

Corporate Sustainability

Grand Challenge Area: *Sustainability*

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Entrepreneurial Experience

Entrepreneurship is identifying a need and working within constraints in order to develop a solution. It is creation: an ability to integrate resources towards building a viable product or service. It is enabling a team of diverse individuals to work towards a common vision. Entrepreneurship is one of the arts that I gained the most experience with during my time at Olin. My experiences started with an introductory entrepreneurship course, *Fundamentals of Business and Entrepreneurship*, in my first year that deepened through *New Technology Ventures*, which focused on technology entrepreneurship and *Entrepreneurial Finance*, which focused on cash flow management and options for raising capital. Outside of coursework, I joined the board of the student entrepreneurship club, completed a two-year Fellowship program at a venture capital firm in Boston, organized informal field trips for Olin students to meet local entrepreneurs, and became a course assistant for the introductory entrepreneurship course. Here is how this story unfolded.

My interest in entrepreneurship, unbeknownst to me, has grown from my early childhood. My parents have owned a small, family restaurant in St. Louis, MO for the past twenty years. I spent much of my childhood in my father's office looking through the menus, receipts, and other documents that showed evidence of the operating business. At least once a year, he'd sit me on his lap and tell me that there are two types of businesses: one that is well-established and has a proven model of operation and another that is new and has a small chance of success. He'd tell me that his interest in this particular type of business stemmed from his desire to be self-employed, able to control his own schedule, and that he did not have a particular interest in the more risky type of business. Innocently, he'd comment that for "a day dreamer" like me, this just may be something to consider.



Figure 1. The entrance of our family restaurant, Cusanelli's. St. Louis, MO.

Entering college, I did not have a definition for this more risky type of business. I did not know there was even a term for it until I saw an Olin requirement, *Foundations of business and entrepreneurship*. I enrolled and through reading articles, case studies, and hearing personal stories from our instructor, I learned that entrepreneurship was broadly about seeing a need and developing a solution to address it. For the final project of the course, I worked in a team of six to establish a custom postcard design and printing business for our college. We determined that the school needed small memorabilia in their store to offer visitors. Our team had all the necessary photography and design skills in order to address this need. We reached out to suppliers that take designs and print postcards in bulk. Ultimately, we made \$1500 in the two week project. My biggest takeaway from this experience was seeing that

entrepreneurial ventures are within reach and, with some hard work, very much implementable. Postcards were not an innovative product; however, our venture created a new, viable and needed product for the school.



Figure 2. One of the five postcard designs. Photo taken by Erik Kolker and designed by Shane Moon. Needham, MA.

I applied this concept again in my second course, *New Technology Ventures*, which pushed me to start a new technology venture starting with existing technology. The products designed here were, by nature, more complex than postcards and the customer base was larger than our one school. I worked with a team to develop a venture that offered a radio-frequency identification (RFID) system for movie theaters: members would be able to pay a subscription fee to watch a finite number of movies per month with a convenient way to enter the theaters. The project was focused on business plan development instead of implementation. Through the experience, I learned that more complex systems do require more careful planning. We had to experiment with various financial projections in order to understand if it could be a viable service. We had to meet with countless theaters to validate whether the service could be implemented. We had to speak with many manufacturers to assess the technical feasibility of the RFID system. I learned that business plans are useful, not only in providing detailed narratives of the daily business activities, but also in serving as a set of guidelines on how to turn an idea into a viable product or service. Moreover, my main takeaway was in seeing that building a scalable new venture requires an integration of my two experiences: making a real product to get out to real users as we did with the postcards and careful planning to evaluate the viability of the business as we did with the RFID system.



Figure 3. Inspiration from the AMC MovieWatcher card and an example of an existing RFID reading system. Needham, MA.

