TAUBER INSTITUTE
FOR GLOBAL OPERATIONS
UNIVERSITY OF MICHIGAN

Recycling Ocean Plastics into the Supply Chain

In sponsoring a student team project at the University of Michigan Tauber Institute for Global Operations, Dell Technologies presented the challenge of developing an Asia-based ocean plastics supply chain for product packaging, designed to significantly reduce the total landed cost of ocean plastic by 73% over the current state.

Dell has been an active sponsor of Tauber team projects since 1999 and is represented on the Tauber Institute's Industry Advisory Board by Piyush Bhargava, its vice president for global operations. The Tauber team for this project consisted of **Dan Partin**, working on Master of Business Administration and Master of Environment and Sustainability degrees, and **Allison Ward**, a member of the Engineering Global Leadership Honors (EGL) program which leads to BSE in Materials Science Engineering and MSE in Industrial and Operations Engineering degrees.

The Challenge: To Identify and Justify the Best Market for Ocean Plastic in Dell Asia's Packaging Division

Dell Technologies is one of the largest privately held global companies and provides a broad range of technology products for the consumer, education, enterprise, and government sectors. In addition to its line of desktop and notebook PCs, Dell offers network servers, data storage systems, printers, Ethernet switches, and peripherals such as displays and projectors. With the recent acquisition of EMC Corporation, Dell Technologies is also one of the biggest storage and enterprise services companies in the world.

Dell has a rich history of supply chain and packaging innovation. As part of its commitment to ocean health outlined at the 2017 United Nations Oceans Conference, Dell pledged to source and incorporate 10 times its current ocean plastic usage into its packaging, up to 160,000 pounds cumulatively, by 2025.

More than 8 million tons of plastic enter the ocean each year, a growth rate that by 2050 would result in more plastic in the ocean than fish. Dell's strategy to tackle this looming environmental crisis is to create a supply chain that intercepts land-based mismanaged waste within 50 kilometers of the shore, targeting plastic at its highest economic value and addressing the root cause of ocean plastic early in its life cycle. In 2016, Dell conducted a pilot in Haiti to source and incorporate 16,000 pounds of ocean plastic into a packaging tray for Dell's XPS 13-inch notebook. This Tauber project adapted the Haiti pilot to South Asia to capitalize on regional economic advantages and target the world's leading source of ocean plastic.

> "The Tauber team project at Dell benefited from exceptional individuals and interpersonal dynamics across the board. Partin and Ward took the challenge of their project and ran with it."
> *Steven Skerlos – College of Engineering*

"Ocean Plastic is at the core of the Dell 2020 Legacy of Good." said Oliver Campbell, Dell Technologies director of procurement and packaging engineering. "Already several key products are using ocean plastic in their packaging and we are continually increasing our efforts to benefit local communities and the environment globally. Finding and utilizing long term sustainable sources of ocean plastic is vital to our sustainability goals and our work to pioneer this method of plastics procurement."

Ravi Anupindi
Ross School of Business

Steven Skerlos
College of Engineering

Above, L to R: Allison Ward and Dan Partin

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L to R: Allison Ward and Dan Partin

Dell engaged the Tauber team and set the stakes high. The team's goal was an improved waste management infrastructure that would result in not only improved communities, but also remove millions of plastic bottles' worth of material from the ocean. Better yet, Dell believes the process can be replicated and brought into other regions of the world, exemplified by its long-term goal of reducing ocean plastics enough to make the business no longer necessary.

The scope of the project included:

- Research study on global ocean plastics supply chain possibilities
- Identifying and justifying the best market for ocean plastic in Asia
- Scope plan and required work documents for supply chain initiation in the chosen market
- Life Cycle Cost Analysis (LCA)
- Implementation plan for ocean plastic supply
- Short term and long term supply strategy

"South Asia – countries like China, Indonesia, Philippines, Vietnam, Thailand – are almost 60% of the contribution to ocean plastic pollution, so we really gave Tauber Team Dell a clean slate to figure out how we wanted to scale the supply chain in any one of those countries, and coming up with a fact-based recommendation that we can take forward and implement in the next six months," said Bhargava.

Ward said, "Our summer internship project was to create a supply chain that would help Dell source more ocean bound plastic for its packaging in an environmentally and economically friendly way. We'd do that by extending the supply chain from Haiti to South Asia."

The Outcome: A New, Cost Effective Supply Chain and $350K+ Savings in One Year

Here are some of the ways the Tauber team reached these goals:

- Developed a scalable and cost-effective supply chain to source ocean plastic from Southeast Asia, reducing raw material costs up to 73% while diversifying the supplier network
- Reduced manufacturing costs by 51% with a sourcing allocation strategy, allowing Dell to effectively remove the equivalent of 3.6 million plastic bottles from the ocean annually
- Collaborated with key stakeholders to analyze and recommend potential next use cases for Dell to exceed a public goal by 700%, totaling 1.1 million pounds of recycled plastic annually

Holistic Approach

The scope of work described in the project had its challenges. Faculty advisor Steven Skerlos pointed out that "Generally, operations projects begin with known inputs and a tried and true supply chain. This project had to concern itself with material quality questions as well as a question of who would supply the ocean plastic. Navigating extra layers of complexity and uncertainty was a hallmark of the students' performance and a testament to their determination and skill."

