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Rethinking University Operations: Applying Circular Economy Concepts at the University Level

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Abstract

Today's typical linear approach to doing business is not sustainable over time due to the finite availability of resources. The concept of a circular economy addresses this issue and suggests a closed-loop system, in which products are continuously processed and essentially do not have an end to their lifecycles. This idea relates perfectly with businesses, but this paper aims to make this alignment at the university level. Parallels will be made between the original suggestions for businesses and how universities can apply these concepts, as well. A development plan for universities is laid out through four main building blocks for successful circular integration.

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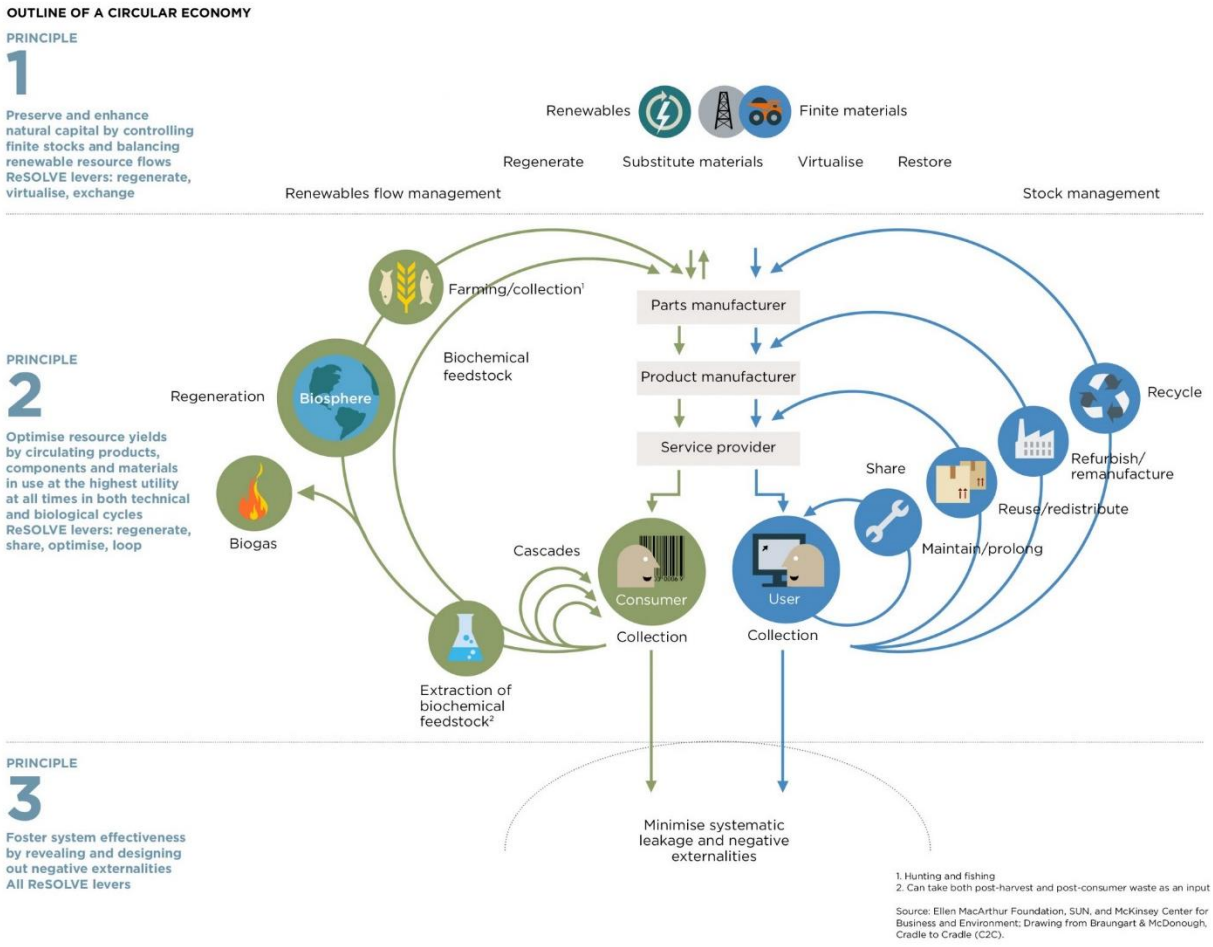
Introduction

