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# Circular Economy: Waste-to-Wealth, Jobs the Global South

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**Circular Economy: waste-to-wealth, jobs creation, and innovation in the global south**

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## Abstract

Circular Economy [CE] is predominantly framed as a means for circulating material streams within the *technosphere* as economically as possible, for as long as possible, in both applications of theory and practice. Arising from requirements for regulatory compliance, some global north industries have ventured into CE, and now this model is making headway in all industrial sectors. Whereas, in the global south, CE has been conceptualized as a mechanism for keeping materials out of the waste streams otherwise destined to reach landfills, waterways etc. Characteristic haphazard waste management is a serious socio-environmental issue in Sri Lanka. As a result, CE is promoted as a sustainable strategy that drives the waste-to-wealth initiative with a rational to creating jobs while diverting waste from the landfills. To that end, the case for industries and civic society to transit to a more sustainable economy is officially recognized, where waste is reduced or eliminated through, for example, development of new business models, eco-designs, and sustainable consumption and production strategies. In tandem, partnerships between local universities, not- for-profit organizations, and social enterprise groups have initiated several community-based projects across the country since 2009, targeting waste streams including household, industrial, and agricultural waste. Presented herein are the lessons learned from the CE-based waste-to-wealth projects in Sri Lanka with an emphasis on the cultural, economic, and structural roadblocks faced by the micro-social entrepreneurs in this field.

**Keywords:** Circular economy; plastic waste; global south; waste prevention and management; upcycling; Sri Lanka; waste-to-wealth; bottom-up circular economy; micro-social entrepreneurs; green jobs

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## 1. Introduction

Circular Economy [CE] is an evolving concept, predominantly framed as a means for circulating materials –biological and technical nutrients– more efficiently, as economically as possible and for as long as possible in the *technosphere*. Global north industries pioneered CE strategy, which emerged out of the need to comply with the strict environmental regulations imposed upon them for curtailing the environmental impacts of industrial emissions. Origins of CE have a strong link to the solid waste sector in the global north, for instance, strict regulations and deadlines on the closure of landfills, as observed in the European Union (see: EU Landfill Directive: 1999). This directive accelerated the material recycling activities and provided the necessary framework conditions for the CE concept and associated tools/activities such as Material Flow Management, Industrial Symbiosis, and Integrated Resource Management etc. Realizing the economic benefits of the application of CE principals, global north industries quickly adopted and replicated the CE approach across most industrial and service sectors in order to manage resources efficiently, with the aim of maximizing bottom-lines while complying with environmental regulations.

Making its way into national legislation, currently, CE dialogues in the global north address concerns pertinent to resource scarcity and limitations, and promote the transition from linear to circular materials flows or closed-loop systems (EC, 2018). The conceptualization of CE renegotiates the cultural norms that couple waste with lack-of-value (Camacho-Otero et al., 2018). Drawing a parallel with the biological systems, the fundamental premise of CE is that waste is a '*resource*' at the wrong place at the wrong time and thus, essentially repurposable and can be used as inputs/raw material to other systems. CE usually takes the systems approach to resource management and is characterized by fundamental elements such as boundaries, input flows, stocks, output flows, and emissions. CE strives to: a.) minimize the resource extraction from nature[1], by improving the efficiency of resource use or resource productivity, and b.) reduce emissions and associated impacts through various means by looping the material and energy flows mimicking ecological/biological systems. In so doing, CE essentially creates new socio-economic subsystems and employment; increases wealth and the volume of money in circulation; reduces negative environmental consequences; reduces the monetary outflow (spent on importation of resources); and decouples the system from fossil/non-renewable resources.

For a holistic conceptualization of CE, Geissdoerfer et al. (2017) combine insights of CE from numerous publications and define CE as, "*a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved though long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing and recycling*." CE designs out the externality of waste and incorporates a way of seeing cradle-to-cradle uses for materials (McDonough and Braungart, 2009). Essentially, CE is a useful frame for conceptualizing long-term sustainability of materials already within social systems (Geissdoerfer et al., 2017), integral to progressive business models in the global north and global south alike.

