

Circular Economy And Ethical Waste Management At Amrita Hospital

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Abstract

The Circular Economy (“CE”) is a business concept that aims to create linkages between economic activity and the environment, dispelling the notion of an inherent conflict between economic activity on the one hand, and the environment on the other hand. CE envisages a circular flow that recognizes the value in products, materials, and resources, and aims to use them resourcefully. It replaces the traditional linear pattern of unsustainable production, consumption, and disposal, with the aim of extending the life of materials. It encourages modern and innovative economic activity that conserve resources and reduce wastage.

There are infinite possibilities for circular business models and activities; this paper highlights the circular business model for integrated waste management at Amrita Institute of Medical Sciences (“Amrita Hospital”) in south India. Amrita Hospital’s circular business model is an innovative, ethical way to treat with biomedical waste and other waste generated at the hospital. Though the case study, the CE is shown to be grounded in environmental ethics as well as business ethics.

Keywords: Circular Economy, Circular Business Model, Biomedical Waste, Integrated Waste Management, Business and Environmental Ethics, Amrita Institute of Medical Sciences (India)

1. INTRODUCTION

This paper highlights an innovative circular business model in the integrated waste management system (“IWMS”) at the Amrita Institute of Medical Sciences (“Amrita Hospital”) in the south Indian state of Kerala. Amrita Hospital is a premier hospital in south Asia, serving more than 1 million outpatients and 70,000 inpatients annually. The hospital boasts an infrastructure of over 3.33 million sq.ft, spread over 125 acres of land. It has received numerous awards for its comprehensive healthcare operations, which include 12 superspeciality departments and 45 other departments. It employs an award winning circular business model that serves as a case study in this paper to illustrate the ethical nature of the CE.

The circular business model at Amrita Hospital in its treatment of waste provides an ideal case study of ethics in circular business operations. It illustrates that circular business models can achieve environmental and business sustainability by linking economic, environmental, and social performance. The discussion in section 2 below describes and lays out various definitions of the CE, discusses its relationship to sustainability, and details the innovative circular business models employed in the waste management operations at Amrita Hospital. Section 3 highlights the ethical nature of the circular operations at Amrita Hospital in the larger context of sustainable waste management and pollution in India and globally. It elaborates the ethical decision making process as it operates at the hospital. Even as a nonprofit organization, Amrita hospital is engaged in economic activity, and is shown to exhibit ethical business operations in that regard. The conclusion in section 4 reiterates the thesis that CE is grounded in environmental ethics as well as business ethics, as exemplified in the circular operations at Amrita Hospital.

2. DISCUSSION

The characteristically antagonistic relationship between economic activity and the environment is often fuelled by an anthropocentric approach that values human beings and their economic interests at the expense of the natural environment. CE emerged in the context of this tension. The roots of CE date to the Boulding (1966) study of limited natural resources. The term itself was introduced in 1990 in the context of interlinkages between the environment and economic activities. It refers to a closed-loop, a circular flow of material and resources, and underscores the economic principle that “everything is an input to everything else” (Andersen, 2007) (Merli et al., 2017).

2.1 Circular Economy and Environmental Sustainability

The understanding which underlies the CE is that economic activity leads to environmental degradation and the exploitation of natural resources. CE rejects the linear path of production, consumption, and disposal, together with the accompanying philosophy of “take-make-dispose”. It aims to decouple economic growth from natural resource depletion and environmental degradation (Lieder and Rashid, 2016) (Merli et al., 2017) (Geng et al., 2009).

As it developed, the CE evolved into a broad and multi-dimensional concept. A recent definition illustrates the broad reach of the CE, as follows:

[A]n economic system that replaces the “end-of-life” concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks), and macro level (city, region, nation, and beyond), with the aim of accomplishing sustainable development, thus simultaneously creating environmental quality, economic prosperity, sustainability and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers (Camacho-Otero et al, 2018).

This definition suggests a far reaching and a heterogeneous scope of possible business models in the CE. There are infinite possible types of circular business activities at any layer of business operation. In that regard, companies, industries, and societies aiming to achieve circularity have unlimited liberty and discretion to develop any type and number of circular business models at any stage of their operations. They may target their production, distribution and/or consumption processes, and therein adopt methods to extend the life of materials by reducing, reusing, recycling, and recovering activities, or otherwise determining other means to extend the life of material to arrive at circularity. The possibilities are endless.