Today's manufacturers and consumers, alike, partake daily in a linear approach of "take-make-dispose" when it comes to resources and materials. The supply of these resources is finite, and our society cannot last forever with this approach. Implementing the idea of a circular economy, though, works to make our society one that is regenerative and restorative by nature. A circular economy creates economic, natural, and social capital by focusing on the transition to renewable energy sources. Effectiveness on all scales and in every aspect of a product's lifestyle is foundational for this idea. Much work is already being done among businesses and organizations to implement the circular economy idea, but an entire mindset shift is necessary for it to become a complete success (The Ellen MacArthur Foundation, 2017). Figure 1 is a good visual representation of the circular economy concept. It shows the continuous flow of inputs into outputs, reducing the amount of finite materials that are required in the parts, products, and services systems. The left side of the figure represents the biological cycle, and the right side represents the technical cycle. These two cycles will be discussed in more detail further on, but this figure does well to summarize the concept as a general outline.

Figure 1: Outline of a Circular Economy



Source: The Ellen MacArthur Foundation, 2017

A prime example of circular economy and reverse logistics concepts being implemented at the corporate level is with Patagonia, Incorporated. This company can be viewed as a trailblazer with its Worn Wear Program. The program brings light to the concern of overconsumption and is a natural extension to Patagonia's environmental campaign. Patrons are encouraged to return their used items to a Patagonia store for them to be repaired and cleaned with CO_2 by employees. Patagonia then resells the products, giving them another life. This process significantly reduces the number of products that are sent directly to landfills. This

program started out with various pop-up stores but has now grown to have a permanent place in Patagonia's daily operations due to the positive feedback. Many consumers have interests and sizes that change over time, and these consumers would typically throw out items once those interests and sizes changed. Worn Wear is a valuable addition to the retail world in that it gives these consumers another option of discarding those obsolete products (Martinko, 2017). Other companies can look to the success of this program, benchmark from the results, and duplicate some of the operational tactics of these circled items being "Better Than New" (*Worn Wear*).

This paper looks to explore this broad economy-based idea through the lens of a university. The university setting is one that has not yet been considered for application of the circular economy concept. It does provide a unique opportunity for this concept to be applied, as it is typically reserved for the competitive marketplace and corporations. The Ellen MacArthur Foundation shares four essential building blocks of design, new business models, reverse cycles, and favorable system conditions that exist for the thorough transition to a circular economy. Companies work to apply these building blocks into their strategic operational plans and implement them in every aspect of the organization. While at first glance it seems that these building blocks are solely referring to a competitive marketplace, they can be scaled to the university level after further research. Analysis will be conducted on the parallel between these business-based ideas and how they can be implemented on a college campus.

Methodology/Approach

Much research has been conducted to gather knowledge and understanding about circular economy concepts. The Ellen MacArthur Foundation provided much information regarding these concepts, and all information used is cited throughout this paper to help the reader understand the background of this concept. The literature review below covers the information that is known to-date about the formulation of these ideas. From these ideas, a framework has been created for these ideas to be applied in a different setting than they were created for. A development plan has essentially been crafted with four specific steps and procedures to be followed at a university level.

Literature Review: The Seven Schools of Thought

It is difficult to trace the origins of the circular economy concept back to a specific date or single author. Momentum around the concept has grown since the 1970s and can be said to have been established from Seven Schools of Thought. The descriptions below go into detail about what is currently known about the origins of the circular economy idea and how it has been refined into what it is today. Specifics are shared about contributors of the idea and what exactly it is that the concept is built upon.

1. Cradle to Cradle

   German chemist, Michael Braungrat, and American architect, William McDonough, established the Cradle to Cradle idea and released a book on the subject in 2002: *Cradle to Cradle: Remaking the Way We Make Things.* This philosophy is based upon the idea that everything is a resource for something else. Two nutrient metabolisms of biological and technical nutrients are the foundation of this idea. Resources can either be returned to the soil as biological resources or re-utilized in new products as a technical nutrient. In 2005, the idea of a certification process was put into place. Materials and products that meet science-based quality standard can become certified through the program. Since it began, more than 150 companies have partaken in the program, and over 2,900 products have earned the Cradle to Cradle Certification (The Ellen MacArthur Foundation, 2017).