Here is another important lesson that I learned through these experiences. Entrepreneurship is much more than a topic; it's a spirit. As such, my interest in entrepreneurship extended well beyond coursework. I joined the board of the entrepreneurship club in my sophomore year to learn from and about others at my school that also had an interest in entrepreneurial work. I soon learned that the club's role was to provide resources to students that already had operating ventures, although this was a very small subset of our student population: the club consisting of a six person board reached only three active members within the Olin community. I saw an opportunity to reach the other students who, like me, were interested in learning more about entrepreneurship but may have not had any previous exposure to it. Our club president vehemently agreed to support the idea and we kicked off the next year by holding an event open to all students to ask them what they considered entrepreneurship and how the club could support them in learning more. We validated that a large group of students on campus for whom entrepreneurship was just a term they heard in our school's introductory course and they were curious to learn more about. Throughout the year, we connected students to entrepreneurs in the community. We brought in speakers such as Brad Feld, an engineer turned entrepreneur; coordinated rides to events in Boston, such as college entrepreneurship night at the Microsoft NERD center; and created events to see local startups, such as Witricity, the maker of wireless electric power components. We also lowered the barriers to moving students' ideas into ventures by providing small funds to allow prototyping, physical space to work in, and web hosting space to reach real users. This experience of rebuilding the entrepreneurship club was an entrepreneurial venture in itself. I learned that entrepreneurship can start from an existing organization: it is also in transforming these establishments by revisiting the need they serve. Moreover, I learned that there was a large and welcoming entrepreneurial community just outside of our campus of which I wanted to see more.



Figure 4. The Olin Foundry logo. Needham, MA.

I acted on the interest to see more of the greater entrepreneurial community by joining the two-year fellowship program at .406 Ventures, a venture capital firm located in the financial district of Boston. The program gathers a select number of technically-minded and entrepreneurially-driven students from across the East Coast. The hope was that by learning about the venture capital process and through inspiration from their peers, the students may become better prepared to start their own ventures. Through the program, I met with countless startups and entrepreneurs and saw firsthand the great diversity that exists in entrepreneurial world. Each person I met had a unique story. They inspired in me a new set of motivations and encouraged new ideas. The main takeaway of this experience was a renewed, focused interest in the engineering concepts I was learning at school. I wanted to be an entrepreneur, to create new viable products and services that met people's needs and I saw the need to keep developing the technical skills that enable me to create such product-service systems. In this way, entrepreneurship became the fuel for my engineering studies.

My entrepreneurial experience has come full circle. It began with an introductory course in my first year, and now, in my last year, I am a course assistant for that introductory course. Now it is me who is asking students about their interests and passions and guiding them to identify needs that are yet to be met. As I am advising and supporting new students, I am also learning much about the field of entrepreneurship and I certainly hope that I share the sense of excitement with the student I work with.

Global Awareness

I am Korean-American: I was born in the United States and raised by two immigrant parents. My life has always existed at that hyphen. Every day, I spoke English at school and was spoken to in Korean at home. Every year, I stood under fireworks on the Fourth of July and bowed for blessings on the Lunar New Year. As with any intersection, I always felt a tension between the two worlds and was aware that there was a country and lives that were a part of me but that I had not experienced firsthand. Unfortunately, I had also always struggled with speaking Korean, and as a result did not want to live in Korea, even temporarily. Interestingly, this attitude extended to other countries, as well; I thought that if I did not want to travel to Korea, I should not want to travel to any other countries. I therefore entered college with a guilt and an unwillingness to experience other cultures.

In college, however, I met people with such an eagerness to learn about the world outside of their own. In my first month, I overheard a Junior speaking about his journey through Laos. He had been studying abroad in Korea and traveled to Laos for an excursion. While there, his tour group was lost in the jungle after sunset and found by a group of men holding machetes. They were led back to a village, where he was sure he would be killed. Instead, they were greeted by welcoming smiles and a feast to honor them as guests. The experience had pushed him to his limit—the closest he had ever felt to death—and, in that he had found trust, friendship, and hope. I was amazed by the story, and even more amazed that he had felt such a connection to people with whom he did not share the language. He did not exchange a single commonly understood word the entire evening, but walked away with a commonly shared experience.

I heard countless stories similar to this one, stories of discovery through meeting new people in new places. I was curious what stories lay out there for me, what kind of discovery I could make in meeting new people in new places. So, in my sophomore year, I committed myself to finding a summer opportunity that allowed me to travel outside of the U.S. Still uncomfortable traveling without knowing the language, I sought group opportunities in which I could be with people who did. I found and was accepted into a program that introduced undergraduate engineering students to the field of energy research. The program kicked off with a two-week tour of universities and businesses in the energy industry. It valued global research and, as such, the tour was through Shenzhen and Hong Kong.