The scope of circular activities vary, and sometimes overlap, in the different definitions that have emerged. Some associate circular strategies with the preservation of products, including their parts or materials therein [insert CITATION]. Some include adoption of any of the following types of circular business models: circular supplies, resource recovery, product life extension, sharing platforms, and product as service [insert CITATION]. These models are not defined, they mean different things in different business operations. Likewise, business indicators to measure the se activities can be elusive. But the activities themselves are clearly within the realm of common sense circularity, and are intuitively opposed to the “take-make-dispose” philosophy.

Potting et al. (2017) offer ten strategies, or ten clearly discernable activities that can increase circularity in business activity. Figure 1 illustrate these activities, which are called the ten Rs of circularity in this paper. They are: refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover.



Figure 1: The 10 Rs of circularity

Geissdoerfer et al., (2017) explain that CE business models are often linked to sustainable development. Sustainability is measured by its effect on three pillars: people, profit, and planet. Modern measures look at the level of integration of economic, environmental, and social performance. The suggestion is that

companies play an important role in enabling CE when their economic, environmental, and social performance are integrated. To achieve this integration, any number of non-economic aspects, and any combination of interdisciplinary approaches in system design and innovations can result in CE developments. In this way CE can be achieved by an abundance of diverse opportunities that link economic activity with environmental sustainability.

2.2 Circular Innovation at Amrita Hospital

Amrita Hospital has adopted several layers of such interdisciplinary system designs and circular business activities in its treatment of biomedical and other waste generated at its facility. The hospital was established in 1998, and at that time biomedical waste collection services were limited in the local municipality, Kochin. Even today, with the necessary infrastructure and capacity to handle biomedical waste, even general waste management, remain largely inadequate throughout India. Most hospital facilities in India dispose waste through common facilities; meaning they rely on external commercial services to collect, transport, and dispose their waste within a 75 Km radius as stipulated by law. Large hospitals like Amrita Hospital that can afford investments in an individual treatment facility, must obtain authorization to process their biomedical waste at the source, within their facilities.

The guidelines and standards for the sorting and disposal of hazardous medical waste are set out in the Bio-Medical Waste Management Rules, 2016 (“the Rules”), established under the Ministry of Environment, Forest and Climate Change. The Rules were first notified in 1998 by Government of India, and were modified in 2000, 2003, and 2011. The 2016 Rules improved segregation, transportation, and disposal methods, decrease environmental pollution, and ensure the safety of the staff, patients, and the public (Datta et. al., 2018).

Amrita Hospital has been authorized to operate its own biomedical waste treatment facility under the Rules. It has been recognized by the Kerala State Pollution Control Board for its best environmental practices and sustained effort to control pollution and protect the environment in its IWMS. In 2019 Amrita Hospital received this award in the hospital sector for the fifth consecutive year. The discussion below details the circular operations at Amrita Hospital that have been recognized as best practices in the hospital sector.

2.2.1 Sorting biomedical waste at Amrita Hospital

Amrita Hospital employs a color coded method for sorting biomedical waste in line with the recommendations published by the World Health Organization. As is enshrined in India’s Biomedical Rules, different categories of biomedical waste are sorted into color coded bags which indicate the method of disposal. For example, the category of “hazardous medical waste” consisting of items such as human and animal anatomical waste are collected in specially labeled yellow non-chlorinated plastic bags that are sent for incineration.

The bags are incinerated at Amrita’s facility in incinerators that are specifically designed to operate with greater efficiency, and exceed the emission standards under the Rules. In response to the increasing global scrutiny about emissions generated by the incineration of waste, Amrita’s incinerators contain a built-in monitoring system for continuous testing of emissions and direct reporting to the pollution control authorities. Incineration remains a best practice for the disposal of hazardous biomedical waste, and optimizing its incinerators to exceed the legal obligation is one way that Amrita handles biomedical waste so as to minimize adverse effects to human health and the environment.