2. Performance Economy

   Swiss architect and industrial analyst, Walter Stahel, is actually the one credited with having coined the term “Cradle to Cradle” in the late 1970s. He had the vision of a “closed loop” economy, specifically looking at industrial production processes. He looked at the closed loop’s impact on job creation, economic competitiveness, resource savings, and waste prevention. The

Product Life Institute in Geneva, which Stahel created more than 25 years ago, pursues four main goals: product-life extension, long-life goods, reconditioning activities, and waste prevention. The overall idea of a performance economy insists on the importance of selling services rather than products and the fact that it should be considered a framework of basic principles. This approach is very market-focused and shows how companies can profit from updated processes while also contributing to sustainable development (The Product-Life Institute, 2017).

3. Biomimicry

In her work, *Biomimicry: Innovation Inspired by Nature*, Janine Benyus, defines her biomimicry approach as "a new discipline that studies nature's best ideas and then imitates these designs and processes to solve human problems." Three key principles make up the biomimicry approach: Nature as Model, Nature as Measure, and Nature as Mentor. The principle of Nature as Model suggests that we study nature's forms, processes, and systems and implement these strategies to solve human problems. Nature as Measure involves using ecological standards in order to determine the true sustainability level of innovations. Finally, Nature as Mentor suggests that we focus more on what we can learn from the environment, as opposed to focusing on what we can extract from it (The Ellen MacArthur Foundation, 2017).

4. Industrial Ecology

Industrial ecology is a young science that studies the flow of materials and energy throughout industrial systems. This approach also focuses on a closed-loop idea, with waste of one process serving as the input for another process. This science has a very systematic point of view, as its designs are in accordance with local ecological constraints while looking at their initial global impact. This framework is also sometimes considered the "science of sustainability" and is not exclusive to the goods sector only. The principle of industrial ecology can be applied to the service sector (Srinivas, 2015).

5. Natural Capitalism

   Natural resources, such as air, soil, water, and all living things, are what are considered when discussing natural capital. This idea is credited to American environmentalist, Paul Hawken, American physicist, Amory Lovins, and L. Hunter Lovins. Their book, *Natural Capitalism: Creating the Next Industrial Revolution*, discusses the interdependence between the "production and use of human-made capital and flows of natural capital." This interdependence is centered on the idea that business and environmental interests do overlap, and much light is brought onto this topic.

   Natural capitalism can be narrowed down into four main principles: Radically increase the productivity of natural resources (by changing the design and technology used) , **s**hift to biologically inspired production models and materials (model nature's closed-loop design), move to a "service-and-flow" business model (value through a continuous flow of services)**,** and reinvest in natural capital (by restoring and regenerating natural resources) (The Ellen MacArthur Foundation, 2017).

6. Blue Economy

   Blue Economy was initiated by CEO and Belgian businessman, Gutner Pauli, and calls for the sustainable use of water resources to contribute to economic growth, quality of life betterment, and ocean ecosystem health. "Blue Economy insists on solutions being determined by their local environment and physical/ecological characteristics, putting the emphasis on gravity as the primary source of energy." Pauli's main report describes "100 innovations that can create 100 million jobs within the next 10 years." The report also shares several South-South collaborative projects that center around aquatic health (The World Bank, 2017).

7. Regenerative Design

William McDonough studied with John T. Lyle while they were in the United States together, and Lyle went on to develop ideas for regenerative design that could be applied to systems other than simply agriculture. Regeneration had mainly been focused on the agricultural arena when Lyle started his research, and it can be said that he laid the foundations of the circular economy framework due to his expansion on the topic. Regenerative design integrates societal needs and environmental sustainability (The Ellen MacArthur Foundation, 2017).

The Triple Bottom Line

All three aspects of the triple bottom line (social, environmental, and economic) are affected at both the business and university levels by the concept of the circular economy being applied. Through the application of circular economy concepts, the outcome in these three areas are wholly beneficial. Everything from corporate governance structure to life-cycles technologies must be reevaluated due to the impact that they have on society, the environment, and the economy (Elkington, 1998).

