-fantastic Plastics: An end-of-life analysis of the University of Virginia's Solid Waste Management System**

(Technical Report)

### **Reduce, reuse, rebrand?: the role of marketing in sustainable consumer engagement with food waste and food insecurity**

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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## **Sociotechnical Synthesis**

The onslaught of the Covid-19 pandemic and attention to the dangers posed by climate change have shifted the focus of innovation in the solid waste industry. Public institutions, private businesses, and individual consumers have adapted their practices in an effort to reduce their impact on the environment. Diverting waste from the landfill to other facilities that can recycle or reuse the materials has been one solution to reducing the impact of landfills in a society of increased consumption and rampant disposal. Another challenge posed by climate change is the dwindling of finite resources. Many organizations have altered their missions to promote access to affordable and equitable nutrition. However, the challenge with food loss and waste (FLW) and food insecurity is optimization. What are businesses and consumers doing to maximize the benefits of keeping materials in circulation rather than disposing of them in the landfill? How can they divert those foods to communities that need them? This investigation seeks to address the challenge of food systems' sustainability by examining the role of marketing techniques and the circular economy in promoting sustainable food management practices across various interest groups as well as the practical application of solid waste management systems' adaptation to regulation at the University of Virginia (UVA or the University).

Released in 2015, the United Nations 2030 Agenda for Sustainable Development sets seventeen goals for combating the climate crisis, improving health and education, reducing inequalities, and promoting economic growth by 2030 (United Nations, n.d.). The agenda prompted other organizations to draft plans for combating climate change by 2030. The University of Virginia, for example, outlines a "30 by 30" program for waste footprint reduction, potable water consumption reduction, carbon neutrality, and sustainable food purchases

promotion by 2030 (Darden School of Business, 2020). The SDGs challenge businesses to advance the global agenda through a commitment to innovating sustainably.

The University of Virginia is at a crossroads with composting and recognizes that the waste stream must change if UVA is to meet the Sustainability goals and contribute to addressing the challenge of FLW and distribution. The ban on single-use plastics (SUPs) across the Commonwealth of Virginia, established in March 2021 under Executive Order No. 77, pushed the University to adapt the status quo waste management system for more compostable materials in the waste stream (VDEQ, 2021). The UVA Sustainability 2020-2030 Plan is another driving factor in reducing the waste to 30% of the University's 2010 tonnage while striving to make University operations carbon neutral and eventually fossil fuel free.

The "Un-fantastic Plastics" capstone group has seven team members and is led by advisors Dr. Lisa Colosi Peterson and Dr. Lindsay Ivey-Burden of the UVA Engineering Systems and Environment department. Team members were tasked with developing a model that evaluates the past, current, and potential waste management of University goods in relation to the 10-year UVA Sustainability Plan and Virginia Governor Ralph Northam's ban on SUPs. The largest constraint is the lack of consistently collected and reported data as it pertains to composting, landfilling, and recycling facilities; the model required numerous assumptions guided by scholarly sourced literature.

The Un-fantastic Plastics team created a model which reflected the following parameters for each waste stream: landfilled, composted, and recycled mass in tonnage; global warming potential (GWP) measured in metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>E); energy measured in million British Thermal Units (mmBTU); and, cost in U.S. dollars (USD). The target parameters were evaluated annually for the pre-ban scenario of calendar year (CY) 2018

and semi-post-ban scenario of CY 2021. Alternative waste management scenarios were built into the model, based on the complete tonnages of 2018, to reflect systems of 50% plastic reduction and to compare two composting facilities of interest to UVA Facilities Management (FM). The model was developed using Microsoft Excel software.

The results of the model indicate that there may be a tradeoff between the University's waste reduction and carbon neutrality goals, as emissions due to decomposition and transportation of solid waste appear to contribute significantly to the total target parameters of all three waste streams. Further investigation is necessary to determine more accurate facility-specific estimates for calculations of the target parameters and more confident recommendations for potential SWM systems' configurations at the University of Virginia. Altering SWM systems to adapt to regulation and changing perception is consistent with the furthering of the circular economy that addresses the importance of optimizing FLW and insecurity through various marketing and media strategies.

## References

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