Figure 2 illustrates the different categories for sorting and disposal of biomedical waste, and also provides details about the quantity of each category of waste generated by Amrita Hospital in January 2020. This list is made publically available on the Hospital’s website as part of its social responsibility commitments. The illustration shows that waste is segregated into six color-coded categories. In addition to human and animal anatomical waste, there are several other types of hazardous waste that is sorted into yellow bags, including items contaminated with blood or body fluids, chemical waste, discarded linen, and biotechnology as well as other clinical laboratory waste. The different categories of waste require different disposal methods.

Other than yellow, the other color codes for sorting are: red, for contaminated waste that is recyclable after autoclaving and shredding; white for sharp items including metals; blue for glassware and metallic body implants; black for general solid waste; and gray for incinerator ash. Another category, not listed here, is green for sorting food waste.

Biomedical Waste for the month of January-2020				
Category	Type of waste	Quantity kg/ month	Treatment/ Disposal	Type of bag/ container
Yellow	Human Anatomical Waste, Animal Anatomical Waste: human and animal tissues, organs, body parts, fetus, experimental animal carcasses etc.	11,933	Incineration	Yellow coloured non-chlorinated plastic bags
	Solid Waste: items contaminated with blood body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood or blood components		Incineration	
	Expired or Discarded Medicine/Cytotoxic waste: pharmaceutical waste like antibiotics, cytotoxic drugs, including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.		Incineration	
	Discarded linen, mattresses, beddings: contaminated with blood or body fluid		Autoclaving followed by incineration	
Red	Microbiology, Biotechnology and other clinical laboratory waste: blood bags, laboratory cultures, stocks or specimens of micro organisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures	18,104	Autoclaving followed by shredding then sent to authorized recyclers.	Red coloured non-chlorinated plastic bags
	Contaminated Waste (Recyclable): waste generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes without needles etc.			
White (Translucent)	Waste sharps including Metal: Needles, syringes with fluid/needles, needles to cutter, scalpels, blades	299	Autoclaving followed by encapsulation in ferro cement container	Puncture proof, Leak proof, Tamper proof containers
Blue	Glassware: broken or discarded and contaminated glass including medicine vials and ampoules	3,138	Autoclaving/ Disinfection with sodium hypochlorite solution then sent for recycling	Cardboard boxes with blue colored marking
Black	General Solid waste: Paper and Cardboard, Plastic bottles etc...	8,517	Segregation and Recycling	To vendors
	Incineration Ash	934	Handover to KEEL for secured landfill	Puncture proof, Leak proof, Tamper proof containers

Figure 2: Sorting categories for biomedical waste

Amrita Hospital has designed its IWMS to meticulously treat each category of waste according to the Rules, often exceeding the requirements in the Rules. Amrita employs sustainable circular practices even when there are no legal requirements to do so. For example, except for the provisions relating to the color coded sorting, there are few legal provisions in India regarding the disposal of non-hazardous general waste. This provides the opportunity for Amrita hospital to employ CE and sustainability measures to treat general solid waste such as discarded food, paper, and plastics. The discussions below detail Amrita's operations which optimize opportunities for circularity and circular innovation in treating organic and inorganic nonhazardous waste.

2.2.2 Recycling organic general waste

Organic waste amounts to approximately 60% of waste generated at Amrita Hospital. Approximately 2.5 tons per day of food waste is generated in the healthcare facility. This includes vegetable waste, grass, coconut husks, waste from Ayurveda medicine, and wet paper. After segregation, organic waste is transported to the hospital's compost processing area. It is shredded to enhance decomposition and aeration, and mixed with wood chips and cow dung to maintain the appropriate carbon to nitrogen ratio, and enhance microbial activity. The compost generated is rich, and is used at the gardens and many green spaces that beautify the 125 acres of land at the hospital compound.

Composting is a biological treatment of organic waste that provides rich carbon content to the soil. It helps to create resistance to soil erosion, and improves soil-water retention, soil fertility and soil biodiversity. It is a sustainable way to recycle food and other organic nonhazardous waste that would otherwise rot in landfills. It extends the life even of discarded food, converting it into a valuable input that is then used productively at the hospital. It is a well-recognized activity in sustainability. It not only replaces polluting chemical fertilizers, when incorporated into business operations, it becomes a circular business activity that extends the life of food and other material produced and consumed at the hospital, for productive use.