The argument of high costs being associated with environmental sustainability in a business or at a university is raised and is a reality and struggle for several professionals. This concern relates to the paradigm shift that is discussed in the first building block of Circular Economy Design. Once a business or university realigns its goals with this concept, the financial output that may be needed will seem to be more of an investment rather than a one-time unbeneficial expense. There is high economic potential with circular economy concepts, in general, also. The initial capital may seem extensive, but cost-saving technologies are often the ones that are implemented for sustainable practices. Jean Rogers, Chief Executive and Founder of the Sustainability Accounting Standards Board shares with us in a Wall Street Journal video the idea of sustainability accounting. Sustainability accounting is considered a subcategory of financial accounting and involves the activities that have a direct impact on the triple bottom line (society, environment, and economic performance) of an organization. Rogers shares that most companies do not account for

Source: Ernst & Young

environmental issues on the bottom line in a clear and comparable way. If they did, she argues, investors and the company itself would be better off. (Rogers 2015). Management of sustainability accounting within a university is also necessary as the paradigm shifts to more of a long-term and circular environmental focus.

The shift to long-term outcomes and benefits speaks to the social bottom line. Having additional resources available in the community greatly impacts the social bottom line, as well. Also, if sustainable practices are used and known to the community, preferences and valuation of the university will likely be positive and have a large benefit for it.

While there may need to be more initial funding for technology and possible staffing and training, the return on investments in all three aspects of the triple bottom line outweigh the costs associated with them.

The Circular Economy Building Blocks

In their 1987 book, *Our Common Future*, The Brundtland Commission coined the definition of sustainable development as “development that meets the needs of current generations without compromising the ability of future generations to meet their own needs." The four building blocks that will be discussed below truly work to meet this definition when they are implemented efficiently. These building blocks come from The Ellen MacArthur Foundation and can be viewed as steps for organizations to follow in order to adjust into circular economy operations. These building blocks are the essential foundations that must be established for a complete transition to a circular economy to be accomplished. Each building block will be discussed in detail as a framework for companies to cultivate into their daily operations and overall strategic plans.

1. Circular Economy Design

    On a basic level, this building block refers to the need of companies to establish core competencies that facilitate the reusing, remanufacturing, and then recycling of products. This is the beginning of the application of a circular economy within the business. Knowledge and skills on the idea are required. This knowledge leads to information sets and then to working methods. According to The Ellen MacArthur Foundation, some of the most important areas for circular design are “material selection, standardized components, designed-to-last products, design for easy end-of-life sorting, separation or reuse of products and materials, and design-for-manufacturing.” It is essential that these beginning procurement and manufacturing-related criteria focus on the useful applications of by-products and wastes that can be used further down the supply chain. A

company could plan on socially responsible and sustainable sourcing and can find new suppliers if they don't meet the requirements (The Ellen MacArthur Foundation, 2017).

2. New Business Models

   After a circular design has been created, it is imperative that innovative business models replace or alter old ways of doing business. Companies with significant market share and a foothold in the economy have the potential to play a major role in implementing these new business models and altering the current linear paradigm. These new business models could create requirements for suppliers and have a major effect on downstream customers. Once other businesses recognize the triple bottom line benefits of these new models, it will naturally follow that these models will be benchmarked against and duplicated. This benchmarking has the natural effect of these ideas expanding exponentially (The Ellen MacArthur Foundation, 2017).

3. Reverse Cycles

   The building block of reverse cycles refers to the return of materials back into the production system or to the soil. This requires a rethinking of the current operations system. The building block of reverse cycles includes several processes, such as: "delivery chain logistics, sorting, warehousing, risk management, power generation, and even molecular biology and polymer chemistry." These collection and treatment systems are cost-effective, once again having a positive impact on the bottom line. This process aims to have no resources lost in the lifecycle of the product and having the leakage of materials outside the system significantly decrease. It extends the length and impact of the individual product while keeping the utility of the product as high as possible (The Ellen MacArthur Foundation, 2017).

4. Enablers and Favorable System Conditions

This building block focuses on the social support that companies will benefit to have. Support from policy makers, educational institutions, and other influential parties can significantly impact whether the concept of a circular economy becomes commonplace or is seen as a nuisance. The Ellen MacArthur Foundation provides examples of some enablers that include collaboration, rethinking incentives, providing a suitable set of international environmental rules, leading by example and driving up scale fast, and access to financing (The Ellen MacArthur Foundation, 2017).