"The students had to establish contact and engage themselves quickly with a complicated reverse supply chain." said Skerlos. "They traveled to China, Indonesia, and India and created meaningful relationships leading to fast iteration on supply chain opportunities."

"Finding ocean plastic was only the first step in the journey." said Ward. "We knew other important supply chain factors must be taken into consideration, such as cost and continuity of supply, but a key focus of our project was to deliver additionality."

"This meant we had to demonstrate that Dell's intervention would make a positive impact on ocean health that would not have been created otherwise. To do so, we created a holistic strategy that would improve the existing waste management structure, targeting the root cause of the problem, not just a symptom. This approach considered the livelihoods and practices of informal sector collectors, local beach clean-ups and community outreach programs, and increased demand for low value plastic."

The Tauber team first defined a cost-effective supply chain for ocean plastic that could be scaled to meet growing demand. Building on previous research, the team defined viable sourcing locations of ocean plastic based on the availability of mismanaged waste, processing infrastructure, and logistical simplicity. Onsite visits in South Asia validated ocean plastic availability and confirmed the capability of local suppliers to source, clean, and process the material. Pricing, capacity and quality certifications were modeled

with logistics, manufacturing costs, taxes, and risk factors to define optimal supply chain scenarios for delivering ocean plastic resin to current Dell manufacturing sites in China, as well as scenarios that co-located manufacturing in regions with suppliers.

The Tauber team went to Shanghai and Xiamen in China, and Chennai in India. The team then identified and recommended that Dell certify three Indonesian and Indian partners as viable sources of ocean plastic and co-locate packaging manufacturing in these countries. The proposed supply chain delivers scalability, with the production capacity to source nearly 500 times Dell's commitment for ocean plastic usage, or the equivalent of 1.8 billion plastic bottles annually. It also reduced the total landed cost of ocean plastic by 73% over the current state, and by 31% and 16% against prevailing recycled and virgin plastic prices, respectively.

Co-locating manufacturing of the current XPS 13-inch packaging tray with sourcing also reduced manufacturing costs by 54%, saving Dell more than $350,000. At the conclusion of the project, the Tauber team successfully delivered an innovative supply chain capable of delivering scalability and cost-effectiveness to both Dell and other like-minded companies.

The team's work also benefited from the involvement of Dell Technologies. Ward said, "It was a daunting task, but through collaboration inside Dell, with external experts, and with the support of the Tauber Institute for Global Operations at the University of Michigan, we proved out a model for Dell that could make an ocean plastic supply chain a reality."

Leadership, Changing the World

Campbell shared with the Tauber team that Dell's work on the ocean plastic initiative was highlighted on Fortune magazine's list of 50 companies which are changing the world. "I think the Fortune article really speaks to your leadership and the Tauber/Michigan advantage which you brought to the initiative." he said.

Lessons Learned Along the Way

In addition to the obvious advantage of doing significant work at a top-tier company while still students, Tauber team members learned about these elements:

- Visiting India opened their eyes to the extent of the ocean plastics problem. It was very humbling to meet the informal collectors and it put their heart behind the project even more.
- Ocean plastic goes beyond just beach clean-ups. The root cause is unmanaged waste infrastructure, which needs to be developed to fully address the problem.
- There are many stakeholders, both internal and external, that are affected while creating this supply chain. It was important to collaborate and gather perspectives from all parties.
- Addressing ocean plastic not only has an environmental impact, but also creates economic opportunities in Indonesia and India for collectors, processors, and manufacturers.
- Dell is truly behind the ocean plastic cause and catalyzing industry change. The project goes beyond just Dell by creating a working group to dramatically increase the impact on ocean health.

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Dell Technology Team

Student Team
Dan Partin – MBA & Master of Environment and Sustainability

Allison Ward – EGL (BSE Materials Science Engineering & MSE Industrial & Operations Engineering)

Project Sponsors
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Adam Bushong – Project Manager, Ocean Plastics Initiative

Oliver Campbell – Director of Procurement and Packaging Engineering

Faculty Advisors
Ravi Anupindi – Ross School of Business

Steven Skerlos – College of Engineering

About Tauber Team Projects

Each two- to three-person Tauber team consists of graduate students in Engineering, MBA, and/or MSCM programs. Along with receiving high-level corporate support from the sponsoring company, each team is advised by a College of Engineering and a Ross School of Business faculty member, and overseen by a Tauber Institute co-director. The projects begin on-site in May and continue for 14 weeks. Students present the results of their projects and compete for over $40,000 in scholarships at the U-M Tauber Institute's annual ***Spotlight!*** event, held each September in Ann Arbor, Michigan. ***Spotlight!*** provides outstanding opportunities for students and corporate partners to establish relationships while exploring innovations in operations and manufacturing.

The 2017 Tauber team projects resulted in $575 million in savings, according to sponsoring company calculations, an average of $18.5 million per project over three years.

To learn more about the Tauber Institute for Global Operations, visit tauber.umich.edu or contact us at 734-647-1333.