Figure 5. Group of undergraduate engineering students in Hong Kong.

During those two weeks, I met with over a dozen people dedicated to work in reducing our global energy consumption. Some were professors at universities leading research projects that ranged from increasing energy efficiency in consumer appliances to developing new sources of biofuel. Others were business leaders and engineers at companies that provide energy, such as the CLP Group and local power plants. My main takeaway was that people were solving similar problems across nations and that language was not a barrier to learning and moreover to collaborating on that work. I saw professors who had brought us on the trip working directly with the leaders in China regardless of having a shared language. The experience eliminated the main obstacle that was keeping me from wanting to travel! I wanted to learn about new cultures, to meet new people, and to visit new places, and I was now prepared to do so without the fear of not knowing a foreign language.



Figure 6. Smiling with students in their classroom in Busan, South Korea.

I finally visited Korea in my junior year. My older sister was teaching secondary school in Busan through a Fulbright scholarship. I went to see her and to experience the world I had always felt was a part of me. I sat in on her class and saw an array of desks. In Korea, a student is given a seat in a classroom and the teachers rotate in and out of that room. The desks are ordered and face the front of the classroom where the teachers stand. Interaction is between the pencil and paper. Life revolves around scores and success teeters on the rank of the university for which the student qualifies. Sitting in the classroom, I automatically compared such traditional lecture-based methods with my own educational experience. I reflected on my education more during that day sitting in the back of a classroom in Korea than I had in sixteen years of schooling in the United States. My main takeaway was that experiencing new cultures has an introspective result beyond just being an 'eye-opening' event. By experiencing a new culture, I naturally reflected on my own and gained a better understanding of my own life. I thus learned that I was limiting my own growth by shutting out the world outside of the United States. I learned that we get to determine the size of our worlds and that I want to strive, always, to expand mine.

Service Learning

I am fortunate to attend a college that provides numerous resources for our development as engineers. We, as students, have access to funding and tools to turn our ideas into physical realities. We test concepts and iterate designs and ultimately prove that our ideas are technically feasible. The downside to such a supportive environment is that we become accustomed to designing overly-wasteful solutions. In my senior year, I completed a service learning project in international development. I worked with HERObike, a small social enterprise combatting poverty in Greensboro, AL, through the sale of bamboo bicycles made from locally-grown bamboo. In the process, I learned that engineering is not just about creating what is technically feasible. It is about creating what is also sustainable, viable, and elegant.



Figure 7. HERObike storefront in Greensboro, AL.

Background: The poverty rate in Greensboro, AL, is 44.2%, nearly three times greater than the national average of 15%. HERO, the Hale Empowerment and Revitalization Organization, was started as a non-profit in 1994 to combat the rising poverty rates of Greensboro and its greater community of Hale County. HERObike is an extension of HERO. The goal is to become a stand-alone, profitable business that creates employment opportunities for adults and job skills training for at-risk youth in the area.



Figure 8. HERObike bamboo bicycle. Greensboro, AL.

For my senior capstone project, I led a team that partnered with HERObike. At the time, HERObike was unable to make a profit that supported any employment opportunities for adults or at-risk youth. It was failing in its mission. Moreover, it had a sole employee who was hired to lead the business towards becoming profitable. This employee was also expected to build the bamboo bicycles, to fulfill orders

and, as such, did not have time to run and improve the business. My team identified the need to free up the human resources and worked to reduce the building time of the bamboo bicycles.

We quickly identified that 62.5% of the building time was spent sanding down carbon fiber used to make the joints. I was the lead engineer on the team and headed the design of a new lug made of metal. We then needed to develop a method of attaching the tubes of bamboo into the metal lug, yet it would eliminate the old carbon-fiber joint. We sent the part out for a quote and learned that it would require thousands of initial capital to manufacture the mold for the part. The metal lug had solved the problem but was not a solution for the small startup that HERObike was. I realized in this moment that I had never before had to develop a technical solution that was not only technically feasible but also economically viable.