Circular Economy Design Applied at the University Level

The four building blocks will now be discussed through the lens of a university. These business-based ideas can be implemented on a university level, presenting a unique opportunity for such an integrated institution to be socially sustainable, as well. It may be ideal for the circular economy concept to be applied at the university level across the nation so the human capital and knowledge of it can then be integrated into society and the corporate world.

Knowledge and skills on the circular economy concept are crucial for this first stage on creating a circular economy design. The similarities between how a business and how a university succeed in this first stage are quite similar. Research is needed to determine how much knowledge on the subject all shareholders have. Additional training and information sessions may need to be established to guarantee that complete understanding of the concept is established. Once a group has been established at the university level, core competencies of the establishment need to shift to or include the circular economy concept. This might require a paradigm shift within the community. Economic focuses are slowly shifting already, but if a university has deep-rooted schools of thought that don't align with the concept, this has potential to be the most difficult step. It is imperative, though, as it is the foundation of our building blocks. This shift may take place in the force of policies that are established at departmental or even a chancellor level. Policies may have some pushback at the initiation, but over time this building block can become strong and transition to the next stage can begin. Brainstorming will come when a knowledgeable and passionate group is formed. This brainstorming needs to start out broad and general and then can later be narrowed down and adapted to fit with the circular design specific to the university.

The basis of the circular economy design is that all products and services retain integrity and have the highest utility possible at all times. It is important to understand that a circular design is never complete; processes will need to be adjusted as the goals and inputs of the university naturally change over time. Once again looking to biological and technical components, technical products tend to be more restorative. Simple recycling requires all usability to be stripped away from a product and requires more labor and materials to be used. With a restorative design in place, though, items can be reused and remanufactured to make the product like new again. This can take place at the university level, as well, as items can be used several times and across several departments. The maintenance of assets also plays a part in this design, as simple maintenance can significantly expand the life cycle of products. Biological products include things like food and fibers and can be viewed as more regenerative. The feedback and outputs from biological products can simply be returned to the ecosystem, and anaerobic digestion can take place. According to the Food Recovery Network, 22 million pounds of food are thrown away each year on US college campuses alone. All 22 million pounds of that biological material could be regenerated biologically back into the ecosystem if circular economy designs were more prevalent nationwide.

New Business Models Applied at the University Level

This stage involves current practices being altered to be more sustainable. At a business level, several functional departments are heavily affected at this point. This stage involves altering processes, such as purchasing and manufacturing, to be more sustainable. The purchasing department can make changes with what is required for supplier relationships. The entire supply chain can be affected if a company alters its standards for materials. A company could even strive to earn certain certifications that will affect their upstream and downstream relationships.

Since there is no specific purchasing department for a university as a whole, the alignment between businesses and universities may not be evident. At a university level, it will be necessary for each college, department, and even organization to align strategies in order to optimize procurement of materials. From raw materials used in campus projects to finished products used in classrooms, there is always room for improvement when it comes to sustainably acquiring these materials. Research can be done in order to determine if the relationships the university has with various companies is sustainable. The relationships can also be simplified by benchmarking and scoring companies based on environmental impact. A large university can leverage scale and vertical integration to consolidate some practices and streamline processes. For example, University of Tennessee Recycling has a goal is to convert the campus into a Zero Waste institution by diverting at least 90% of all waste from the landfill. This goal focuses on reducing, reusing, recycling, and composting across all functions of the university.

Altering or adding some educational courses can also be part of this stage. Universities with similar goals can look to each other to benefit from and build upon work that is being done.

Specific courses can be established at the university level with the goal of creating a global network of learning. Students can explore and develop the circular economy concept through studying and research and then spread the word even further as they progress into the corporate world. If this concept becomes a core competency of any university, specific courses related to the idea will naturally be established. Some already established network universities with the Ellen MacArthur Foundation around the world include places from the University of Chile to the Georgia Tech Institute of Technology to the Technical Institute of Berlin.