Other applications and studies of CE point out the economic appeal:[2] as a means for symbioses between industrial sectors (Chertow et al., 2008); materials lifecycle productivity (Strazza et al. 2011), and a means for the sustainable development of industry (Veiga et al., 2009). With a similar focus on industry, Merli et al. (2008) document the agency of CE on the proliferation of top-down life cycle assessments, resource efficiency, and cleaner production models. Likewise, in response to the UN's Sustainable Development Goals (SDGs), CE framework applies specifically to visions for *Sustainable Cities and Communities* (SDG#11); *Sustainable Consumption and Production* (#12); and Climate Action (#13); *Increasing wastewater recycling* (#6.3); *Prevention of marine pollution from land-based activities* (#14.1); and when CE is interpreted through a social lens, *Gender Equality* (#5).

[1] In CE some linearity remains as virgin resources are required and residual waste is disposed (EC, 2014).

[2] According to the European Commission (2014), CE-based resource productivity improvement has a strong industrial economic appeal. The Commission emphasizes that, "*the resource efficiency improvements all along the value chains could reduce material inputs by 17-24% by 2030 and a better use of resources could represent an overall savings potential of EUR 630 billion per year for European industries. [...] studies demonstrate significant material cost saving opportunities for EU industry from CE approaches and a potential to boost EU GDP by up to 3.9% by creating new markets and new products and creating value for business.*"

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Some critics argue that there is an overemphasis on CE solutions for industry, while social benefits of designing new economic models are overlooked or implicit (Geissdoerfer et al., 2017). This consideration for CE is a point of interest in the global south context. As a result of industry prioritization, grassroots stakeholder inclusion or civic inclusion in CE dialogues are sometimes excluded, and opportunities for inclusion and increased CE activities at grassroots social enterprise

levels for livelihoods are missed (as well as opportunities for further resource recovery).

Hence, one may query: Is there space within the circular economy dialogues for bottom-up CE approaches that address existing ecological and social considerations? Can circular economy discussions move beyond industry and economic gains, and into the rationale of increasing local livelihoods and keeping materials out of the local waste stream? As we will explore in the following sections, the answer is a resounding 'yes.'

added value[3]) by valorising 'waste' through CE is a way for the global south countries/industries to overcome hurdles such as resource accessibility (social, economic, and infrastructure barriers), while simultaneously addressing other pertinent social issues like jobs creation, economic

New ways of creating value (or regional

diversification, waste management, and environmental protection.

Focusing on Sri Lanka –a fast-growing economy in the global south - this analysis aims to provide insights into the characteristics of CE in Sri Lanka; uncover agency in waste-to-wealth and associated values creation; and assess the shortcomings of the deployment of CE for global south industry, as well as resource and waste management. To these ends, the following sections sequentially present: the status quo of waste management of Sri Lanka; the trigger factors for the deployment of CE; and then explores the effectiveness of waste-to-wealth implementation through three case studies (Yaal Fibre, Katana Upcycle, and Paalam Products), within broader discussions of inclusive livelihood development; CE in the global south context; plastic proliferation and

implications; and co-processing.

## 2. Background: The Sri Lankan Context

Sri Lanka is an island nation in the Indian Ocean with a population of approximately 21 million (Department of Census and Statistics Sri Lanka, 2012). The 26-year civil war that ended in 2009, marked the beginning of an era of economic growth and post-war social recovery, reconciliation and development. During the post-war period, rates of urban growth, industrial activity, infrastructure development, and the volumes of imports (packaged foods and goods, and subsequent consumption) have substantially increased. These social-behavioral changes, in turn, play a key role in influencing the national waste volume. As an island nation that still relies on predominantly open dumping, Sri Lanka is at a critical point. Moreover, improperly managed waste contributes to Sri Lanka's rank as one of the highest contributors to marine plastic pollution in the world (Jambeck et al., 2015).

[3] A concept grounded in the economic theory, regional added value (RAV) refers to the increase in the value of goods and services of a region directly and indirectly as a result of the subjective action. RAV encompasses both tangible and intangible value/benefits elicited in all dimensions of sustainability.