Amrita designed its composting unit to also include vermicomposting. Vermicomposting relies on earthworms and microorganisms to help stabilize active organic materials and convert them into rich nutrients. Amrita Hospital employs a method of vermicomposting called 'Worm Racetrack', which maximizes space and productivity. The 'racetracks' are formed by creating oval shaped beds in which the worms consume food waste in a constant circular direction. Figure 3 is a picture of the worm racetracks used for vermicomposting at Amrita Hospital. It shows the design which directs the worms around and around the racetracks, eating the food waste, leaving behind valuable nutrients, mimicking the CE in their circular movement.



Figure 3: Worm Racetrack (To insert Amrita picture)

Under standard conditions, the worms eat up to half their body weight per day and double their population monthly. Once the racetracks have taken form and the worm population is sufficiently large, feeding waste and harvesting finished compost occurs daily. This process continues in a never-ending cycle that exemplifies the circular economy. In the circular loop, inputs of food waste is converted into outputs of nutrients. Waste becomes valuable fertilizer, used to beautify the hospital premises.

2.2.3 Recycling inorganic general waste

In addition to recycling its organic general waste, Amrita Hospital has established a circular business model with special infrastructure for the treatment of inorganic general waste. It is here, in the treatment of inorganic waste, that Amrita hospital has employed true CE innovation. The hospital has developed a way to reuse plastic bags as filler material inside cement bricks, or building blocks.

To make the building blocks, non-recyclable non-infectious plastic is further segregated from the general waste category. This consists of single use plastic bags and plastic wrappers. Once segregated, the plastic is compressed into blocks using a specially designed hydraulic steam compressor that was engineered in-house with a relatively small investment outlay. About 2 to 2.5 kg of plastic is compressed to form 1 block, which is then coated with a concrete mixture of cement, metal and m-sand (manufactured sand used for construction). Figure 4 compares the specifications of the plastic filled bricks with ordinary bricks made in India.

Type	Size (mm)	Compressive Load (kN)	Compressive Strength (N/mm ²)
Building Blocks made with Plastic	360 X 222 X 164	104.40	1.30
	360 X 222 X 164	116.90	1.46
	360 X 222 X 164	107.50	1.34
Ordinary Building Blocks used for construction	360 X 222 X 164	70	0.87
	360 X 222 X 164	60	0.75
	360 X 222 X 164	73	0.91

Figure 4: Comparison of the specifications of the plastic filled bricks with ordinary bricks made in India.

The plastic filled bricks are less sturdy than full cement blocks, and are most suitable for ornamental use. The hospital uses them primarily for landscaping, as protective fences around gardens and walkways. Experiments with commercial sales of the bricks suggests that there is a market willing to purchase them, especially when sold at discounted rates compared to normal bricks. However, the hospital has not yet explored the economies of scale for mass production. Producing large quantities would result in reduce costs. The true cost/benefit analysis of the bricks, however, is associated with the reuse of plastic waste that would otherwise end up in landfills and in the oceans. It extends the life of plastic waste in a circular business model.

Amrita Hospital was established as a state of the art medical teaching hospital, as part of the Amrita Vishwa Vidyapeetham university system. It is not primarily in the business of making bricks, but in designing the plastic filled bricks, it collaborated with sister schools at Amrita University. The Amrita School of Engineering ranks as one of India's top ranking engineering schools. With easy access to engineering experts at the university, who were already involved in researching methods for the sustainable disposal of plastics, Amrita hospital arrived at this innovative way to extend the life of plastic waste. This combination of interdisciplinary approaches to create circular business designs and innovations exemplifies the CE.

2.2.4 Recycle and reclamation of waste water

In addition to the circular treatment of solid waste, Amrita hospital has developed a circular system to recycle and reclaim waste water. It has invested in a Liquid Waste Management - Effluent Treatment Plant (ETP) with the capacity to treat 3 million liters of effluent per day. Biomedical effluent generated in the hospital is contaminated with high levels of microbiological pathogens, as well as pharmaceutical and chemical waste. It must be treated before being released into the environment. The ETP operates as a circular business model that recycles water for safe disposal into the ecosystem as well as circular institutional use.