Feedback mechanisms are an important aspect of the new model, as well. It is difficult to know if a circular design is successfully put into place without some sort of feedback. Data is relatively convenient to capture, and the Internet of Things can play a role in this. Businesses and universities, alike, can benefit greatly from having feedback mechanisms in place to track items that are used and distributed. Once feedback is gathered, ideas and processes may need to be altered and adapted to align with new goals. This new "business" model for universities can also share what value is created for its "customers," which are the students. Benefits are also created for the key partners of the university and the community as a whole as a new model is put into place.

Reverse Cycles Applied at the University Level

The act of returning biological materials back to the soil and technological materials back into the production system is the basis of this stage. If a circular design is truly in place, products no longer have an end but continuously takes on new forms. Businesses can look to doing this internally and also working with other supply chain partners to make sure all material gets accounted for and regenerated back into the business cycle.

This stage at the university level requires, once again, all functions of the university to interact and align goals. An entire university can be regenerative and restorative by nature if the practice of reverse cycles gets established efficiently enough. There is specifically and Office of Sustainability at the University of Tennessee that "coordinate[s], manage[s], advise[s], and report[s] on sustainable initiatives at UT through research, data collection, and collaboration with a variety of on-campus and community stakeholders", but the initiatives can still be improved upon since the university has yet to reach the goal of being a Zero Waste institution. Most universities have several franchised restaurants onsite that can be partnered with that can also implement reverse cycle processes. Most restaurants will have biological materials that can be returned to the environment. If there is excess biological waste that is no longer needed on campus, the products can be used in various places in the community, as well. Large events on campuses, such as sporting games or concerts, can be large opportunities to initiate reverse cycles Community members are likely to be at these events, so these are good chances to make these reverse cycle practices intuitive. What products that are used at these events need to be carefully considered, as they all need to be able to be reutilized. The opportunity does exist for sustainable development; the actions toward it just simply need to be taken and engrained campus-wide.

Enablers and Favorable System Conditions Applied at the University Level

For companies, this stage focuses on the social support that they can receive from influential parties, such as educational institutions. The question then arises, though, about who it is that will socially support those educational institutions. Perhaps it is at universities that these four building blocks get started and then the circular economy concept becomes commonplace in the community and marketplace. One enabler that universities can utilize is collaboration. As mentioned above, there are several networking universities within the Ellen MacArthur Foundation that can be collaborated with for support and knowledge transfer. This collaboration can also refer to collaboration between university staff and policymakers. That policymaking can start on a campus level, but eventually it is necessary for that policy making to grow to cover states and countries. Having ambitious, yet reasonable, environmental regulations and rules may be just what is needed to get the concept to stay successful and grow to be commonplace. Campuses can make it known what International Standards Organization (ISO) regulations they choose to follow so the public is aware of actions that are taken. Making already established regulations known can be beneficial when looking to the future for what policies could eventually be put into place. The conformity assessments provided by the ISO involve a set of processes showing that a product, service, or system meet the requirements of a set standard. According to the ISO website, the ISO14001 relates to sustainability specifically and "is a global benchmark for environmental management best practice that can be applied to businesses of any size." Universities can choose to follow these standards, as well, in order to keep themselves accountable on a regulatory level (ISO 14000 Family - Environmental Management).

If policies are made at a high level, there may be the opportunity for incentives to be offered, if that is needed. Competition between districts, regions, and schools are already very

prominent, so having schools be benchmarked and rewarded based on sustainability practices is something that can prove to be effective. When larger schools take these concepts to a deep level and lead by example, it is easy for the scale to get driven up quite quickly and exponentially.

Governmental organizations, such as the Environmental Protection Agency (EPA) can also work to be enablers for universities. The EPA has created a simple formula that professionals within business and at universities alike can look to for environmentally preferable practices: "Environment + Price + Performance" (Tate et al, 2018). This formula can be the mantra for universities to balance several core competencies, and the above stages and suggestions can help them do just that.

Conclusion

The circular economy concept has been refined over several decades to relate perfectly with today's environmental, societal, and economical needs. While this concept generally applies to industries, strategies have been suggested in order to apply it at a university level, as well. The four building blocks of Circular Economy Design, New Business Model, Reverse Cycles, and Enablers and Favorable System Conditions have been reanalyzed in order to fit in a university setting. With this development plan utilized and the suggestions followed, the concept of a circular economy can become widespread and commonplace.

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