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As with the field of CE, waste management in the global south is also an evolving concept. Waste management in the global south is significantly influenced by the rapid changes in urban dwelling populations and consumption patterns. As global south countries urbanize and develop, waste production increases proportionally to the GDP (Lacy & Rutqvist, 2015), and the challenge of how to manage ever-increasing waste streams falls on local governments. Currently, half of the world's population –3.5 billion people– lack means of waste disposal to manage increasing materials flows (WB, 2016). South Asia alone expects more than 250 million new urban dwellers by 2030 (Ellis & Roberts, 2016). Municipal solid waste [MSW] in South and South East Asia currently makes up approximately 33% of global waste streams; and waste in the global south overall is expected to double in the next 20 years (Hoornweg & Bhada-Tata, 2012). Increasing waste creation and accumulation put pressure on already overtaxed global south governments, and as a result, the effects of the increasing impacts of waste fall on local communities and the environment.

In Sri Lanka, the responsibility of waste management falls on the municipal government, and most struggle to manage the waste collection, as the municipal workforce change every few years linked with party elections and corruption. In municipalities where sorting is neglected, the informal sector often sorts recyclable materials of value and finds markets, predominantly external (such as India for wood and metals; China for polyethylene terephthalate [PET]). In some cases, informal sector workers are responsible for 20-30% of a city's recycling (Wilson et al., 2006). Additionally, informal sector waste pickers and upcycle social enterprise groups are able to see value in material streams, and in Sri Lanka, these two groups work together in the recycling and CE domains.

Un-managed solid waste is a serious social, environmental, health and political concern in urban areas of Sri Lanka. Characteristic haphazard waste management is exacerbated by the unwitting civil contributions such as waste dumping on roadsides, waterways and abandoned lands, and the open burning of plastics etc. that negatively impact health, quality of life and social well-being. The most critical incident was the April 2017 collapse of the largest dumpsite in Colombo, Meethotamulla. Mismanagement of waste has also been linked to dengue, as well as the environmental disturbances when elephants, cows, dogs, and other animals graze on the waste heaps (Rodrigo, 2017). As a response, waste management has been given a higher priority with intensive clean-up drives conducted around the country to remove waste from residential areas. These problematic incidents highlight that Sri Lanka lacks proper final waste disposal options, which has brought in an increased interest for new approaches at various levels of concern, which could lead to more sustainable and innovative ideas to manage waste *or* more practices that ultimately facilitate the creation of more waste.

In 2008, *Pilisaru*, the nation-wide solid waste management programme, launched for a waste-free Sri Lanka by 2012. While the aims of the Pilisaru project are well drafted - and the most substantial budget for a waste program ever in Sri Lanka - the program itself has not proved viable as evident by the ongoing problems related to waste management in the country. To address this dilemma, Medina (2005) suggests that developing countries need "*affordable solutions that work well in a [global south] context, that create jobs, that protect the environment, that promote community participation, that encourage and support the entrepreneurial spirit in the community* (5)."

**3. Case Studies – Waste-to-wealth projects**

As negative impacts of waste accumulation are increasingly felt in Sri Lanka, the social appeals for CE are high, as CE can improve the industry and economic flows as well as improve jobs creation, livelihood improvement, and waste management. Specifically, findings from a three-year feasibility study conducted from 2011 to 2014 found the opportunity for local economic development through upcycling discarded materials (Jayasinghe & Baillie, 2017). The study also indicates the presence in Sri Lanka of multiple layers of stakeholders who depend on waste for their livelihoods: individuals, small-scale recyclers, community-based organizations, and social enterprises. Their study pointed out that product design, prototyping, and manufacturing are rare, due to lack of affordable machinery, technological skills, design

protocols, and knowledge of manufacturing processes. Yet, these skills are key to enabling the development and longevity of successful small-scale industries (Thamae and Baillie, 2009).

One of the main issues with poor waste management is the lack of awareness about different waste types, recycling, and proper management methods. As such, a project on value addition through waste upcycling highlights that waste can be a valuable resource in an emerging island economy like Sri Lanka where raw materials are expensive and/or unavailable. Based on the aforementioned feasibility study, the University of Western Australia partnered with three counterpart Sri Lankan Universities (Universities of Jaffna, Moratuwa and Sri Jayewardenepura), and the not-for-profit organization Waste for Life, to develop the waste to wealth educational program that engenders and supports community-based waste recycling and manufacturing businesses, as well as positively impacts both local economies and environmental health.