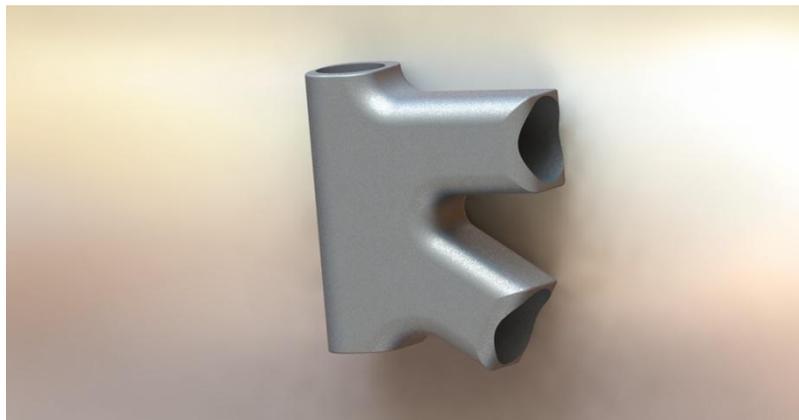


Figure 9. CAD for metal lug. Needham, MA.

Therefore, I brought my team back to the drawing board. In the end, we delivered a solution that improved the process of building the carbon-fiber joint. If the builder laid down a smoother carbon fiber layer, it greatly reduced the time of sanding. Moreover, there was an unmet desire of HERObike customers to have customized joints. Customers had expressed desire to have a choice in the color and texture of the joint. Our solution included an external aesthetic layer of wrapping that eliminated the need to sand the carbon fiber underneath. This solution was appropriate given the additional capital constraint.

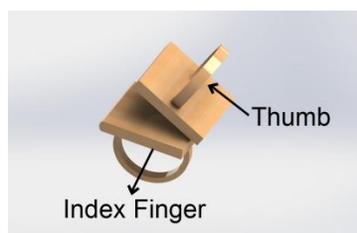


Figure 10. Wrapping tool to help builder lay down a smoother layer of carbon fiber. Needham, MA.

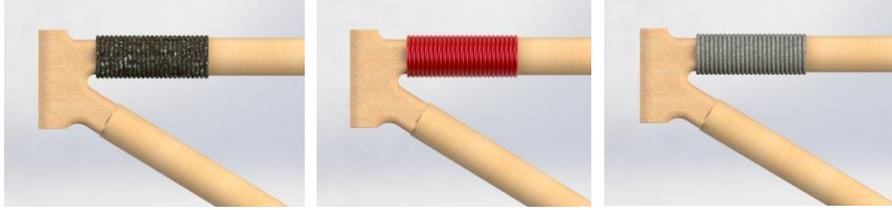


Figure 11. Examples of the customizable nature of the aesthetic wrapping method.

Interdisciplinary Experience

I chose to work with HERObike for a second semester, because I wanted more experience developing solutions with constraints beyond technical feasibility. Another unmet need was that HERObike had a large subset of people who wanted to support its mission by purchasing a product, but could not afford to buy the costly bamboo bicycles. We set out to answer the question, “What product can HERObike offer at a lower price range that would allow customers to support the venture without the need to purchase a bamboo bicycle?”

In order to answer the question, we first tested assumptions of who our customers were. This user-centered aspect of our process stemmed from the user-centered design methodology that every student at Olin College learns in his or her second year. In this project, we had two users. HERObike was our immediate user since we were developing a product that had to align with its goals of building hand-manufactured products made from locally-sourced bamboo. HERObike’s customer was our indirect user since we had to develop a product that they would want to purchase. Thus, we applied the user-centered design process early on to inform our product development process. I had learned that design methodology was a powerful tool in technical design, because it places constructive guidelines on an otherwise unconstrained problem space. We could have spent months talking about solutions that answered the initial question; instead, we made strategic progress in developing a solution for the people who would use our creation.



Figure 12. First iteration of the design process. Identifying user needs and values and ideating product ideas. Wellesley, MA.

Given the context, we decided to prototype bamboo bicycle tire levers. The tire levers were consistent with the small-manufacturing, bamboo-made, bicycle-related story of HERObike. Moreover, it could be offered at our desired pricing point of tens of dollars. Design methodology had led us to identify a bamboo product to prototype. The next step was bringing in materials science understanding in order to begin prototyping. We read books on bamboo’s material properties and learned the techniques of working with uncured bamboo. We would have to harden the bamboo by heat-treating it with a torch. We learned that as strong as bamboo is, no power tools are necessary in cutting in lengthwise because it naturally splits in this direction. We cut the samples to width by tapping a blade down its length. Then

cut the samples to length using a band saw. In the process of prototyping the product, I had integrated materials science understanding with building skills I gained in my mechanical engineering curriculum.