Wastewater generated at various locations of the hospital is directed to the ETP through underground sewage lines. The effluent undergoes treatment in stages. First, coarse solids and other large materials are removed in grit and screen chambers. This enhances the operation and maintenance of the treatment processes. The next three stages are as follows:

During the 'Primary Treatment' stage, effluent flows into a collection tank with sufficient aeration to maintain an equalization process. Incoming effluent flows into the collection tank at different rates, which vary during peak and non-peak hours. More toilets and taps are used during business hours than in the late night, so more effluent flows into the collection tank during these peak hours. Despite the variation in incoming rate, the equalization process feeds effluent in a consistent flow for the further processing.

During the 'Secondary Treatment' stage, the effluent is pumped from the collection tank into an anaerobic reactor, where anaerobic digestion takes place. Here, microorganisms help to decompose organic matter in the effluent. Anaerobic digestion helps to reduce the emission of gases into the atmosphere. After digestion, the effluent is pumped into the aerobic reactor with MBBR (Moving Bed Biofilm Reactor) media. The MBBR media are plastic carriers with lighter density than water. They provide more surface area for the microorganisms to feed on the organic matter in the effluent. The bubbles from the aeration system continuously agitate the MBBR media in the reactor and also add oxygen into the effluent.

During the 'Tertiary Treatment' stage, the treated wastewater overflows, and is collected in an overflow receiving tank. There, the effluent is pumped into chemical mixing channels. Chemicals are added to neutralize the pH of the effluent and enhance the coagulation process. After the addition of chemicals, biologically stabilized solids and chemically precipitated sludge flows into a flocculation channel and into a settling tank. The settling or sedimentation tank allows the heavier solids to settle down, and the clear water flows into the overflow channel directed into the filter feed tank.

The sludge in the bottom of the settling tank is transferred to the sludge feed tank where more microorganisms are added. The sludge is then transferred to a sludge digester where the microorganisms generate biogas. The digested sludge is then collected in an overflow collection tank. The filter feed tank collects the clear water that overflows from the settling tank, and Sodium Hypochlorite is added for disinfection. The water is then pumped into a sand filter and activated carbon filter to remove any remaining suspended solids and odor.

At the completion of the process 1,00,000 liters per day is pumped into the ultra-filtration for further removal of suspended solids. The resulting reclaimed water is used to flush toilets at the hostel within the hospital compound. The rest of the water is discharging into the ecosystem in accordance with the standards of the Kerala State Pollution Control Board.

Figure 5 diagrams the layout of the hospital's ETP. The energy required to run the ETP is met with electricity produced from roof-top solar panels, to create another layer of sustainability in the hospital's circular IWMS. The entire ETP is automated and requires less labor than a conventional plant.