A key aim of the project was to provide education and training in developing waste-based businesses, and for participants to instigate their own start-up social enterprise by the end of the training. The community groups were first trained in materials and products development; then the project team worked with the groups to identify a brand name and find sustainable markets for each business. Resulting, the end of the project period in 2017 generated three community projects - two in Jaffna, in the Northern province and one in Negombo, in the Western province. These social enterprises manufacture a variety of domestic products from upcycled materials, such as book jackets, file folders, coasters, placemats, decorative sheets, and panels.

a. ***Y aal Fibre*** – Y aal Fibre is a women' s cooperative that upcycles waste fibres from discarded banana trunks at a banana transportation facility in Jaffna. With the extracted fibres, the women weave sustainable goods such as bags, baskets, and hats. Start-up support came from a German NGO, yet in the initial phases, the women faced difficulties finding a reliable market in Jaffna for their products. With aspirations to expand and diversify their products, the project team introduced a simple heat-press technology, which combined banana fibre with waste plastic to create different products such as notebook jackets, clipboards, coasters, and placemats. Waste plastics such as LDPE, HDPE, and PP packaging materials are collected from different businesses in the area, including a bakery shop and a motorcycle spare parts store. This shift in design and products prompted continuous orders for Yaal products from a diverse range of service-industry clients: gift shops, travel agencies, hotels, and restaurants. However, with increasing production, Yaal has a new challenge of finding good-quality, locally-generated packaging materials, as the spare parts store in Jaffna is no longer in operation.

Yet, this new process is not without its critics. Natural-fibre composites or laminates in many ways make the end product complex by mixing up elements that could otherwise be recycled separately. Some criticize natural-fibre composites for encapsulating natural materials that can biodegrade, into a plastic material that cannot. Before the upcycling project, the packaging materials were burned or dumped informally or improperly. With this project, the materials are collected and used to make products that raise awareness on waste management and environmental impact, and show innovative ways of upcycling waste.

Yaal production is therefore not only associated with the CE upcycling of material resources available in the area, but also promotes providing solutions to local problems – employment, livelihoods, women's empowerment, post-war revitalization - in ways that create social and environmental benefits while being at the same time financially sustainable. From their inception in October 2016 through August 2018, Yaal has upcycled 240 kg of plastic packaging materials into value-added products. The social implication through job creation was more profound, providing an income source for around 14 women from nearby villages.

b. ***Katana Upcycle*** – Katana Upcycle is a social enterprise that collects, separates, and upcycles plastic waste into a range of commercial products. The products are made from HDPE and LDPE plastic packaging materials, gunny bags, old sarees, curtains and mixed- material (aluminum, plastic and paper composite) food wrappers. Katana Upcycles was developed as the domestic product manufacturing arm of a small recycling business by a local entrepreneur. The social enterprise provides employment for eight to ten women from neighboring houses and villages, and allows a flexible working schedule where women have the freedom to manage their time at work, depending on their other household responsibilities. During an interview with the women, this flexibility is cited as one of the main draws for them to work at Katana.

Katana Upcycle's initial product range includes folders, notebooks and stationery, and they continuously experiment with materials and develop new products. The latest additions to the range of products included file covers and tiles made from mixed-material (metalized food wrappers that cannot be recycled using conventional recycling methods). Since inception in July 2016, Katana has converted around 700 kg of plastic waste and other materials into value-added, upcycled products. Katana also runs a successful stall at Good Market (a weekly marketplace in Colombo that provides social enterprises with a unique platform to promote and market their products and services). Katana Upcycle uses this platform not only to market their products but also to actively engage in environmental education and to promote recycling. This could be seen as an important service where the social enterprise supports circular economy education and the systems thinking required to accelerate a transition.

c. ***Paalam Products*** – Paalam Products is a social enterprise that works with war-affected communities, particularly women in the Northern Province, to support employment and livelihood development and promote social responsibility in the local community (with

support from a UK-based organization). Paalam receives second-hand clothing items from its UK base, that they then sort and sell for local reuse. Some garments do not pass quality checks, and Paalam identified a further entrepreneurial opportunity converting these textile wastes into value-added products. Initially, six women (mostly single mothers from the area) received training to upcycle the fabric waste with plastics into stationery products such as pencil cases, file covers, and folders (products sold both locally and in the UK). Paalam is still in its initial stages since production began less than a year ago. Yet, during this time, they have converted around 50 kg of plastic packaging materials and 80 kg of fabric waste into value-added products.