Figure 13. Evolution of the bamboo tire levers. Needham, MA.

Lastly, after producing a working physical prototype, I brought in my experience in graphic design in order to customize the tire levers. I created a design and etched it onto the bamboo. I made note of the kerning, tracking, alignment, and measure of the letters. As such, I had integrated my artistic experiences with my scientific understanding and technical skills in the process of taking a technical design to its polished finished stage. Each aspect had played a crucial part of the final product, which I was immensely proud of.

Grand Challenge Project

My interest in sustainability rose from a multitude of conversations with my design professor. As previously mentioned, all Olin students are required to take a course in user-centered design in their sophomore year. I was fascinated by the user-centered design process because it put a methodology to the core aspect of entrepreneurship that I loved: identifying a need and developing a product or service to address it. The design process helped me answer the question, “Once you identify a need, how do you know what product or service to develop?” After the introductory course, I wanted to gain more experience with the design process, so enrolled in Sustainable Design following the design professor who taught it.

The focus of the course was to get us to acknowledge that product design was not only about feasibility or even viability, it was also about responsibility. We were responsible as designers to create products that would not add harm to people and to our environment. We were responsible as engineers to understand the materials we used and the processes of transforming those materials into our final products. Before this course, I saw products as objects that ranged between what I received in a package to what I eventually threw out into the trash. Through this course, however, I saw that products began as raw materials and oftentimes ended as unrecyclable landfill. This new definition inspired me to think about all the stuff I owned and my impact on the world as an individual.

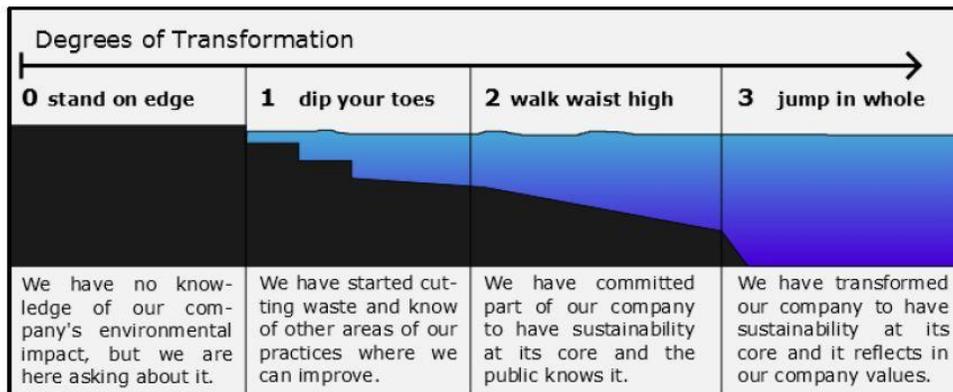


Figure 14. Varying degrees of corporate sustainability. Needham, MA.

Driven by my entrepreneurship experience, I then began thinking about the impact that companies had as a whole. At the time, the phrase “Going Green” was heard on a daily basis and splashed across popular media. I realized that I did not know what it meant for a company to go green but that, without knowing exactly what it entailed, I wanted my future company to be environmentally conscious. I dedicated my final project in the course to understand corporate sustainability. I conducted a comprehensive literature review into thirty years of corporate sustainability research and abstracted takeaways into a five-page primer. I learned that corporate sustainability exists in varying degrees. At a minimum, it revolved around costs savings by eliminating production waste. At a maximum, it involved reorganizing companies around a central value and commitment to sustainable practices. I made a

framework through which companies could identify their current level and understand the relevant issues of proceeding to the next.