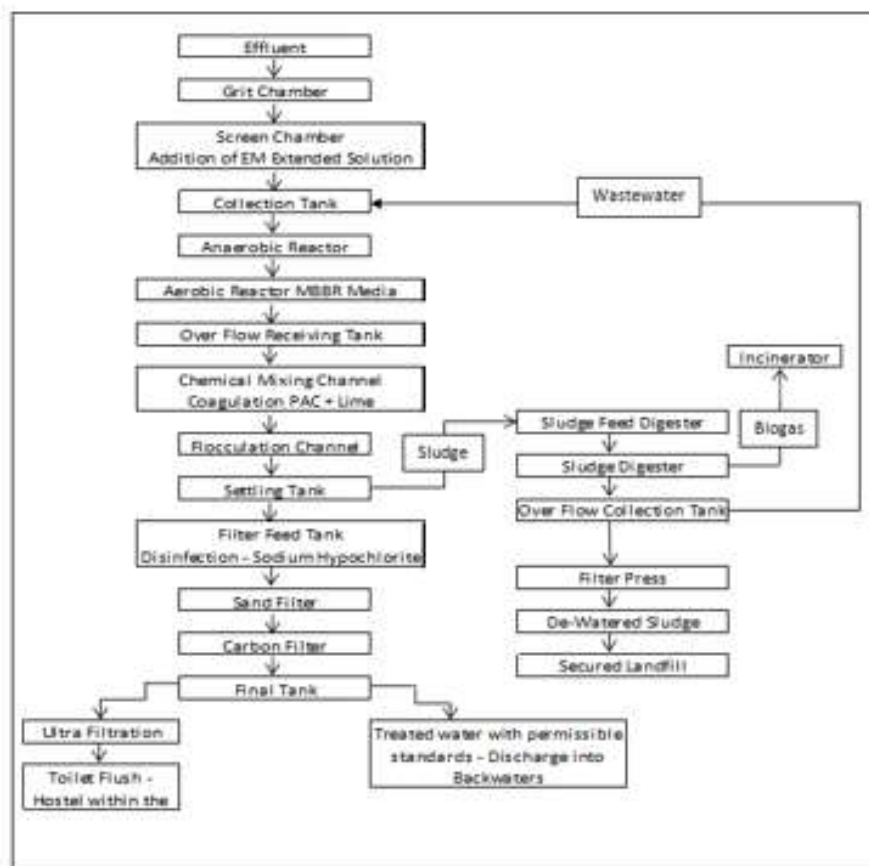


Figure 5: Layout of Amrita Hospital's ETP

The ETP helps Amrita Hospital to maintain effluent standards, and also to meet its water demands. Droughts and water shortages are occurring more frequently in India. The ETP helps Amrita hospital to reclaim waste water for productive use, extending the life cycle. Through this circular activity, water consumption decreases, with an accompanying economic value to the hospital.

3. ANALYSIS OF THE ETHICAL CE AT AMRITA HOSPITAL

The business activities highlighted above illustrate the circular activities in the IWMS at Amrita Hospital. The various definitions of CE discussed above contemplate include these interdisciplinary activities seen in the hospital's waste management design. Namely, the in-house sorting of waste, the composting of organic waste, the manufacturing of building blocks using plastic waste, and the recycle and reclamation of waste water, all extend the life of waste that would otherwise find its demise in landfills, and sewage infested discharge points in the case of waste water. These activities close consumption loops; after the hospital consumes food, plastics, water, etc., it again uses them for other productive, economical use. This is the very nature of circularity, and it is also an ethical way manage waste.

The concept of CE itself presuppose a certain linkage to ethical decision making, and the circular reuse of waste as input for other business purposes at Amrita Hospital is an example of the ethical nature of the CE. In a given situation or context, such as the current unsustainable state of the natural environment that results from proliferation of the "take-make-dispose" philosophy, ethical decision making occurs in four stages. Figure 6 illustrates the process of ethical decision making in response to a situation such as the current state of the environment.



Figure 6: Situational factors in ethical decision making

Situational decision making is structured in such a way, that recognition of a moral issue leads to a moral judgment, the establishment of a moral intent, and finally engaging in moral behavior (Crane, Matten 2016). Here morality simply refers to values judgments of right and wrong as influenced by individual and societal considerations. Thus, based on these factors, recognizing the existence of pollution,

environmental degradation and unsustainability as moral issues is the first step in environmental ethics. Next is the formulation of a moral judgment that it is wrong to engage in activities to contribute to pollution/unsustainability, or conversely, that given the situation it is right to engage in remedial action, to refrain from pollution, and to engage in sustainable activities. This leads to a moral intent, for example, an intent to refrain from polluting activities. Here, for example may be the decision to reject the “take-make-dispose” philosophy, and to institute sustainable circular models. Finally, the decision and intent result in engaging in moral behavior, in this case, the establishment of an IWMS that contains several layers of interdisciplinary processes to reduce pollution, reuse and recycle waste for greater environmental sustainability, while also serving viable economic interests. In this way, Amrita Hospital has engaged in an ethical way to manage its waste. The discussions below further elaborate the ethical nature of the circular business models at Amrita Hospital that is grounded in environmental ethics and business ethics.