Yaal, Katana, and Paalam achieve a mix of positive social, economic and environmental impacts through their businesses, and waste is diverted from haphazard disposal practices through the

development of value-added products. They all support the notions: ‘small is beautiful’ and ‘start local but think global;’ and simultaneously, contribute to the climate change mitigation efforts by reducing emissions.

All three waste-to-wealth businesses source their raw materials locally - materials that would normally have been deposited in a landfill, dumped in a vacant land or openly burned - and in doing so provide new opportunities for new value-added products and increased social dialogue on the potentials of CE. All projects focus on providing job opportunities in the community, and often target marginalized groups who otherwise lack access to employment and income-generating activities. Social impacts include: an increase in income and job opportunities for marginalized groups, as well as training and skill development in local communities. As these social enterprises are mostly run by women, they also encourage women empowerment and improvement of gender equality, broadly addressing the aforementioned SDGs. The creation of job and income opportunities also stimulates local economies. From an economic point of view, the encouragement of local business development, reduction of community costs, the increase of purchasing power, and the creation of innovative value chains, leads to increased local economic activity.

The three waste-to-wealth businesses have recycled over 1 ton of waste since their inception. Converting waste into value-added products not only address environmental degradation due to unmanaged waste, but also reduces consumption of raw materials, and energy for the production of new products. According to Stanford University’s recycling program, recycling 1 ton of plastic waste is equivalent to nearly 16.3 barrels of oil, 98 million BTU's of energy, and 30 cubic yards of landfill space (PSSI, n.d.); and reduces emissions 25 times more effectively than through incineration (Tellus Institute, 2008). Based on these studies, considerations for furthering CE potential in Sri Lanka could include:

- Further quantification of CE endeavors, such as the amount of methane reduced due to landfill minimization; or carbon dioxide reduction due to locally processing materials and minimizing the extraction of new materials.
- Initiate programs that further synchronize CE efforts, like local collection points for materials that can be reused or provide CE operations with transportation so that they are able to increase collection and scale-up to other areas.

• Provide training and technology like shredders, molds, and 3D printers to open up opportunity for further processing and jobs creation with repurposed materials, as well as generate more interest in CE possibilities.

## 4. Discussion

### 4.1 Circular Economy: inclusive employment and livelihoods

The aims of CE enterprise can shift by context, for instance: closed-loop, sustainable transitions, waste management, livelihoods creation, etc. In the global south context, CE has numerous benefits, especially in the realm of inclusive jobs creation for women and marginalized

communities (UNIDO, 2017; WEIGO, 2018). Moreover, the CE model is a means for efficient, long-lasting, sustainable resource use, as well as creating shared prosperity and safeguarding the environment (UNIDO, 2017). In Sri Lanka specifically, the CE emphasis shifts from an industry-focused material flow model to a bottom-up approach for social enterprise development in a waste- to-wealth, upcycling model.

In the example of Yaal Fibre, cast-off LDPE from motorcycle businesses is repurposed by women in the cooperative, and their upcycling crafts create livelihoods from material once destined for the waste pile. This valorization help: a.) identify value in waste materials for new enterprises – decoupling waste from existing social norms and values– and b.) value marginalized communities with jobs creation, which also assist in helping the community revive after decades of civil war.

As can be inferred, women play a key role in waste-to-wealth businesses in Sri Lanka. All three community projects presented herein are run primarily by women - mostly single mothers or women who cannot find other work due to their household responsibilities. These social enterprise start-ups provide valuable livelihoods and a sense of self-worth through employment for vulnerable communities.

### 4.2 Circular Economy in the Global South Context

In global north dialogues, CE is framed within an urban, industrial lifecycle model, whereas in the global south, CE pathways can be both urban and rural. As many rural areas have minimal to non- existent waste management programs, CE is even seen as a practical tool for preventing materials from being dumped in agricultural and natural resource areas on which rural communities depend. Yet, rural CE projects face challenges both in transporting (logistics) and marketing their products. Additionally, the social challenge of changing purchasing norms and creating an awareness of value in upcycled products is also a significant factor for success and scaling-up (Camacho-Otero et al., 2018) –in Sri Lanka, buyers of these projects are predominantly tourists and foreigners who already have the ethos or market awareness to see value in upcycled products.