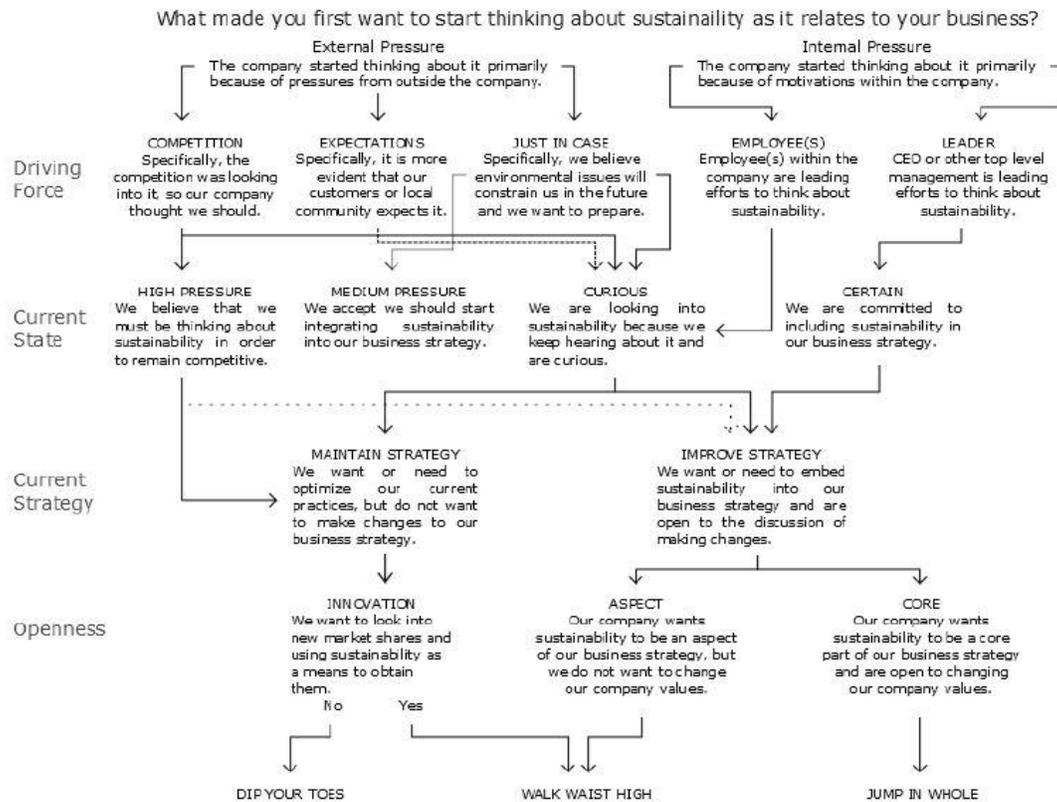


Figure 15. Framework for identifying company's current level of corporate sustainability.

Off of this work, my professor recruited me to the *Sustainable Design Lab* at Olin College. I spent the next year working closely with a company in Boston that makes consumer products from recycled plastic. The business trend of the time was the Sharing Economy, a revolution to companies that offered access to products rather than selling ownership to them. I worked to understand the space, so that I would be able to advise companies on the new product-service systems they could create to encourage more sustainable uses of their products. In particular, we looked at whether the company in Boston could make sharing of kitchenware party kits viable and scalable. My main takeaway was that the organizations that we create are oftentimes grounded in the same values that we have as individuals. My new system of values now included sustainable design and thus I wanted to establish a company that was also sustainably conscious. Most of the companies that I studied that were sustainably conscious had a leader who valued it as an individual. I learned that understanding and challenging my individual values was an important part of my work.

Final Reflection

Looking back at my undergraduate experience, Olin's engineering curriculum taught me how to identify a need and develop a product or service to address the need. This process lies at the core of entrepreneurship. Over the past four years, I grew to understand the necessity for applying my engineering skills in creating viable products and services. In my first experience applying the process, I created a postcard design and printing business.

The product-service systems became more complex than postcards over time and I learned that creating a viable solution oftentimes requires interdisciplinary thinking. On numerous occasions, I naturally coupled my mechanical engineering skills with design methodology, artistic expression, and materials science understanding to realize an idea through to reality. Moreover, through my studies, I learned that our values as individuals naturally inform our creations as well as the understanding that personal growth and work are intertwined. From my peers, I learned that a necessary part of personal growth is meeting new people and new places. One of the most impactful values that I picked up was one for sustainable living.

My definition of engineering evolved in the process: engineering had gone from creating products that were technically feasible to viable products with sustainable lifecycles. I evolved in a similar way. I started as a curious student making technically rigorous products and became an aspiring entrepreneur. I leave college committed to creating products that solve human needs through viable businesses grounded in social and environmental responsibility.