3.1 Environmental Ethics in Amrita’s CE

Environmental ethics is a broad field that includes many competing schools of thought. Given the differences, it is less concerned with establishing definitions and more concerned with determining practical issues. Foremost among the practical issues is the transformation into an environment-friendly civilization that is morally responsible towards nature. Generally, there is overarching consensus regarding the principle of respect for nature, and the rights of others to enjoy nature. Environmental ethicists also tend to agree that there is a duty to conserve and protect the natural environment, or, as much as possible, to refrain from activities that harm the environment. After all, the prosperity of human beings largely depends on the prosperity of nature (Yang, 2006).

A moral responsibility towards nature suggests that efforts should be directed toward achieving sustainability. The most prominent understanding of sustainability and sustainable development arose with the Brundtland Report (1987), which refers to “[meeting] the needs of the present without compromising the ability of future generations to meet their own needs” There are competing views about how to measure sustainability, but it is understood that sustainability measures should reduce the impact of human activity on environmental resources, and improve the earth’s ability to absorb the effects of further human activities. (Brundtland, 1987) (Geissdoerfer et al., 2017).

To understand the ethical nature of Amrita Hospital’s circular activities, it is important to first recognize the present state of the environment as a moral issue. After recognizing the gravity of the issue, it is natural to make a normative moral judgment that pollution and environmental degradation are bad and undesirable, and that the polluting impact of human activity on the environment is wrong. Then, having made this judgment, the next step is the formulation of an intention not to pollute, not to engage in unsustainable consumption and disposal. And finally, acting in moral ways consistent with the moral judgment and intent.

The situation related to biomedical waste in India is indeed a moral issue. According to the World Health Organization, stakeholders associated with financing and supporting health-care activities have moral and legal obligations to ensure the safety of others, and are collectively responsible for the proper management of biomedical waste. It has suggested that the best biomedical waste methods should aim at avoiding generation of waste or recovering as much as waste as possible, rather than disposing (Datta et. al., 2018) (Hamel 1998). This is exactly what Amrita Hospital has done by engaging in the moral behavior of recovering waste through its IWMS.

The situation regarding plastic waste in India presents another moral issue. Nationwide, there is a shortage of organized mechanisms to deal with the 15,342 tonnes of plastic waste generated per day. Plastic litter, strewn indiscriminately, is an eyesore, and it creates environment and public health problems, particularly in urban areas. It clogs drains, gutters, and rainwater vents, creating flood conditions even with sparse rains. It poses a danger to stray cattle and dogs who consume plastic waste. In landfills plastic waste releases greenhouse gases into the atmosphere. Plastic waste also creates fire hazards in landfills. Reports indicate that 0.60 million tons of the plastic waste per year that is generated in India, end up in the seas. The seas near Mumbai, Kerala (home to Amrita Hospital), and India’s Andaman and Nicobar Islands are said to be amongst the worst polluted in the world. In the seas, plastic pollution wreaks havoc to fish, birds and other marine species and their habitats. Toxic heavy metals like copper, zinc, lead, and cadmium have adverse effects on coastal ecosystems (Bhattacharya, nd).

Another analysis can be made about the moral issue concerning the right to clean water, the diminishing ground water resources, and polluted water bodies in India. Recognizing these as moral issues, the ethicist arrives at a moral judgment, sees a duty to conserve water and not to pollute water bodies, and develops an intention to act accordingly.

Such moral judgment and intent are clearly present in the circular IWMS at Amrita Hospital. Its founder, Sri Mata Amritanandamayi Devi (known as Amma) is a highly revered Hindu spiritual leader, and compassionate motherly figure, who has been recognized internationally for her practical spiritual wisdom, and extensive humanitarian and disaster relief efforts around the world. Amma teaches that selfishness is the cause for pollution, and she urges humanity to consider the interests of humanity and future generations before exploiting nature. She says:

The fundamental reason for pollution is our selfishness. If we don't consider the interests of the society and future generations instead of focusing on our short-term benefits, a major tragedy is awaiting us. Exploiting nature for individual gains is like cutting the branch of the tree on which we are sitting. If we don't realize this now, it will be too late. Our culture used to teach us to love and worship plants, trees, forests, and rivers (Mata Amritanandamayi 2016 pp. 132-133).