Although sustainability is not emphasized in the CE projects in Sri Lanka, one cannot overlook the environmental value of materials circulation on an island with limited resources coupled with the pressures of a growth/development trajectory. Eco-efficiency, resource efficiency, and optimizing resource yields are something especially prudent for an island economy's sustainability, as transporting materials from overseas incur high costs, increase carbon dioxide emissions, and shifts the economy away from local livelihoods and local economies. Although

known for its biological diversity, linear growth models in Sri Lanka have brought about a situation where the nation now operates at an *ecological deficit*, at 3 times the island's biocapacity (Global Footprint Network, 2017). This means that material kept out of the waste streams through CE brings a plurality of benefits: 1.) not requiring additional landfill space; 2.) not necessitating the extraction of virgin raw materials; and 3.) reduce the associated

environmental pressures, and 4.) providing 'green' jobs and economic opportunity for those reprocessing these materials into new products.

### 4.3 Problematic, yet Material of Value: Beyond Plastics

CE theory and practice focus on how to "make plastic never become waste" (EMF, 2017, 5). Yet, regardless of whether plastics are kept out of the linear waste stream and repurposed into other economic activities through CE, increasingly, plastics are realized as a material at the root of social and environmental harm (Barnes et al., 2009; Freinkel, 2011; Geyer et al., 2017; Thompson et al., 2009), and regarded as the "lubricant of globalization" (Moore, 2014). Plastic critics say that CE distracts from the root causes of consumption and pollution that are creating widespread destruction across the planet (Monbiot, 2018). As a result, many social organizations across the globe –organizations such as Break Free from Plastic, Story of Stuff, Local Futures, and GAIA– strive to move beyond the calls for recycling and place emphasis on the reduction and phasing out of the plastics altogether.

Studies on the impacts of plastics increasingly cite harms. Market costs of plastics do not necessarily equate with the environmental costs of plastic's impact on human and environmental health (Andersen, 2007). Microplastic fragments, for instance, are in 90% of bottled water (Mason et al., 2018); 83% of drinking water (Tyree & Morrison, 2018); dislodge from synthetic clothing in the wash and enter waterways (Tyree & Morrison, 2018); and bioaccumulate in marine life due to ocean plastic pollution (Andrady, 2011); and pose threats for progressing up the food chain for human consumption. Yet, CE *promotes* the use of PET bottles (also ocean plastic pollution) as raw material for apparel despite that these repurposed plastics can continue to cause harm, cycle after cycle. Studies also show the impact of increased and repetitive exposure to endocrine disruptors found in plastics on human health (Wagner and Oehlmann, 2009).

Although plastics are materials much discussed within the theme of CE, simultaneous warnings regarding plastic within other fields are overlooked. Whether linear or circular, the longer plastics flow in economic systems, the more risk of microplastics and plastic additives entering food and water, and altering ecosystem services and biological systems. CE discussions are prime to question the nature of plastic flows, as the creation of CE processes includes evaluation and redesign.

Plastics facilitate mass consumption of products, but they are also an unmanaged nuisance. In the global south -such as in Sri Lanka – low-density polyethylene [LDPE] plastic, a material commonly used for food packaging and single-use items like shampoo sachets etc., is heavily relied upon because it is cheap. However, since these materials lack value beyond a single-use, they are disposed. Economically, the use of LDPE makes sense, but socially and ecologically this material is a disaster). This material not only contribute to an abundance of waste, but also triggers a spectrum of subsequent problems including the accumulation of these plastics in the ecosystems

causing issues such as flooding, animal mortality, and the spread of disease vectors such as dengue. Development of schemes such as extended producer responsibility [EPR] to counter the aforementioned issues is stymied because economically there is little incentive for their reuse. As a result, lower grade plastics can only be downcycled into lesser quality products that are positioned to quickly enter the waste stream once again.

CE models are vulnerable to the changes in business practices, policies, and public opinion. CE creates plastic upcycling/repurposing jobs and also link global south CE innovators to processes that are subject to change in the waste and recycling economies. For instance, as observed in the Yaal example and also in the case of China's recent importation ban on waste plastics, the changes in secondary raw material availability due to market dynamics severely affect upcycling operations. Also, the notion of either opting for jobs or the environment is a dangerous false dichotomy. These issues raise questions, such as: when the global north transitions away from plastics, will the global south be stuck using and repurposing material that has been phased out in other systems? Do race-to-the-bottom principles equally apply to CE, even though this model poses itself as more 'sustainable' and systems-oriented?