Such self-imposed universally ethical principles as love for nature, and the belief that everyone should follow these principles are considered the highest in cognitive moral development according to the popular Kohlberg's cognitive moral development theory (Carroll 1979, 2016). Along with Amma's moral judgment, her moral intention to act morally with regard to pollution is seen in the statement below.

As science progresses, there will be new cities and factories. Some areas will have to deal with excess population. Mountains of waste will be formed. We should develop waste management techniques and install them or else the atmosphere will become dirty. We have to try to follow good decision making and take actions to relieve us from the unpleasant happenings of life. The effort has to be from all fronts - government, associations, and individuals - both individually and collectively (Mata Amritanandamayi. 2016 pp. 130-131).

Amma's moral judgment, intention, and resulting action can be seen in the IWMS developed at Amrita Hospital. It was designed with ingenuity, innovation, and circularity to manage waste ethically. The Energy and Resources Institute of India has indicated that "as India progresses towards a circular economy, there is need to transition towards improved waste management systems" (Bhattacharya, nd). This is exactly what Amrita Hospital has done through its IWMS. The circular model for waste disposal developed by Amrita Hospital in the different layers of its IWMS address the weaknesses in biomedical waste disposal, plastic waste, and waste water in Indian. It presents truly sustainable and ethical ways to treat with waste. In Amrita Hospital's IWMS, the CE becomes an ethical way to do manage waste.

3.2 Business Ethics in Amrita's CE

The CE model in Amrita Hospital is also grounded in business ethics, in that it links circularity to economic activities. Amrita Hospital is a not-for-profit hospital, which means it is not a business, per se. None-the-less, it is engaged in economic activities, and linking those economic activities with the environment. It is not bound by traditional concepts of business ethics, which has defined corporate social responsibility in terms of the mandate and responsibilities towards stake holders. But as an economic actor, its activities affect society, both positively and negatively. In this regard, it should be mindful of corporate social responsibility ("CSR").

CSR refers to attempts by businesses to meet the various needs of the society in which they operate. The most established model for CSR is Carroll's (1979) model, which identifies for societal needs that companies must meet. It encompasses the economic, legal, ethical, and discretionary (philanthropic) expectations that society places on organizations. Figure 7 details the levels of societal responsibility in Carroll's model.



Figure 7: Carroll's model of CSR

At the base of the model is the economic responsibility to be profitable, as required by society. In a traditional business, profits are required to reward investor/owners and also for business growth when profits are reinvested back into the business. Here, Amrita Hospital being an NGO, the profits are applied to growth, to expand, to constantly improve its services and upgrade facilities, hiring more doctors and

administrators, serving more patients, keeping its rates affordable, and reinvesting back into the hospital. Next, are the legal responsibilities that are also required by society, under which, businesses are required to obey the laws and regulations imposed upon them as a condition of operating. Such laws and regulations are often seen as “codified ethics”. In the case of Amrita Hospital, we see full compliance with the Biomedical Rules. Amrita Hospital even exceeds the legal requirements, as discussed above.

At the third level, the ethical responsibilities expected by society refer to the obligation to do what is good and fair and to avoid harm. (Bloomquist, ND) notes that in the nonprofit sector, social responsibility takes many forms. Nonprofit corporate social responsibility generally includes recycling and adopting environmentally friendly practices. Indeed, Carroll has included the environment among the most frequent ethical issues that business faces today. At the pinnacle of the pyramid are philanthropic responsibilities desired by society for companies to be good corporate citizens (Carroll, 2016).

Corporate Citizenship, Sustainability, Business Ethics, are components of the CE, in which the business benefits, the environment benefits, and the larger society benefits in ways elaborated above. Businesses have an ethical responsibility to help shape the future by following ethical practices and by being more responsible towards the society. Again, this is what Amrita Hospital has done.

4. CONCLUSION

The paper has explored the ways by which Amrita Hospital operates its IWMS to serve both its business operations and societal purposes. The hospital has developed safe and sustainable ways management of biomedical and other waste generated at its facility. It complies with, and exceeds legal requirements. It employs innovative interdisciplinary circular designs that are aimed at achieving sustainability. It has established several layers of circular models that employ innovation and result in sustainability. The circular designs link economic activity with sustainability, and are grounded in environmental and business ethics.

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