### 4.4 Access Denied: Co-processing and the elimination of circulating resource pathways

*Co-processing* of waste materials in the kilns of the cement industry is promoted as a means for symbiosis between industrial sectors (Chertow et al., 2008), materials lifecycle productivity (Strazza et al. 2011), and a means for the sustainable development of industry (Veiga et al., 2009). However, in Sri Lanka there is no public accountability for what is co-processed in cement making processes, and the majority of waste from the Free Trade Zones (FTZs) and municipalities are co- processed by the cement industry, instantly destroying large swaths of resources that have either been extracted from or transported long distances to Sri Lanka. Co-processing or incinerating within this cement making process –although an expedient way to get rid of waste– removes accountability of waste produced and severely restricts the amount of materials that can enter the circular economy. Moreover, social enterprises –Yaal, Katana and Paalam– lack access to be able to utilize these resources in further economic activities. This incineration process accelerates a linear take-make-waste model, thus exacerbating limits-to-growth and environmental concerns, as it removes materials from circular economic pathways, necessitates the further extraction of virgin raw materials for production, and also blocks the opportunity for economies of care, sustainability, and resource accountability.

## 5. Conclusion

As uncovered in this work through the case studies in Sri Lanka, the global south provides new ways of interpreting CE through a lens of social benefits, livelihoods, and waste reduction. The circular economy is about processes, innovative lifecycle thinking, and systems thinking. CE is also about finding opportunities to link systems and economies that were not linked before; it is an alchemy of creating value out of material that before was considered worthless. CE facilitates the integrity of the whole system –not just one industry's system– and this creation of new value streams shifts local awareness of what is valuable. When citizens realize the worth of materials, behaviours shift, material is conserved, and new economies develop. Yet, CE can also facilitate

economy that is not sustainable in the long-term (such as with harmful materials such as plastics), due to continued prioritization of economic gains over social and environmental concerns.

Seeing opportunities in gaps in waste management and values shifting for new modes of waste collection and repurposing, the social enterprises complement existing waste management activities by providing CE opportunities to improve autonomy and livelihood of low-income communities. Importantly, the formation of a 'social enterprise' that encourages community level opportunity and inclusion would appear to address local environmental, social and economic needs through:

- Reducing the overall environmental impact and waste accumulation by encouraging local reuse, upcycling, and recycling;
- Providing social mobility and employment opportunities for those involved;
- Creating an income source for community members, particularly women, and reduce poverty and social vulnerability;
- Broadening local values and awareness on waste (why it matters and how it can be managed); and
- Coupling a holistic vision for healthy communities, sustainable livelihoods, and a healthy environment.

In a country where waste dominates the visual landscape, the prospect of inducing change at a community level is a positive and necessary step in the right direction for waste management and environmental awareness. By becoming involved in recycling plastics, communities have become aware of the potential hazards that waste can cause by being dumped and the valuable products that can be made with them as an alternative. Moreover, that the projects provide the opportunity to do so in a manner that promotes social inclusion and raises awareness regarding better waste disposal techniques is an important one. Greater inclusion of the social enterprises in policy selection and development could also be an option with high social benefits, particularly for fledgling local authorities that lack adequate infrastructure and personnel.

In the global south, in Sri Lanka and other nations, the complexity of intangible problems such as poverty, social equity, and long-term sustainability require new approaches for alleviation, which come from the juxtaposition of ideas and fields not normally put together, as traditional models have not shown promise in solving complex systems problems. Although CE is in its infancy in Sri Lanka, current successes point to the value in exploring the further potential for social and ecological benefits. Increasingly, countries have adopted policies to facilitate circular economy such as China in 2008 and the EU's policy for segregating material and minimizing the amount of 'waste' that gets sent to landfill. In order to further the development of a CE in Sri Lanka, policy and business incentives for CE could help facilitate the innovations and associated processes.

Future trajectories might include circulating waste-resource streams from other Sri Lankan industries such as rubber and tea plantations, coconuts and FTZ fashion

clippings. With CE, the potential lies in realizing the economy in-situ and not requiring the constant input of new/virgin, raw material. By co-joining the fields of waste management and circular economy and finding

ideal symbioses, it is possible to develop business models that essentially work towards a more sustainable world and contribute to the reduction of poverty in the global south.

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